ROAD TRAFFIC INJURIES AND ALCOHOL IN ELDORET, KENYA: EPIDEMIOLOGY AND POLICY ANALYSIS

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ABSTRACT

Road traffic "accidents" are a major cause of morbidity and mortality in Kenya, exerting a considerable burden on health care services. Human error is recognized as the leading cause. Alcohol is suspected to be an important contributing factor, although such evidence has not been documented, and specific policies and interventions do not currently exist. This study aimed to establish the magnitude of the contribution of alcohol in traffic crashes as a basis for planning and developing drink-driving policy. The main objectives were:

1. To determine the incidence and characteristics of injury presentations in hospitals and estimate injury-related workload.
2. To determine alcohol prevalence and distribution of blood alcohol concentration (BAC) in casualties with different types of injuries.
3. To estimate the contribution of alcohol in traffic crashes, in combination with data from a roadside survey of drivers.
4. To establish the knowledge and perceptions of key informants and different groups about causes of road "accidents", effects of alcohol, awareness of road safety measures, and the preferred interventions.
5. To explore the potential for successful development of drink-driving policy.

The research was undertaken in Eldoret, Kenya. It comprised three sub-studies employing epidemiological methods complemented by focus group discussions, key informant interviews, documents review, and policy analysis techniques. Relevant data was gathered from 2,637 injury-affected hospital attenders, 479 drivers, 12 key informants and 3 focus groups. The results indicated that:

1. Assaults are the most frequent cause of injuries requiring hospital treatment, while traffic crashes are the leading reason for trauma-related admissions. Males and young adults aged 20-39 years are the most affected by traffic crashes and collisions. Children are affected mainly by falls and burns. Traffic crashes lead to the most severe types of injuries, and

greater utilization of operating theatre, and inpatient services (total bed-days) than other injury mechanisms.

2. Alcohol is most associated with assaults and traffic injuries. Alcohol-related injuries predominantly involve men, and occur with a greater frequency on week-ends and at night. Traffic crashes involving drivers and pedestrians are more likely, than passengers, to be associated with alcohol.

3. Drinking and driving is common in the general driving population in Eldoret: on average 20% of night-time drivers had imbibed some alcohol. Drinkers were mostly men aged over 24 years, driving personal cars on short trips. The risk of involvement in a road crash is six times greater in drinking drivers and increases with the rise in BAC.

4. There is a general perception of the multifactorial nature of causation of road "accidents", comprising human, road, vehicle and social factors, with alcohol playing an important role. Support for the introduction of drink-driving interventions is evident, although some scepticism exists about effective enforcement and availability of resources.

5. Involvement and the support of key government ministries, non-governmental institutions and the commercial sector with interest in road transport and alcohol industry, and various professionals in the decision-making process would increase the feasibility of successful development of a public policy on drink-driving. The availability of convincing data is likely to enhance the decision-making process.

Adverse effects of alcohol on driving increases the incidence of traffic injuries, potentially avoidable by establishing drink-driving interventions. Successful formulation of a policy to discourage driving under the influence of alcohol is feasible and will require working with a range of stakeholders to establish a politically and financially feasible approach.

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DEFINITION OF TERMS

An **accident** means any unintended, incidental event or mishap happening by chance . The term has a connotation of fate or inevitability (an "act of God"), and include a range of events, only a small proportion of which results in injury.

The term **"accident"**, expressed in parenthesis in this thesis, refers to an event that results or could result in an injury; and to denote the misleading connotation that such an event and its outcomes are unpredictable or random and, therefore, uncontrollable or not preventable (WHO, 1989).

Road traffic accident (RTA) is an event occurring on a street, road or highway, in which at least one vehicle in motion is involved, by collision, crashing or losing control, and which causes injury, death or damage to property.

Road crash refers to a road traffic accident that results in injury or death (the terms are used interchangeably in this thesis).

Injury refers to tissue damage resulting from different types of "accidents", and may be slight, serious or fatal.

Casualty- a person injured or killed in an event ("accident"), such as a road crash, inter-personal violence, fall or other mechanisms.

Fatal casualty- a person who dies from injuries sustained from an "accident".

Road traffic fatality- death occurring within 30 days from injuries sustained in a road "accident" (WHO, 1979).

Alcohol-related injury infers that a casualty had been drinking around the time the event causing the injury occurred (variable BAC criteria and detection methods are often used).

ABBREVIATIONS

AA	Automobile Association
AG	Attorney-General
AIS	Abbreviated Injury Scale
ALAC	Alcohol Advisory Council of New Zealand
AMA	American Medical Association
ANOVA	Analysis Of Variance
AR	Attributable Risk
AR%	Attributable Risk percent
ASCII	American Standard Code for Information Interchange
ATLS	Advanced Trauma Life Support
BAC	Blood Alcohol Concentration
BMA	British Medical Association
CAREC	Carribean Epidemiological Centre
CBS	Central Bureau of Statistics
CFR	Case Fatality Rate
CI	Confidence Interval
CNS	Central Nervous System
DALYs	Disability Adjusted Life Years
DPWO	District Public Works Officer
EDH	Eldoret District Hospital
ENH	Eldoret Nursing Home
EU	European Union
FB	Foreign Body
FGDs	Focus Group Discussions
GNP	Gross National Product
ICU	Intensive Care Unit
ID	In-Depth interviews

IMF	International Monetary Fund
INRETS	Institut National de Recherche sur les Transports et leur Securite (French)
INSUR	Insurance
ISS	Injury Severity Score
KBS	Kenya Bus Services
KANU	Kenya African National Union
KMA	Kenya Medical Association
LTSA	Land Transport Safety Authority
LOS	Length of Stay
LSK	Law Society of Kenya
MADD	Mothers Against Drunk Driving
MMWR	Morbidity Mortality Weekly Report
MOH	Ministry of Health
MOTC	Ministry of Transport and Communication
MP	Member of Parliament
MVOA	Matatu Vehicle Owners' Association
NGO	Non-Governmental Organization
NHTSA	National Highway Traffic Safety Administration
NRMA	National Roads and Motorists' Association
NRSC	National Road Safety Council
NTRP	National Trauma Research Programme
ODA	Overseas Development Administration
OPD	Out-Patient Department
OR	Odds Ratio
PAR	Population Attributable Risk
PAR%	Population Attributable Risk percent
PH	Pacifica Hospital
PNG	Papua New Guinea
PSV	Public Service Vehicle
RBTs	Random Breath Tests

RTAs	Road Traffic Accidents
RSA	Road Safety Authority
RSC	Road Safety Committee
RSN	Road Safety Network
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TLB	Transport Licensing Board
TP	Traffic Police
TRL	Transport and Research Laboratory
UGH	Uasin Gishu Memorial Hospital
UNDP	United Nations Development Programme
WHO	World Health Organization

NON-ENGLISH LANGUAGE TERMS

Matatu	a converted pick-up vehicle, minibus or Family Estate car used for transportation of passengers (see Box 2.1)

DEDICATION

To my sons Francis and Michael, my daughter Jacqueline, my wife Eunice, and my mum Susan to whose lives, health and prosperity my academic endeavours have special endearment.

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ORGANIZATION OF THE THESIS

This thesis is presented in Ten Chapters. **Chapter One**- Introduction and Literature Review, starts with a brief introduction then provides a review of literature highlighting evidence of the association of alcohol with road crashes and the impact of drink-driving interventions; traffic injury epidemiology in developing countries; and an overview of principles of injury control. **Chapter Two**- Kenya: A situational Analysis, describes key demographic and health profiles, epidemiological features and the burden of road traffic "accidents" in Kenya, and concludes by stating the rationale for the study. **Chapter Three**- Objectives and Methods of the Study, describes the different methods used, the study setting and the research process, including preparation, field work, data analysis and the writing of this thesis.

The Results of the Study are presented in five chapters, with a summary of key findings at the end of each chapter. **Chapter Four**- The Pattern of Injuries in Eldoret with Particular Reference to the Effect of Alcohol, presents findings describing characteristics of trauma-related attendances to hospitals, including the extent of association of different types of injuries with alcohol. **Chapter Five**- The Burden of Injury on Hospital Services in Eldoret, examines the impact of injuries on hospital workload using selected indicators, and the associated determinants such as injury severity and alcohol use. **Chapter Six**- The Prevalence of Drinking and Driving in the Driving Population in Eldoret, presents results of the roadside alcohol prevalence survey, describing characteristics of drinking drivers and their levels of blood alcohol concentration. **Chapter Seven**- A Qualitative Study of Causes and Prevention of Road Traffic Accidents in Kenya, presents perceptions of selected key informants to causes and prevention of traffic "accidents", and preferences to prevention of drink-driving. **Chapter Eight**- Political Mapping for Decision-Making on a Policy on Drink-Driving, illustrates an approach to assessing potential policy response to drink-driving, interactions of different stakeholders, and the feasibility of success of such a policy.

Discussion, Conclusions and Recommendations are presented in two chapters. **Chapter Nine**- discusses the key findings of the research in relation to the set objectives and published literature, including an overview of factors influencing the policy-making process. **Chapter Ten** suggests actions needed to prevent alcohol-related traffic injuries in Kenya, and identifies some key issues for future research. **References and Appendices**, including questionnaires used in the data collection, conclude the thesis.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

This chapter presents a review of literature on the epidemiology of traffic "accidents"[1] with special reference to the effects of alcohol, the subject of this thesis. It has four main sections. The first section starts with a brief introduction giving a synopsis of the problem of alcohol and traffic injuries; the second presents an international overview of evidence of the association of alcohol with crashes, the magnitude of the problem and the various interventions for dealing with it. The third section discusses the public health importance and epidemiological aspects of traffic injuries in developing countries with emphasis on the contribution of alcohol; and the fourth outlines principles of traffic injury prevention and control, citing examples of existing interventions and impediments to their adoption in developing countries. A summary of key issues arising from the review of literature concludes the chapter.

1.1. INTRODUCTION

The contribution of alcohol to increased risk of traffic "accidents" has received international public health attention for many years. Empirical evidence of the role of alcohol in motor vehicle "accidents", based on experimental studies during the first half of this century, characterized the first phase of research in this area. Fatality studies and epidemiologic surveys, conducted in the preceding period, further provided estimates of the prevalence and association of alcohol with traffic crashes. Over the last decade, and in recognition of the increasing importance of road traffic "accidents" (RTAs) as a major cause of mortality, morbidity, disability and economic loss, international attention has

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[1] The term "accident" means an event that results or could result in an injury: the term is expressed in parenthesis to denote the misleading connotation that such an event and its outcomes are unpredictable or random and, therefore, uncontrollable or not preventable (WHO, 1989).

been focused on the development of policies and strategies for the prevention of injuries resulting from alcohol-impaired driving. As a consequence, most industrialised nations have introduced new legislation, intensified enforcement of drinking and driving laws, and increased research in alcohol-related traffic crashes. However, the diversity of demographic and socio-cultural characteristics in different countries, levels of economic development, transport infrastructure and road traffic patterns, imply that the direct transfer of countermeasures successfully applied in the Western world to developing countries is not appropriate and that careful adaptation to the local context is required. The identification of country-specific risk factors is fundamental to the development of appropriate policies and strategies for preventing alcohol-related traffic injuries and deaths.

1.2. THE ASSOCIATION OF ALCOHOL WITH ROAD TRAFFIC ACCIDENTS: AN INTERNATIONAL PERSPECTIVE

The association of alcohol with injuries has been known since ancient recorded history. Smith and Kraus (1988), quote the following from an ancient Egyptian papyrus:

> *Make not thyself helpless in drinking in the beer shop. For will not the words of thy report repeated slip out from thy mouth without thy knowing that thou hast uttered them? Falling down thy limbs will be broken, and no one will give thee a hand to help thee up.*

While both ancient historical and present day literature strongly associate alcohol and injuries, alcohol is still commonly consumed to provide "stimulation" and or relaxation after a long day's work or, in some cases, instead of it! To understand the mechanisms of influence of alcohol on human functions, research has largely focused on the interaction between people and the operation of motor vehicles.

1.2.1. Scientific Evidence of the Effects of Alcohol

The importance of alcohol as a factor in traffic safety has been extensively studied since the early part of this century when the use of automobiles increased markedly in the industrialised countries. Factual evidence concerning the influence of alcohol on road safety has, over the years, become necessary as the basis for new legislation. While the use of physical co-ordination tests, such as the Romberg sign for locomotor ataxia for assessing the influence of alcohol were known before the 20th century, early scientific research into the psychomotor and psycho-sensory effects of alcohol in drivers were only developed between 1914 and 1940s. The increase in the use of motor vehicles for transportation, rising traffic volumes, and the numbers of traffic "accidents" and fatalities, stimulated the need for scientific data to help formulate legislation, guide law enforcement and develop appropriate social policies. Dictated by these circumstances, research on alcohol and driving intensified with the focus being on three main approaches: laboratory experiments and psychological tests, driving under controlled conditions, and epidemiological surveys.

1.2.1.1. Laboratory Experiments and Psychological Tests

Studies in Sweden by Widmark (1922) and Goldberg (1943), and in the United States by Heise (1932), using chemical tests in body fluids to measure alcohol levels, showed that alcohol disturbed the Central Nervous System (CNS) and impaired reflexes. Goldberg's research was the first to document evidence of a threshold of impairment of normal reflexes at blood alcohol concentrations[2] (BACs) ranging between 0.03% and 0.07%. Later experiments, under simulated driving conditions, to test skills resembling driving, employed a dummy car with conventional controls for steering, accelerating and breaking.

[2] BAC expressed as a percentage of alcohol in blood by weight; thus, 0.03% = 30mg/100ml = 30mg%

A continuous road picture was projected to give the subject the impression that the car was moving along a road. Using this type of apparatus, several researchers (Drew et al, 1958; Loomis and West, 1958) examined the psychomotor and psycho sensory effects of alcohol in the operation of motor vehicles. Such experiments showed that the accuracy of steering decreased progressively as blood alcohol increased and nearly all subjects showed some impairment at a blood alcohol concentration (BAC) of 0.05%. There was no specific threshold level at which driving skill suddenly became worse as even very small amounts of alcohol impaired a person's steering capacity.

1.2.1.2. Actual Driving Experiments Under Controlled Conditions

Bjerver and Goldberg (1950) in Sweden, Coldwell et al. (1954) in Canada and Huber (1955) in Germany conducted experiments in which driving performance before and after ingestion of alcohol on special controlled driving courses outside normal traffic, were compared. After drinking alcohol, a decrease in judgement, prolonged reaction time and an increase in self-confidence were observed in the subjects. Noticeable signs of deterioration in driving ability emerged at blood alcohol concentrations less than 0.05%, and the signs of impairment became more evident as BACs exceeded this level. Of the participants, those used to drinking heavily showed signs of impairment at higher BACs (between 0.05 and 0.12%).

All the experimentation demonstrates that alcohol impairs psychological and physical functions at relatively low blood alcohol levels. These effects are consistent with the established pharmacological properties of alcohol, as a depressant of the central nervous system (AMA, 1986; Gilman et al., 1990). In small doses, alcohol possesses transient stimulatory properties, but as its concentration in the blood rises, it induces sedation and produces a whole spectrum of CNS depression, ranging from sedation to general anaesthesia and death. The acute effects of alcohol can inhibit coordination and judgement, prolong reaction time, and decrease motor performance and sensory skills. The early simulated driving experiments thus provided scientific insights which inspired direct studies of the more complicated situations facing drivers in the actual traffic environment.

1.2.1.3. Epidemiological Studies

Experimental laboratory work and driving course simulations can only approximate what might happen in actual driving conditions. Subsequent phases of research on the effects of alcohol on driving therefore followed two practical dimensions.

a) Fatality studies:

Direct studies of the relationship of alcohol to motor vehicle "accidents" started by collecting and tabulating data of BACs from victims of fatal crashes. Early reports by Pearson (1957) and Bowden et al. (1958) of post-mortem blood alcohol analysis among drivers killed in motor vehicle crashes in Australia, showed that between 39% and 65% had BAC levels in excess of 0.1%. In the United States, where blood testing in fatal road "accidents" was a routine practice, 50% of fatally injured drivers had detectable levels of alcohol in blood, and between 39% and 75% of the drivers had BACs in excess of 0.15 % (Haddon and Bradess, 1959; McCarroll and Haddon, 1962; Borkenstein et al, 1964; Laessing and Waterworth, 1970; Baker et al. 1992). Equivalent results have since been documented by researchers in many countries, including Australia (Tonge et al, 1972; Vine et al, 1983), the United Kingdom (BMA, 1954; Harrison, 1987) and Canada (Lance 1979, Beirness et al., 1994). In general, varying amounts of alcohol were found in between 25% and 75% of drivers killed in motor vehicle crashes; and the probability that an intoxicated driver would be involved in a fatal crash increased with the increase in blood alcohol level.

b) Case-control surveys:

The extent of association between a driver's BAC and the risk of that driver being involved in an injury-producing motor vehicle accident has been investigated in many case-control studies. Most of these were specifically designed to provide data on exposure, blood alcohol levels and characteristics of drivers who have crashed and those in similar traffic settings but not involved in a crash. The first case-control survey to show the significance of alcohol in traffic "accidents" was conducted by Holcomb in 1938 (Holcomb, 1938). In this study, BACs of 270 drivers involved in personal injury "accidents" over a three-year period were compared with those obtained from 1750 drivers (control group) randomly selected on the road during one week in Evanston, Illinois. Comparisons between the "accident" and control groups showed a high correlation between BACs in excess of 0.05% and involvement in an injury-producing "accident": 47% of crash-involved drivers had been drinking compared to 12% in the control group. McCarroll and Haddon (1962) conducted a similar survey in New York: the case series consisted of 43 drivers fatally injured over a period of 10 months (in 1959 and 1960), and the control group comprised of 258 drivers randomly selected on subsequent dates at the sites of the fatal crashes. Sixty two percent of the drivers, who died within 6 hours of the crash, had been drinking (BAC>0.01%) compared to 24% in the non-accident group; and 41% of those killed had very high BAC levels (>0.25%), whereas none of the control group had such high levels. Among the subset of drivers judged as probably being responsible for their "accidents", 73% had been drinking to some extent, whereas only 26% of similarly exposed but non-involved drivers had been drinking. The most elaborate case-control study, the Grand Rapids Study by Borkenstein et al. (1964), compared 5985 drivers involved in "accidents" with a control group of 7590 non-accident involved drivers randomly sampled in the same area, at times and days of week representative of "accidents" occurring over the previous three years. The study demonstrated a strong association of blood alcohol levels of over 0.04% with an increased "accident" rate of a driver: the relative probability of "accident" involvement starts to increase slowly at low BACs then rapidly as BAC level increases. Other studies (Carlson, 1973; McLean and Holubowycz, 1981) have since documented comparable findings.

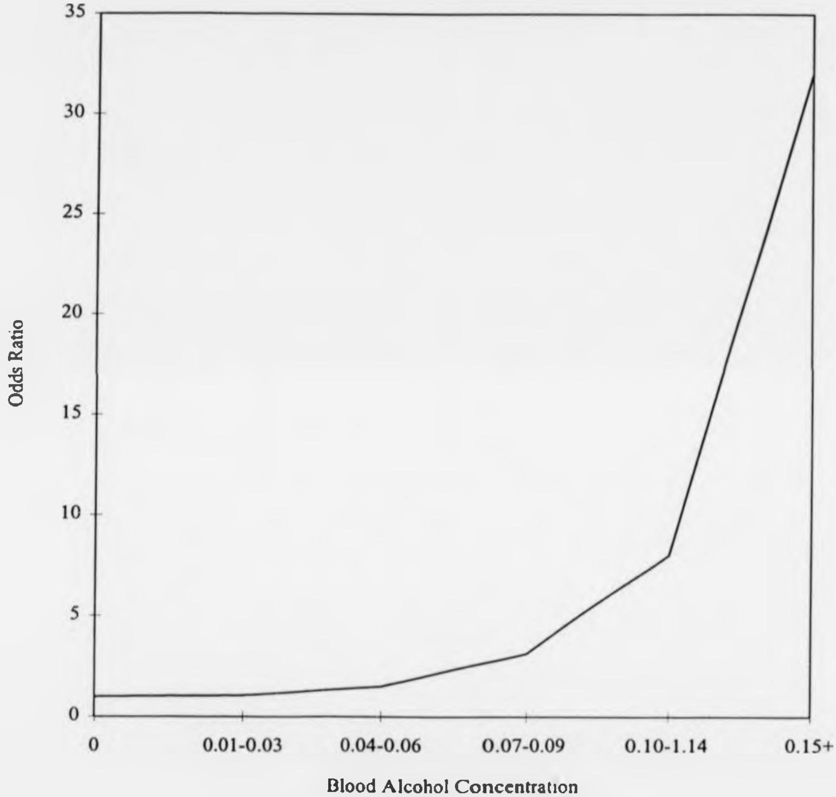
Table 1.1 presents a summary of computed odds ratios from the BAC data reported in the cited case-control studies: the risk of accident-involvement increases with the level of BAC. These studies, thus, document consistent and convincing evidence of the direct dose-response relationship between increasing blood alcohol concentrations in a motor vehicle driver and the increasing risk of involvement in a road "accident. The probability of causing an "accident" is 3-fold greater at BAC of 0.08% than in a sober driver, 7-fold at 0.10%, and over 25 times at BACs in excess of 0.15% (see Figure 1.1). The deterioration in driving ability due to alcohol consumption results in an increased number of road "accidents"; and the probability of a crash is greater in drinking drivers than in those who are sober.

Table 1.1: Summary of case-control studies showing the odds ratios (risk) of a drinking driver being involved in a crash.

BAC level	**Odds Ratio and 95% CI, by study (1st. Author, City and year)**			
	Holcomb, 1938, Evanston	McCarroll, 1962†, New York	Borkenstein, 1964, Grand Rapids	McLean, 1981, Adelaide
0	1.0	1.0	1.0	1.0
0.01-0.04	3.8 (2.5-5.9)	0.9 (0.2-3.3)	1.1 (1.0-1.9)	0.8 (0.4-1.6)
0.05-0.09	2.9 (1.7-5.0)		1.5 (1.2-1.9)	2.5 (1.2-4.8)
0.10-0.14	11.2 (6.2-19.9)	26.3 (9.1-78.9)	5.7 (4.1-8.1)	7.1 (2.8-18.0)
0.15+	58.5 (25.1-157.1)		16.7 (8.2-35.2)	30.4 (8.9-160.7)

† cases consisted of fatally injured drivers (BAC levels grouped differently)

Figure 1.1: Risk of accident involvement in drinking drivers, based on data from the Grand Rapids Study



Source: Data from Table 17, Borkenstein et al., 1964.

Other potentially contributing demographic and crash factors, such as age and gender of the driver, drinking frequency, type of collision, as well as time and day of the week, have been identified as being associated with increased incidence of crashes. Young drivers aged between 19 and 25 years are over-represented in traffic fatalities (McCarroll and Haddon, 1962; Galloway, 1981; Millar and Last, 1988). Male drivers exceeding the legal alcohol limit are more frequently involved in fatal crashes than females (Plueckhahn, 1978; Warren and Simpson, 1980; Galloway, 1981; McDermott and Hughes, 1982; Trinca, 1987; Foster, 1988). Greater proportions of weekend and night-time crashes are associated with drink-driving than those occurring during midweek and day-time (McCarroll and Haddon, 1962; Plueckahn, 1978; Warren and Simpson, 1980; Holt, 1980; Galloway, 1981; Walsh and McLeod, 1983; Harrison, 1987). Even after controlling for these factors in multivariate analyses (Warren and Simpson, 1980), the drinking driver is still substantially more likely to be involved in a serious injury or fatal crash compared to the non-drinking driver.

1.2.2. The Magnitude of Alcohol-related Traffic Fatalities

Road traffic "accidents" (RTAs) are the most important cause of unintentional injury and constitute a major health problem worldwide. In 1990, RTAs resulted in 856,000 deaths (World Bank, 1993) and ranked ninth among all causes of disease and injury burden, accounting for 2.5% of the global disease burden: they are projected to be the third biggest cause of DALYs (disability adjusted life-years lost) by the year 2020 (WHO, 1996). The increasing importance of motor vehicle injury as a major cause of adolescent and adult mortality has been documented in all regions of the world (Stansfield et al, 1992; Feachem et al, 1992; World Bank, 1993). In the United States, for example, traffic crashes are the leading cause of death in the age group 1-34 years: approximately half of all traffic fatalities reported in the U.S. between 1982-1991 were alcohol-related (BAC>0.01%); and 24% of the 60,398 drivers involved in the fatal crashes in 1989 were defined as legally intoxicated (BAC>0.10%) (CDC, 1988; 1990;1992 & 1993). In Canada, the proportion of driver fatalities attributable to alcohol, with BAC greater than 0.08% (the legal limit), in 1990, was 36.6% (Ross, 1993). In Britain, between 18% and 25% of drivers killed in road "accidents" in the years 1984-1995 were over the legal blood alcohol limit of 0.08% (Stark, 1986; Harrison, 1987; Department of Transport, 1996), whereas the equivalent figure in Scotland was 23% (Foster et al, 1988). In Australia, 33.5% of the reported driver fatalities in 1989 had BAC levels greater than 0.05% (Ross, 1993), while earlier figures reported in Australia varied between 21% and 68% (Pearson, 1957; Bowden et al, 1958; Tonge et al, 1972; McDermott et al, 1978; Plueckhahn, 1978).

Overall, evidence of alcohol intoxication at the time of a fatal crash (with BAC above the legal limit) range between 18% and 37% of the total numbers of drivers killed. The variation in alcohol-related driver fatalities between countries probably reflect differences in levels of alcohol consumption in the different countries, different years of reporting, variations in the reference legal BAC limit, and varied levels of effectiveness of drink-driving countermeasures. Nevertheless, recent studies still indicate that on average, a third of all drivers killed in industrialised countries have BAC levels exceeding the defined limit of a country, with the UK reporting the lowest proportion (Table 1.2).

Table 1.2: Summary of recent fatality studies on drink-driving in industrialized countries, 1989-1996.

Country	Author, year	Subjects	% tested	Criterion BAC	% above limit
USA	NHTSA†,1990	drivers	-	0.10	36
Canada	Simpson, 1992	drivers	81%	any amount 0.08	45.4 36.6
UK	TRL,1991	drivers*	61%	0.01 0.08 0.20	29 18 7
UK	Dept of Transport, 1996	drivers**	-	any amount 0.08	35 20
France	Got,1991	responsible drivers†	89-99%	0.08	32-35
Norway	Gjerde,1991	drivers	64%	any amount 0.05	27.4 24.9
Sweden	Laurell,1991	drivers	91%	0.01	29
Italy	Flaminio,1989	drivers	50%	0.08	72
Australia	NRMA,1991	-	80%	any amount 0.05 0.08 0.15	39.6 33.5 30.8 21.9
South Australia	Holubowycz, 1994	drivers	94%	any amount 0.08	45.3 37.9
New Zealand	LTSA, 1995	drivers	-	0.08	32

* excludes motorcyclists;
** based on Coroner's reports;
† drivers judged to be responsible for causing the crash in which they were killed

Sources: CDC, 1992; Ross H.L., 1993; Holubowycz et al, 1994; LTSA, 1996; Department of Transport (UK), 1996.

1.2.3. Drinking and Driving Legislation

The findings of the early experimental studies in Sweden by Widmark (1922) and Goldberg (1943) were instrumental in establishing maximum blood alcohol limits for drivers. Norway in 1936 and Sweden in 1941 were the first countries to introduce deterrence-based law (the "promille"[3] legislation), also known as *per se* law, based on specific BACs above which it was a crime to operate a motor vehicle (Andreasson, 1962; Peterson, 1992). Many countries have since enacted similar legislation (Table 1.3) with corresponding provisions for allowing police to demand breath tests, and for dealing with offenders. A legal BAC limit of 0.05% was established in 1966 in Victoria, Australia (McDermott and Strang,1978). In the UK a BAC limit of 0.08% was established by the Road Safety Act of 1967 (Harrison, 1987), but its implementation was not effected until the introduction of the Transport Act in 1981 which defined drink-driving as an offense, in terms of blood and breath alcohol levels as well as permitting the use of breath tests as evidence in court (Ross, 1988; Editorial, Brit.J.Addict., 1988). The Act resulted in increased efficiency in the prosecution of drink driving offenses, which has generally been associated with a decline in the percentage of drivers killed who had blood alcohol levels exceeding 0.08%: declined from 31% in 1978 to 25% in 1984 (Broughton and Stark, 1986; Harrison, 1987), then later to 18% in 1989 (Ross, 1993). Of the 51 states in the U.S., forty-seven have laws making it illegal to have a certain BAC while driving, with Indiana being the first State to enact such a legislation

Table 1.3: BAC limits for selected countries

Country	BAC (%)
Sweden	0.02
Portugal	0.04
Australia	0.05
Belgium, France, Netherlands	0.07
UK, Italy, Denmark, Germany	0.08
Spain, Canada, New Zealand	0.08
USA	0.08 / 0.10
South Africa, Zimbabwe	0.08

Sources: Kobus, 1980; LTSA, 1994; Bielcher-Reter and Couzard, 1995; van der Spuy, 1996.

[3] promille = BAC in grams per litre (0.05% = 0.5‰)

in 1957 (Borkenstein et al., 1963). The legal BAC limit in most states in the U.S. is 0.10%; and since 1983, eleven have lowered it to 0.08% (Johnson and Fell, 1995).

As shown in Table 1.3, the set legal limits therefore vary considerably between countries, being lowest in Sweden (0.02%) and Portugal (0.04%), while it is 0.08% in most countries in Europe.

Besides establishing statutory alcohol limits, the legislation has been designed to deter potential offenders through licence suspension, vehicle confiscation, community service sentences or jail. These depend on the degree of intoxication, frequency of the violation (whether a first or repeat offender), and whether a crash resulted in death (a diplomat in the U.S. was recently charged with manslaughter for crashing to death a 16-year-old girl, while driving under the influence of alcohol)[4]. Random breath testing and compulsory testing of blood alcohol in crash-involved drivers have been effectively introduced in a number of countries for the enforcement, surveillance and evaluation of drink-driving countermeasures (Trinca, 1987; Chang and Astrachan, 1988).

1.2.4. Trends in Alcohol-related Fatalities

In recognition of traffic "accidents" as a major cause of death, serious injury and property damage, considerable resources have been spent on road safety measures in the developed world. As a result of emphasis placed on improving road safety and the successful application of a wide range of safety measures, many countries have experienced a decline in traffic fatalities (WHO, 1989). A decrease in the proportion of alcohol-related fatalities has contributed considerably to the overall reduction in deaths from motor vehicle "accidents".

[4]Washington Post, February 16, 1997.

In Victoria, Australia, the introduction and enforcement of strict drink-driving laws backed by intensive mass media campaigns were associated with a 14% decline in the proportion of alcohol-related driver fatalities (BAC>0.05%), from 39% to 25%, observed between 1977 and 1984 (Hardess et al, 1985; Trinca, 1987; Powles et al, 1993). Traffic-related death rates, in Victoria, in relation to the number of vehicles also fell from 3.0 per 10,000 in the 1970s to 1.9 in 1991(Powles and Gifford, 1993) and lately to 1.3 in 1994 (Road Safety Committee, Victoria, 1995), to be one of the lowest in the world. While not solely attributable to drink-driving countermeasures, these have played an important role.

In the United States, between 1982 and 1993, the number of alcohol-related traffic fatalities (BAC>0.01%) fell by 30%, while non-alcohol related traffic deaths decreased by only 4%; and as a proportion of all traffic fatalities, deaths attributable to alcohol declined in the US, from 39% to 30% (CDC, 1993 & 1994). In Great Britain, the total number of traffic-related deaths declined by 35% over the last decade, from 5598 in 1985 to 3621 in 1995, whereas deaths involving illegal alcohol levels declined by 44%, from 1040 to 580 over the same period (Department of Transport, 1996). Overall, considerable declines in alcohol-related motor-vehicle fatalities, ranging between 24% and 45%, have been experienced in many industrialized countries, including Australia (Road Safety Committee, 1995), Canada (Beirness et al., 1994), and New Zealand (Alcohol Advisory Council, 1995), indicating the effectiveness of drink-driving countermeasures.

Other packages, introduced in a number of countries aimed at changing societal attitudes toward health and alcohol have, in general, contributed to the overall decline in alcohol-related crashes. These include, the adoption of laws raising the minimum drinking age from 18 to 21 years in the United States (Decker et al, 1988), the introduction of low alcohol beers, increased media publicity, intensified alcohol education campaigns, formation of volunteer activists and lobby groups against drink-driving such as Mothers Against Drunk Driving (MADD) based in the U.S. (Brown, 1995), and the continued action-oriented research on alternative approaches to prevention.

The extensive epidemiological studies, described above have elucidated, the extent of the contribution of alcohol and other associated factors in traffic crashes. This documentation has played a part in stimulating the formulation of relevant policies and strategies as well as enabling the public to make informed decisions on alcohol use. The combined effects of these measures have contributed to the overall decline in traffic fatalities experienced over the last decade in the industrialised world. Nevertheless, the apparent persistence of a group of drinking drivers resistant to control policies justify the need for new policy options and increased commitment to sustain compliance with the interventions. Furthermore, measures taken in the industrialised world have proved successful and could be adapted to developing country contexts.

1.3. TRAFFIC INJURIES IN DEVELOPING COUNTRIES: EPIDEMIOLOGY AND CONTROL, WITH SPECIAL REFERENCE TO THE EFFECTS OF ALCOHOL

1.3.1. The Size of the Problem

Motor vehicle crashes are a major cause of morbidity, mortality and disability; and account for between 2% and 3% of all recorded deaths in all age groups worldwide (WHO, 1996). Seventy four percent of the total number of persons killed from traffic crashes annually worldwide are in the developing world (World Bank, 1993). In many low-income and middle-income countries, motor vehicle fatality rates have increased over the last 20 years, while death rates from infectious diseases have decreased considerably (Jacobs and Sayer, 1977; Feachem et al, 1992). Studies carried out by the Transport and Research Laboratory (TRL, 1990 & 1991; Ross et al, 1991), further indicate that traffic-related deaths reported in some developing countries between 1970 and 1980 more than doubled, while industrialised countries experienced a decline greater than 20% over the same period. Kenya (NRSC, 1992) and Nigeria (Oluwasanmi, 1993), for example, have experienced a five-fold increase in road traffic fatalities over the last 30 years.

Fatality rates per 10,000 vehicles, presented in Table 1.4, are high and vary widely between countries in the developing world, ranging from 3.0 in Saudi Arabia (Bener and El-Sayyad, 1985) to 301.9 in Haiti (Bangdiwala and Anzola-Perez, 1987). When compared with European and North American countries, African and Asian countries experience considerably higher fatality rates per 10,000 vehicles (Downing et al, 1991).Traffic-related death rates in some developing countries are in excess of 100 per 10,000 vehicles, whereas in industrialised countries the rates are less than 4. The numbers of fatalities per vehicle decrease exponentially with the increase in the level of vehicle ownership, and are inversely related to per capita annual Gross National Product (GNP) of a country (Soderlund and Zwi, 1995). However, with a very rapid development of motorisation, the rates tend to rise with increasing level of vehicle ownership, and also increase in relation to population density (Mekky, 1985; Soderlund and Zwi, 1995). Countries in Sub-Saharan Africa and South-East Asia have fewer deaths per 100,000 population, compared to those in Latin America and Middle-East; this has been shown by Soderlund and Zwi (1995) to be a function of a country's wealth. Where rates initially rise with increasing GNP per capita, they subsequently tend to decline as the problem is recognized and more resources become available for road safety and public health measures.

Case fatality ratios (CFR) - the percentage of deaths to all injuries, as a measure of the seriousness of road traffic injuries range from 2 in Puerto Rico to over 20 per 100 casualties in Nigeria (Table 1.4). This has been shown (Jacobs and Hutchison, 1973) to be strongly correlated with the level of medical facilities available (in terms of number persons per physician, and number of persons per hospital bed): the poorer the medical facility the higher CFR. It will also be influenced by the quality and completeness of routine statistics collection systems.

Table 1.4: Fatality rates in relation to vehicle ownership and population size of a country (in descending order of rate per 10,000 vehicles by region)

Country, 1st author (yr)	Rate/10^4 vehicles (N)	Rate/10^5 pop. (mln)	Motor. Index†	CFR
AFRICA				
Zambia, Vaaje (1985)	118.0 (60,000)	11.3 (6.2)	9.7	14.3
Uganda, Schram (1968)	113.6 (44,000)	6.4 (8.0)	5.5	21.0
Kenya, NRSC (1992)	68.0 (390,000)	11.4 (23.5)	16.4	10.2
Ethiopia, Dessie (1991)	59.5 (60,000)	17.9 (1.6)*	3.4	6.3
Tanzania, Vaaje (1985)	59.0 (140,000)	4.0 (20.6)	6.8	11.9
Cote d'Ivoire, Muhlrad (1987)	43.0 -	8.2 (8.5)	-	7.8
Swaziland, Vaaje (1985)	41.0 (40,800)	28.0 (0.605)	67.4	15.5
Botswana, National RSC(1984)	37.7 (34,479)	13.8 (0.941)	63.6	8.6
Zimbabwe, Zwi (1993)	28.8 (386,943)	11.1 (10.0)	38.7	8.8
S.Africa, Dept.Health (1989)	20.5 -	35.8 (34.5)	-	8.3
Nigeria, Jinadu (1984)	-	7.4	-	20.8
Nigeria, Obembe (1988)	-	10.0 (7.6)*	-	36.8
ASIA				
India, Bhandari (1969)	37.0 -	12.6	-	-
India, Mohan (1985)	12.4 (535,129)	11.6 (5.7)*	93.9	10.9
India, Gururaj (1993)	8.6 (700,000)	13.6 (4.4)*	159	9.8
Papua NG, Jayasuria (1991)	67.4 (51,498)	9.9 (3.5)	14.7	9.8
Malaysia, Krishnan (1992)	8.4 (4.5 mln)	22.2 (17)	264	12.6
Sri Lanka, Sayer (1984)	39.0 (314,626)	-	-	8.0
Sri Lanka, Salgado (1988)	23.3 (523,723)	-	-	-
MIDDLE EAST				
Jordan, Jadaan (1989)	23.5 (221,700)	-	-	5.6
Qatar, Eid (1980)	16.1 (88,688)	65.0 (0.22)	403	4.9
Kuwait, Bayoumi (1981)	8.4 (454,463)	32.0 (1.2)	379	11.4
S. Arabia, Mufti (1983)	3.0 -	41.3	-	8.5
S. Arabia, Bener (1985)	3.0 (981,811)	40.7 (0.73)*	1335	9.3
UAE, Weddele (1981)	-	25.0 (0.93)*	-	3.1
LATIN AMERICA & CARIBBEAN				
Haiti, Bangdiwala (1987)	301.9 (53,000)	31.7 (5.053)	10.5	-
Mexico, Olivares (1968)	40.0 (438,744)	-	-	14.4
Suriname, CAREC (1987)	9.9 (71,860)	19.7 (0.36)	199.6	16.0
Puerto Rico, Kaye (1971)	9.0 (500,000)	16.1 (2.8)	178.6	1.7
Puerto Rico, Kaye (1973)	7.0 (793,883)	19.5 (2.83)	280	2.0

*based on hospital data for region or city
† Motorization index= number of vehicles per 1,000 population
Case Fatality Rate (CFR)=number of deaths per 100 casualties

As a result of morbidity, mortality and property damage, traffic crashes exert a significant economic burden on the countries, estimated to cost between 1% and 2% of a country's GNP per annum (Fouracre and Jacobs, 1976; Jacobs and Sayer, 1977; Jaadan, 1998 & 1990; WHO, 1989; Downing, 1991; Arokiasamy and Krishnan, 1994); and the burden on health services is enormous. Hospital morbidity statistics from Zambia (Haworth, 1989), Zimbabwe (Zwi et al, 1993) and Kenya (Jacobs and Bardsley, 1977; MOH, 1994a) show that injuries from traffic crashes account for 2 to 3% of all hospital attendances, 5-9% of the total number of admissions, and 15-20% of injuries requiring hospitalization. Other studies have shown that traffic-related injuries account for between 30% and 85% of all trauma admissions (Schram, 1968; Eid, 1980; Jadaan, 1980; Shephard, 1980; Chovararech, 1980; Gururaj, 1993), and seriously constrain the scarce resources for health services.

On average, due to severity of their injuries, the mean length of hospital stay (LOS) for traffic-involved inpatients range from 13 days to 19 days, but are considerably longer for those with spinal and head injuries (Table 1.5). For instance, traffic-involved patients admitted at a Spinal Injury Hospital in Kenya stayed for an average of 8.5 months (Ating'a, 1990), while admissions to orthopaedic wards in Malaysia (Iqbal, 1974) spent a mean duration of more than one month (36.6 days); and in one study, 25% of traffic-related admissions remained hospitalized for over 60 days (Balogun, 1992). A recent population-based study in Ghana (Mock et al, 1996) further shows that, in comparison to other mechanisms of injury, transport-related injuries are more severe, result in greater long-term disability and have higher medical costs per casualty.

Table 1.5: Summary of studies with hospital utilization indicators in relation to traffic injuries

Source: 1st author, year	City, country	Indicator examined	
		Mean LOS	Other
Schram, 1968	Kampala, Uganda	16.8 days	50% of trauma admissions
Jacobs, 1977	Nairobi, Kenya	30 days	4.8% of all admissions 5.3% of total bed days
Choovaravech, 80	Bangkok, Thailand	15.5 days	65.8% of trauma admissions
Eid, 1980	Doha, Qatar	-	85.6% of trauma admissions
Shepherd, 1980	Port Moresby, Papua New Guinea	-	30% of trauma admissions High utilization of operating theatre
Weddel, 1981	Shurjah, U.A.E	17.7 days	50% x-rayed
Jadaan, 1984	Jordan	-	31% of trauma admissions 94% x-rayed
Ating'a, 1990	Nairobi, Kenya	8.5 months*	75% of adm. to Spinal Injury Hospital
Wu, 1991	Taipei, Taiwan	13 days	Hospital cost per casualty- US$ 3826 Rehabilitation - average of 2 months
Sathiyesakaran, 1991	Madras, India	-	35.1% of trauma admissions
Balogun, 1992	Ife, Nigeria	>2 months in 25%	Lengthy periods for physiotherapy and rehabilitation
Gururaj, 1993	Bangalore, India	-	52% of trauma admissions
Shanks, 1994	Jeddah, S. Arabia	19 days	High utilization of ICU

* This is a unique population of casualties with disabling injuries, requiring long-term health care; does not reflect a general RTA-affected population.

1.3.2. Epidemiological Features of Traffic Injuries in Developing Countries

1.3.2.1. Data Quality

The major difficulty in assessing the specific risk factors of RTAs in the developing world is the incompleteness of the basic data available on the numbers of casualties and the proportion which are alcohol-related. Under-reporting of injuries from different causes is well documented (Reichenheim and Harpham, 1989). For RTA-related injuries, the problem of under-reporting is likely to be more acute for unprotected road users (pedestrians and cyclists) and those with non-fatal injuries that are less severe, especially in countries with poor communication and adverse geography (WHO, 1984). Surveys of police accident data and hospital records have shown that 50% of traffic-involved casualties attending hospitals in a number of countries in southern Africa (Vaaje, 1985) are not entered in police reports, while in Colombo, Sri Lanka, Sayer and Hitchcock (1984) found that less than 25% of hospital records (of road traffic injuries and deaths) were identified in the police accident data. Police records normally contain statistics of RTAs reported or those investigated, while hospital-based data include only affected casualties presenting for treatment; and in many instances such records lack complete information on demographic characteristics of the casualty, such as; exact age, sex, or category of road-user involved. Even where deaths are concerned, there is evidence of under-reporting. A study in Nigeria, for instance, noted that 40% of deaths occurring after 10 days of a crash are not reported to the police (Owosina, 1981). Lack of a uniform definition of the time interval between the occurrence of an "accident" and death further compounds the problem as the standard definition recommended by the WHO (1979), encompassing deaths occurring within 30 days as a result of a road "accident", is rarely applied. These factors should be taken into account when making international comparisons.

1.3.2.2. Casualty Characteristics

a) Sex:

There is consistent evidence of over-involvement of males in traffic crashes, with males being more than twice as affected as females. As shown in Table 1.6, the proportion of males range from 67% to 97.8%, with a mean of 80% in forty five studies from different countries. Such male preponderance may be partly attributed to their greater exposure to traffic. Men are more accessible to motor vehicles - especially as drivers - than women across all countries, this perhaps is a reflection of traditional gender division of labour, as well as social and religious customs. In some Muslim countries, religious norms prohibit women from driving (Eid, 1980; Weddell et al, 1981; Jadaan, 1989). The preponderance of male vehicle operators is also common in countries where motorised two-wheeler and non-motorised means of transport are prevalent, such as in Indonesia, Taiwan, India and other South-East Asian countries (WHO, 1984). Aside from increased exposure to driving, men may take more risks when driving, for example by driving at higher speeds than women. The involvement of alcohol is perhaps also more likely in men than women.

b) Age:

Globally, adolescents and young adults aged 15- 44 years account for nearly 60% of all mortality from RTAs (World Bank, 1993; Feachem et al, 1992; Stansfield et al, 1992). The most affected age group is 5-44 years, as 10% of all deaths in this age group result from traffic crashes (Jacobs and Bardsley, 1977; Downing, 1991). Deaths from motor vehicle crashes alone, within this age group, is responsible for more years of potential life lost, in developing countries, than for tuberculosis and malaria combined (Stansfield et al, 1992). Mortality of young adults in their most productive years, therefore presents a considerable waste of human resources that developing countries cannot afford.

Traffic morbidity and mortality data reported in twenty eight studies undertaken in different countries (illustrated in Table 1.6) indicate that on average, 70% (range 48% -78%) of casualties are aged between 15 and 44 years, 58% (46%-75%) are between 15-39 years of age, 51% (45% - 59%) are aged 20-39 years; and approximately 50% (37%-59%) are within the age bracket of 20-40 years. Children aged under 15 years account for less than 15%. Although these studies have presented casualty data in varied age groupings, they do provide additional evidence of the excess representation of adolescents and young adults.

Table 1.6: Percent distribution of traffic-related casualties by gender and age (in 28 countries)

Age group (years)	1st Author, year	Country	% Male	% in age group (N)
15-44	Patel, 1977	Zambia	79.2	60 (217)
	Sinha, 1981	Papua NG	86	77 (171)
	Bayoumi,1981	Kuwait	84.2	48 (803)
	Weddell, 1981	U.A.E	90.6	78 (1041)
	Vaaje, 1983*	Tanzania	74.0	74 (760)
	CAREC, 1987	Suriname	77.8	78 (265)
	Sinha, 1989	Papua NG	83.5	70 (363)
	Bouramia, 1992	Benin	74.8	66 (556)
20-39	Oyemade, 1973	Nigeria	69.3	51 (737)
	Obembe, 1988	Nigeria	76	52 (209)
	Salgado, 1988	Sri Lanka	84.5	36 (534)
	Wu, 1990	Taiwan	77.5	48 (449)
	Robles, 1991	Costa Rica	-	51(10592)
	Balogun, 1992	Nigeria	67	45 (353)
	Bener, 1992	U.A.E	87	59 (1197)
15-39	Sayer, 1984	Sri Lanka	85.3	53 (2440)
	Dessie, 1991	Ethiopia	68.0	46 (1092)
	Jayasuria, 1991*	Papua NG	-	75 (3084)
20-40	Olivares, 1965	Mexico	75	28 (855)
	Nair, 1977	Zambia	79	49 (300)
	Siddique, 1977*	Nigeria	75.6	59 (78)
	Eid, 1980*	Qatar	97.8	48 (2896)
	Mufti, 1983	S. Arabia	91.0	48 (234)
	Jinadu, 1984*	Nigeria	68.6	47 (8378)
	Jadaan, 1989*	Jordan	96.0	45 (469)
	Sathiyasekaran, 1991	India	80.0	52 (670)
	Shanks, 1994	S. ARABIA	81	37 (361)
	Kayombo, 1995	Tanzania	76.1	51 (113)

* the actual lower age limit in these studies is 1 year greater than group classification

c) Type of Road-User:

There are some general patterns of types of road-user involved in traffic "accidents", although considerable variations exist between countries and regions. Pedestrians bear the brunt of injury and death across nearly all regions of the developing world, representing the largest category of road-user killed in traffic crashes. They account for between 15% and 75% of all traffic-related fatalities reported in 24 studies (Table 1.7). On average the greatest proportion of pedestrian fatalities (50-55%) are found in the Gulf states, while they comprise 45% in most African countries, and in one African city, Muhlrad (1987) reported that 75% of all road-users killed were pedestrians. Forty percent of traffic-related deaths in Latin America and the Caribbean, and 35% of those reported in countries of South-East Asia and Pacific Islands, are pedestrians. These figures are considerably greater than the 20% found in Europe and the United States (Downing, 1991). The large number of pedestrians sharing the roadway with vehicles, inadequate and overloaded public transport system with vehicles often driven at high speeds (relative to road conditions), lack of physical segregation of pedestrians from motor vehicles coupled with little knowledge of road use rules are some of the main reasons thought to explain the high rate of pedestrian involvement in developing countries (Berger and Mohan, 1996). The presence of many migrants from rural areas into cities who may not have had previous exposure to heavy vehicular traffic and are not as street-wise in relation to traffic may be another contributing factor.

Passenger fatalities rank second, although in some countries, such as Papua New Guinea, they comprise the highest proportion (51.3%) of the total number road deaths: this is attributed to the frequent use of open-back pick-ups as passenger transport vehicles (Laurie and Sinha, 1983; Nelson and Strueber, 1991). In addition, the large numbers of buses, trucks and different forms of passenger transport vehicles, often old, poorly maintained and in an overloaded condition are common; one crash of such vehicles results in many deaths and injuries. Zwi (1996a), for example, points out the significance of repeated bus disasters in Zimbabwe, each leading to 15 or more deaths, as a public health problem and suggests strategies for policy response. Furthermore, recent reports show that buses and trucks are frequently involved in pedestrian collisions resulting in; 72% of pedestrian deaths in India (Mohan, 1985), 72% in Bangladesh (Hoque, 1996), 50% in Ghana and 45% in Zimbabwe (Downing, 1991).

Fatality among cyclists rank first in India and Surinam, and second in Sri Lanka; this is due to the traffic mix on the road, characterized by large numbers of motorized and non-motorized two- and three-wheeler vehicles in the vehicle population (Mohan et al, 1985; Wu, 1991). Drivers killed rank third in 50% of the studies, but are second in the wealthy Gulf states. Vehicle occupants are thought to be at a higher risk of involvement in a traffic crash in these countries because of the rapid motorisation, large numbers of powerful vehicles on road systems which are inadequate for such vehicles, and high driving speeds (Bener, 1985; Ofosu et al, 1987).

Of the non-fatal traffic injuries, passengers are the majority affected in most African countries (representing 40% on average). This is associated with greater use of crowded public transport in the cities. Pedestrians rank second, with the exception of one study in Addis Ababa (Dessie and Larson, 1991) where they constituted the greatest proportion (91%). Operators of motorized and non-motorized two- or three-wheeler vehicles are the most involved in South-East Asia (Gururaj, 1992; Wu, 1992; Silva, 1978); whereas motor vehicle drivers represent nearly half of non-fatal traffic casualties in the wealthy nations in the Middle-East, as the numbers of vehicles per capita are also much higher than in other developing countries.

Table 1.7: Percentage of traffic fatalities by country and class of road-user

	Class of road user			
Country, Source (yr)	Pedestrian	Passenger	Driver	Cyclist
AFRICA				
Coted'Ivoire†, Muhlrad (1987)	75.0	17.0	-	-
Kenya, Jacobs (1976)	45.0	32.5	8.0	11.8
Kenya, NRSC (1992)	41.2	39.7	12.3	7.0
Nigeria, Siddique (1979)	45.5	6.8	15.9	32.0
Swaziland, Vaaje (1987)	43.0	30.0	20.0	7.0
S.Africa, Ferguson (1974)	65.0	-	35.0*	-
S. Africa, Auto Assoc (1991)	45.0	28.1	22.3	7.9
Tanzania, Vaaje (1985)	39.0	44.0	11.0	6.0
Uganda, Schram (1968)	45.0	26.0	9.0	20.0
Zambia, Patel (1977)	50.2	28.1	15.2	6.4
Zambia ,Vaaje (1985)	46.0	33.0	14.0	8.0
ASIA AND OCEANIA				
India, Mohan (1985)	33.0	15.0	3.0	39.0
India, Sidhu (1993)	16.0	58.0*	-	25.8
Papua NG, Wyatt (1980)	41.0	38.0	10.0	5.0
Papua NG, Sinha (1981)	34.5	45.6	14.6	3.5
Papua NG, Sinha (1989)	34.4	45.0	18.2	3.0
Papua NG, Dept Transp. (1991)	33.8	51.3	13.4	1.6
Sri Lanka, Salgado (1988)	51.4	11.2	2.4	34.5
MIDDLE EAST				
Kuwait, Bayoumi (1981)	55.0	-	40.8*	4.0
Qatar, Eid (1980)	50.0**	-	50.0*	-
LATIN AMERICA AND CARIBBEAN				
Puerto Rico, Kaye (1971)	54.0	16.0	23.0	4.7
Puerto Rico, Kaye (1973)	47.0	19.0	23.0	2.2
Suriname, CAREC (1987)	15.0	15.0	9.0	58.0
Trin. & Tobago, Holder (1989)	45.7	21.7	21.7	10.9

†data for Abidjan; * vehicle occupants; ** pedestrians and cyclists

1.3.2.3. Causes of Crashes

The causal factors of RTAs have been recognized to be multifactorial, and involve the interaction among human, vehicle and environmental factors (Haddon, 1980a; Council of AMA, 1983; Baker et al, 1992; Robertson, 1992). Haddon classified these factors based on the time sequence of the accident event into pre-crash, crash, and post-crash phases. The pre-crash phase includes all events that determine whether a crash actually takes place; the crash phase includes factors that determine whether injury occurred in the crash and, if so, its type and severity; and the post-crash phase includes all factors that determine the consequences of the injury.

In the pre-crash phase, human factors (as determined by the police) are responsible for the generation of between 74% and 95% of all RTAs in developing countries (Silva, 1978; Eid, 1980; Mufti, 1983; Jacobs and Sayer, 1983; NRSC, 1992; TRL, 1990; Downing, 1991; Williamson et al, 1993). The frequency distribution of the main causes of road "accidents" reported in some countries are shown in Table 1.8. Surveys to elucidate the magnitude of human errors conducted on a sample of drivers by the TRL (Sayer and Downing, 1981) in Jamaica, Pakistan and Thailand show that fewer than 60% had received professional driver training; half of the drivers failed to stop at a red signal in Thailand, 17% in Pakistan and 6% in Jamaica. In addition 15% of drivers in Pakistan crossed continuous "no-overtaking" lines. It is, therefore, common for the police to adjudge the cause of a road accident as driver negligence, encompassing reckless driving, improper overtaking and ignoring traffic signs. Other reports (Downing, 1991) further indicate lack of discipline of road users at pedestrian crossings, as only 10-17% of drivers choose to stop, and less than half of pedestrians actually use pedestrian crossings. These findings suggest that road safety measures which require behavioural change may not be effective unless integrated with publicity, education and enforcement campaigns.

Speed is well documented as a major factor contributing to crashes (Meiring, 1974; Baker et al, 1992; Lave and Elias, 1994) and the severity of their effects. Proportions of crashes attributed to excessive speed, as determined by the police, vary widely from 7.5% in Nigeria (Aganga, 1983) to 67% in Saudi Arabia (Mufti, 1983; Bener, 1985); equivalent values reported from other countries are 8.5% in Kenya (NRSC, 1992), 10% in Jordan (Jadaan, 1989) and 60% in Cote d'Ivoire (Muhlrad, 1987). Although such figures are subject to judgement bias by the police, they do suggest the importance of speed and driver behaviour as determinants of traffic crashes. Another area of concern, related to road-user behaviour, is associated with drug and alcohol use: evidence of attempts to address the problem of drinking and driving in developing countries is presented in a separate section of this chapter (see section 1.3.3). Little information is available on the contribution of other human-related factors such as driver age, driving skills and experience, fatigue and medical conditions such as poor eyesight or illness.

Other factors operating in the pre-crash phase include those that are vehicle-related, such as deficient brakes, worn-out tyres, malfunctioning head lights, vehicle overload, vehicle control and performance characteristics including speed. In many countries, most of the existing vehicle fleets are old or used models imported from countries of origin: in Nigeria, for instance, the average age of buses and taxis is 15-20 years (Asogwa, 1992 & 1996). Besides aging, vehicle maintenance is generally not sustained due to the high cost of spare parts, often requiring foreign exchange, and the worsening economic situation. Nonetheless, police "accident" statistics indicate vehicle defects as a minor factor, accounting for only 1% to 8% of all causes (Downing, 1991). Both the road layout and traffic environment (including state of road surface, curvature and gradient of roads, road width, whether single or dual carriage way, the presence or absence of pedestrian facilities and cycle lanes, presence of roadside hazards, signposts, traffic control at intersections, road lighting and weather conditions) are recognized pre-crash factors (Baker et al, 1992). In addition, the presence of a diverse mix of the slow moving human- and animal-powered vehicles, that increase traffic congestion (carts, wagons, bicycles, tricycles, and trishaws), with motorized vehicles are thought to further increase the probability of crashes (Simon, 1996). Surprisingly, the contribution of the road environment is seldom reported and is considerably under-estimated at between 1% and 9% of all causes in a sample of developing countries (Downing, 1991).

Table 1.8: Main causes of road "accidents" (%) in selected countries

Country, year	Road-user	Vehicle	Road Environment	Other
Afghanistan, 1984	74	17	9	-
Botswana, 1982	94	2	1	3
Ethiopia, 1982	81	5	-	14
India, 1980	80	7	1	12
Kenya, 1990	85	5	3	7
Pakistan, 1984	91	4	5	-
Phillippines, 1984	85	8	7	-
Malaysia, 1985	87	2	4	7
Zimbabwe, 1979	89	5	1	5

Sources: Data from: TRL, 1990; Downing, 1991; NRSC, 1992.

Despite these variations, human behaviour (and personal responsibility) stands out as the most common determinant of whether a crash actually occurs, with other factors accounting for less than one-third of all causes across all countries.

1.3.3. Alcohol-relatedness

Many developing countries have not recognized alcohol as a factor in traffic crashes, despite the availability of well documented evidence in industrialised nations. Police "accident" statistics often imprecisely refer to alcohol, while health statistics make no mention of alcohol as a factor. For example, police statistics on road "accidents" in Swaziland indicated alcohol (based on smell and speech impairment) as a primary cause in 4.3% of crashes where drivers were involved, in 5.4% where cyclists were involved and in 8% where pedestrians were involved (Haworth, 1982). In Botswana, Finlay and Jones (1984) reported that 6.8% of drivers involved in all reported traffic "accidents" in 1980 were intoxicated, whereas Zimbabwe police reports in 1983 (Haworth, 1989) indicated that only 4.9% were alcohol-related; and in Tanzania, 8% of accident-involved drivers were shown in the 1986 statistics as having taken alcohol (Jokinen et al, 1994). In Zaria, a largely Muslim region in Nigeria, less than 0.2% of drivers involved in "accidents" were suspected to have been drinking (Aganga, 1983), and in Saudi Arabia, also a Muslim state, it was just 0.7% (Bener,1985). The estimated proportions of alcohol-involvement in traffic crashes in Latin America region greatly vary across the countries (in different years of reporting): 70% in Chile in 1965, 20% in Argentina in 1980 (Roizen, 1989), 9% in Guatemala (Caetano, 1984), and 7% in Mexico (Silva, 1972). Wide variations have also been documented in Western Pacific islands (Casswell, 1989), where police estimates of the alcohol factor range between 10% in Papua New Guinea and 45% in Cook Islands. It is, in general, evident from these examples that either police tend to attribute a very small proportion of road traffic "accidents" to alcohol, or drink-driving is far less frequently a cause of "accidents", a somewhat unlikely scenario.

Of the 36 identified studies (published and unpublished reports) on traffic injuries in developing countries (spanning over the last 30 years) that mentioned alcohol as a possible contributing factor, 18 provided alcohol prevalence data (Table 1.9). Proportions of casualties with evidence of blood alcohol varied considerably. However, due to a number of factors, such as variable time interval between the crash event and measurement of alcohol, different evaluation methods and blood alcohol cut-off levels applied, direct comparison of intoxication levels between studies is problematic. For instance, in five fatality studies where a threshold BAC level of 80 mg% was applied, alcohol prevalence in drivers ranged from 27% in Zambia (Patel, 1977) to 53% in Papua New Guinea (Sinha, 1981), with very high rates of intoxication (90%) in pedestrians. Of the non-fatal surveys using the same cut-off BAC (80 mg%), a recent report (Johnson et al, 1995) shows that 80% of drivers and two-thirds of pedestrians tested immediately after a crash in Port Moresby were intoxicated, while the equivalent percentage reported in South Africa for crash involved-drivers presenting to hospitals is 47% (Myers, 1977). Where the criterion BAC was lower (10 mg%), a greater proportion was considered intoxicated: 56% in Nigeria (Aguwa et al., 1982) and 62% in Cape Town (Fosseus, 1983). At a threshold BAC of 50 mg%, 9% of traffic casualties presenting to hospitals in Suriname (CAREC, 1987), and 8.5% of motorcyclists in Taiwan (Wu, 1991) exceeded the cut-off BAC limit. Subjective evaluation undertaken in ten studies using both smell of alcohol in breath (8 studies) and self-reports (2 studies), in general, provided low estimates of alcohol use, ranging from 8% in Nigeria (Asogwa, 1980) to 16% in India (Gururaj et al., 1993).

These data are illustrative of the limitations of information currently available on alcohol-relatedness with traffic crashes in developing countries; and, in particular, reflect under-reporting of alcohol in the official "accident" statistics. Differences in measurement techniques and cut-off levels of BACs further render comparability of published alcohol prevalence figures inappropriate. Among other factors, cross-cultural differences between regions and countries with regard to alcohol consumption may also, partially, explain the differences. Direct evidence of the extent of association of alcohol with RTAs in developing countries therefore still remains limited and inconclusive.

Table 1.7: Alcohol prevalence, in percentages, by country and category of road-user

Author,year,country	Casualty type	Sample Size Total	% tested	Class of road user (n) Driver	Pedestrian	Passenger	Cyclist	All	Test method & cut-off BAC
									Blood analysis
Myers,1977, *S.Africa*	N/F	165	70	47.0 (34)	28.6 (21)	37.5 (24)	27.7 (36)	35.6	80 mg%
Patel, 1977, *Zambia*	fatal	217	100	30.3 (33)	32.1 (109)	14.7 (61)	33.3 (12)	26.7	80 mg%
Wyatt,1980, *Papua NG*	fatal	121	70*	33.3 (15)	69.0	-	-	76.0	80 mg%
Lourie,1981,*Papua NG*	fatal	171	23	52.6 (19)	90.0 (20)	-	-	71.8	80 mg%
Sinha, 1989,*Papua NG*	fatal	363	17	48.5 (33)	66.7 (30)	-	-	57.1	80 mg%
Francis,1995, *Jamaica*	fatal	39	79	9.7 (5)	16.1 (13)	6.5 (6)	- (4)	35.5	50 mg%
Kaye,1971,*Puerto Rico*	fatal	451	75	63.0 (57)	61.0 (106)	26.0 (67)	-	58.9	20 mg%
Kaye,1973,*Puerto Rico*	fatal	552	73	69.2 (65)	64.8 (105)	48.8 (29)	-	63.2	20 mg%
Kaye,1974,*Puerto Rico*	fatal	577	85	48.0	34.0	-	-	-	20 mg%
Fosseus,1983,*S.Africa*	fatal†	48	83	-	-	-	61.3	-	10mg%
Aguwa, 1982, *Nigeria*	N/F	32	100	56.0 (32)	-	-	-	-	10mg%
									Breath test
Wu, 1991, *Taiwan*	N/F†	489	92	-	-	-	8.5	-	50 mg%
CAREC,1987, *Surinam*	N/F**	289	87	15.4 (26)	18.2 (44)	13.6 (44)	22.1 (140)	20.6	1 mg%
									Subjective
NatRS,1984,*Botswana*	N/F,fatal	1614	-	-	-	-	-	7.5	blood/smell
Bouramia, 1992, *Benin*	N/F	796	-	-	-	-	-	1.0	judgement/smell
Aganga, 1983, *Nigeria*	N/F	2669	-	0.16	-	-	-	-	,,
Obembe, 1988,*Nigeria*	N/F	209	100	14.0 (50)	17.6 (159)	-	-	16.7	,,
Vaaje,1985, *Swaziland*	N/F	915	-	1.6	-	-	-	-	,,
Mbaruku, 1977,*Tanzania*	N/F	239	100	-	-	-	-	13.0	,,
Vaaje, 1985, *Zambia*	N/F	4213	-	0.7	-	-	-	-	,,
Zwi, 1993, *Zimbabwe*	N/F	11463	-	3.2	-	-	-	-	,,
Bener,1985, *S.Arabia*	N/F	20339	-	1.1	-	-	-	-	,,
Ofosu,1988, *S.Arabia*	N/F	-	-	0.9	-	-	-	-	,,
Asogwa,1980, *Nigeria*	N/F	1296	43	7.7	-	-	-	-	Self-report
Gururaj,1993, *India*	N/F	1784	-	16.0	16.0	-	21.0	16.0	Self-report
Wong,1990, *Singapore*	N/F†	198	100	-	-	-	-	10.0	Self-report
Golding,1974, *Jamaica*	N/F	-	-	-	-	-	45.0	-	Self-report

N/F- non-fatal; * age tested >10 years; ** age tested >14 years; † motorcyclist

1.4. TRAFFIC INJURY CONTROL: PRINCIPLES AND INTERVENTIONS

1.4.1. Historical Perspectives

The first road death in Britain occurred 100 years ago, on August 17, 1886, when a woman pedestrian aged 44 was struck in London[5]. The driver was reported by a witness to have been *zig-zagging at high speed to show off to his girlfriend*, but an inquest returned a verdict of "accidental death". Over the last 100 years, more people have been killed on the roads than in all of the world's wars, disasters, famine, diseases or murders. Many of these deaths are preventable through purposely designed engineering, educational and enforcement approaches.

The pioneering works of De Haven (1942) and Gordon (1949) showed that the severity of injury is determined by structural characteristics of the environment, conditions of the human body, the nature of the agent of injury, and human behaviour relative to the environment. Subsequent work in understanding mechanisms of motor vehicle injuries and possible interventions were advanced by Haddon (1968, 1975, 1980a, 1980b). In a model now known as "Haddon's matrix", Haddon conceptualized the time sequence of a crash in three phases - pre-crash, crash, and post-crash - and their interaction with three sets of factors - human, vehicle, and environment (Table 1.10). Haddon's analysis suggests that preventing an injury may require modifying not only one of the elements, but various contributing factors; and each cell in the matrix presents an opportunity for interventions.

[5] The Guardian, 17 August, 1996

Table 1.10. The Haddon's Matrix: Examples of factors related to the likelihood of injury

Phases	Factors		
	Human	Vehicle	Physical and Social Environment
Pre-crash	Alcohol intoxication Driver vision Fatigue Experience Judgement Amount of travel	Brakes, tyres Centre of gravity Ease of control Speed of travel Load weight	Traffic laws, laws related to alcohol and driving Visibility of hazards Road surface and curvature Divided highways, single lanes Intersections, access control Road signs Speed limits
Crash	Seat belt use Helmet use Age Sex Osteoporosis	Speed at impact Vehicle size Automatic restraints Interior contact surfaces Side-impact bars Load containment	Speed limits Recovery areas Guard rails Characteristics of fixed objects Median barriers Roadside embankments
Post-crash	Age Physical condition	Fuel system integrity Anti-burst door locks	Emergency communication and transport systems Distance to and quality of medical services Rehabilitation programmes

Source: Adapted from Haddon, 1980; Baker et al, 1992

1.4.2. Principles and Examples of Traffic Injury Prevention

> *Although Mercedes-Benz is already renowned for its development of safety systems, it deserves great credit for understanding that no matter how many passive and active safety aids are fitted to a car, the driver has the final responsibility in avoiding accidents.*
>
> (The Daily Telegraph, November 2, 1996).

The above citation helps to illustrate the current understanding of the range of interventions that have been developed for preventing motor vehicle crashes and injuries, and the multifactorial nature of causation of crashes. Haddon's matrix therefore presents a pragmatic framework for systematically identifying strategies that can be adopted for different mechanisms of injury. For example, ten basic strategies developed by Haddon (1973), for preventing harmful interactions between man and the hazards in the environment can be applied in traffic injury prevention. The strategies aim to:

1. Prevent the creation of the hazard;
2. Reduce the amount of hazard produced;
3. Prevent the release of a hazard that already exists or reduce the likelihood of its release;
4. Modify the rate of release or the spatial distribution of release of the hazard;
5. Separate, in time and space, the hazard from the people to be protected;
6. Separate the hazard from that which is to be protected by a material barrier;
7. Modify the relevant basic qualities of the hazard;
8. Strengthen the resistance of people to the hazard;
9. Begin to counter the damage already done by the hazard;
10. Stabilize, repair, and rehabilitate the object of the damage.

These strategies can aid decisions on appropriate choices of countermeasures. Primary interventions require actions specific to identified risk factors in the pre-crash phase. Examples include improvements in road engineering and vehicle safety standards, known to have made significant contributions in reducing the risk and severity of injuries; education to raise awareness of injury risk, influence behaviour and motivate adoption of more responsible road use culture; and legal regulations, such as drink-driving legislation, traffic rules, helmet and seat belt use laws, as well as the corresponding sanctions.

Secondary prevention aims to reduce the severity of injury that may occur in the crash phase; these include both active and passive interventions. Examples of an active intervention is a seat belt for car occupants or a motorcycle helmet that must be worn properly by the rider, whereas air bags and side-impact bars that automatically protect vehicle occupants represent passive interventions. The effectiveness of such measures in preventing injury and death in motor vehicle crashes is well established (Foldvary and Lane, 1974; Robertson, 1978; Watson et al., 1980; Mueller Orsay et al., 1988; Sosin et al., 1990; Mackay, 1991; Sosin and Sacks, 1992; Robertson, 1992). In addition, bicycle helmet use laws coupled with education and conspicuity enhancement measures have been shown to be effective in reducing head injuries (Thompson et al, 1989; Williams, 1991). Other interventions include speed limit legislation and traffic calming measures such as speed bumps or strips. For instance, studies in the United States (Baum et al, 1989; Wagenaar et al, 1990) and Denmark (Engel and Thompson, 1992) have shown that case fatality ratios (number of deaths to injuries) increase dramatically with raising the speed limit; from 5 deaths/1,000 injuries, where the limit is 30 mph or less to 31/1,000 injuries, where the limit is 55 mph. Raising the speed limit from 55 to 65 mph also resulted in a 20-30% increase in road deaths and 40% increase in injuries. In addition, as discussed earlier in this chapter (section 1.2), a number of alcohol-related interventions, including random breath tests, have contributed to the observed decline in motor vehicle fatalities.

Strategies for preventing pedestrian injuries include separation of pedestrians from vehicles, provision of adequate pedestrian crossing facilities and signs, adequate lighting of roads and paths, wearing bright clothing or reflective bands at night and road use education. For these measures to be effective, pedestrians must be ready to comply with the road use rules and actually use the designated facilities.

Tertiary injury prevention in the post-crash phase emphasizes the care of casualties through improving ambulance and emergency services, and raising the quality of rehabilitation services. Prompt evacuation of crash victims, timely initiation of emergency treatment, and provision of effective definitive care and rehabilitation services have resulted in considerable reductions in fatalities and the duration of morbidity. For instance, significant declines in injury mortality have been experienced in Trinidad and Tobago between 1986 and 1990 after the institution of Advanced Trauma Life Support (ATLS) training programme for physicians (Ali et al., 1993; Ali and Sherphard, 1994).

Addressing traffic injury prevention and control issues inevitably requires a multifaceted approach that encompasses all dimensions of the causal factors matrix, while focusing on both the affected individual and the population at large. However, sufficient knowledge of epidemiological features of road traffic trauma, such as demographic and crash characteristics, injury severity, anatomical location of injury, as well as social and physical environmental factors are required to aid in choosing priority interventions.

1.4.3. Impediments to Traffic Injury Control in Developing Countries

Since the early 1980s, many developing countries have established road safety agencies, the National Road Safety Council or Road Safety Committee, mostly within Ministries of Transport and of Roads, with the aim of preventing road "accidents" (Yerrel, 1984). They are intersectoral in composition, with membership derived from both government and non-governmental sectors. Most of these operate at the national level. Their specific roles and capacity to effectively function, however, vary from country to country. In Nigeria, for example, the mandate of the Federal Road Safety Commission, established in 1980, include, ensuring law enforcement, collecting road accident statistics, revising traffic legislation, promotion of road safety education, ensuring adequate provision of medical facilities for traffic injury victims, undertaking research in road safety, and co-ordination of all road safety activities (Asogwa, 1978 & 1992). Contemporary agencies with similar roles have been established in many developing nations. In general, these organizations do not have the capacity to function effectively due to inadequate funding, lack of sufficient human and material resources, as well as lack of authority to fully discharge their duties.

Other major impediments to promoting road safety measures in less developed countries include lack of complete documentation on road traffic "accidents" and the resulting injuries, imprecise surveillance methods used, limited research on causes and risk factors, as well as lack of awareness of existing interventions by the public and many policy-makers (Asogwa, 1992; Forjuoh and Gyebi-Ofosu, 1993; Zwi, 1993). In some cases, policy-makers are reluctant to introduce legislative measures proven to be effective in reducing injury severity. For instance, in India, the implementation of a law on compulsory wearing of crash helmets has been postponed indefinitely as policy-makers are apparently still unconvinced of its effectiveness (Dixit and Khairnar, 1992), and in Nigeria, the law enacted in 1976 has been repealed and the wearing rate declined from 92% in 1982 to 10% in 1996 (Asogwa, 1982 & 1996) resulting in a dramatic increase in head injuries (Falope, 1991; Odelowo, 1994). In Kenya the seat-belt use law was gazetted in 1987 (Laws of Kenya, Cap 403, Rev. 1993) but its implementation was suspended soon after for unexplained reasons. Even where specific traffic legislation exist, they are largely ignored due to poor enforcement and low conviction rates of offenders. In Zimbabwe, the police has limited powers in enforcing legal limits of alcohol, as the law against drunk driving only allows them to breath test persons whose driving conduct arouses suspicion (Kobus, 1980); this often results in very low prosecution rates (2.4% of all traffic offenses in 1992) (Central Statistics Office, Harare, 1993). The police also often lack the necessary resources and logistics such as; sufficient numbers of alcohol testing equipment, adequate number of officers trained to administer breath tests, limited access to transport, and the overwhelmed traffic courts, causing delays in convictions (Zwi et al., 1993; van der Spuy, 1996). In addition, the requirement that people suspected of alcohol and driving have to be taken to a hospital for a doctor's examination and a blood test further presents a major obstacle to enforcing drink-driving legislation, as doctors may not be readily available and distances to health services are often long.

Furthermore, owing to inadequate medical infrastructure as well as resources for health care, the lack of effective post-injury management, including emergency care, definitive treatment and rehabilitation, present considerable constraints to injury control in less developed countries.

Although a variety of road safety approaches have extensively been applied in industrialised nations, little attempt has been made to promote and implement them in the developing countries. In Africa, in particular, no definite policies and institutions exist for injury surveillance and control in most countries (Forjuoh and Gyebi-Ofosu, 1993; Zwi, 1993). However, policy response to injury-related problems in Zimbabwe has been innovative, as a national injury control committee has been established and a range of injury prevention activities have been initiated, co-ordinated by the Ministry of Health (Zwi et al, 1993; Zwi et al, 1996). Specific initiatives for traffic management and injury control have also been undertaken in the middle-income countries of South-East Asia region and the Caribbean. Policy response to injury control in Thailand, for example, is one of the most comprehensive that addresses all major safety issues of concern in conformity with the principles of the Manifesto for Safe Communities developed and promoted by the WHO (1989). The National Safety Council, presided by Thailand's Prime Minister, has specific sub-committees for traffic, occupational, agrochemical, public and home safety (Berger and Mohan, 1996). The work of each of the sub-committees is broad-based, encompasses legislation and enforcement, education, training and research, public relations, and public education on safety (see Box 1.1).

In summary, it is clear that impediments to traffic injury control cut across the entire spectrum of causative factors and phases of crash events in the different economic, political, cultural, organizational and bureaucratic contexts prevailing in developing countries. These obstacles can be overcome through availability of accurate information on crash characteristics, recognition of traffic injury as a priority public health problem, raising awareness of policy-makers on the available effective countermeasures as well as mobilizing resources and commitment for their implementation.

Box 1.1: National Safety Council of Thailand

Unlike many less developed nations, Thailand has an abundance of government agencies dealing with injury-related problems: at least 12 ministries, including the Ministry of Public Health, Departments of Highways, Land Transport, Police, Labour and Industrial Works. The National Safety Council was established in 1983 as a central office to set priorities and co-ordinate government activities in the field of injury. Membership of the Council include the country's Deputy Prime Minister and senior government officials, such as permanent secretaries of ministries and the Director-General of departments with direct authority for decision-making. With the NSC's offices physically located on the grounds of the Prime Minister's office, political support from Thailand's highest officials has lent significant credibility and importance to injury control activities.

Source: Berger and Mohan, 1996; p 180.

1.5. SUMMARY OF THE REVIEW OF LITERATURE

1. Traffic injuries are a major and increasing public health problem in developing countries, accounting for 2-3% of all deaths and costing an equivalent of 1-2% of the annual GNP of a country.

2.The dearth of data for assessing risk factors and consequences of road traffic "accidents" is evident, owing to under-reporting and incompleteness of morbidity and mortality statistics, and imprecise surveillance methods.

3. Demographically, in all countries, males and young adults of ages 15- 44 years are the most affected; whereas pedestrians and passengers are the most vulnerable groups of road-users, although significant variations exist between countries due to the traffic mix.

4. Human factors are recognized as a major factor responsible for over 75% of all road "accidents" (64-95%) in all developing countries, of which road-user behaviour and indiscipline are the most common. Vehicle, road environment and social factors are estimated to account for less than one-third of all causes.

5.There is sufficient scientific and epidemiological evidence of a driver's increased risk of involvement in a road "accident" as the BAC level increases. The introduction and implementation of specific drink-driving countermeasures in industrialised countries have contributed to significant reductions in alcohol-related fatalities of between 24% and 45% over the last decade.

6. There is little data quantifying links between alcohol and traffic injuries in most less developed countries. Police statistics attribute very small proportions of accidents to drink-driving, while no such information is available from health records. Few fatality and inpatient surveys that are available show wide variations in alcohol prevalence in drivers.

7. The promotion and adoption of proven traffic injury prevention interventions in most developing countries have been hampered by many factors, including lack of complete documentation of risk factors, poor awareness of existing control strategies by policy makers and the public, reluctance to introduce relevant legislative changes, lack of commitment in enforcement and inadequate resources.

8. Recent initiatives to establish special multisectoral agencies for injury control in Zimbabwe and Thailand are cited as innovative examples of addressing the problem.

This study will attempt to quantify the extent of contribution of alcohol in road traffic crashes, assess the level of public awareness, and explore the potential for using the data for developing appropriate policy response to drinking and driving in Kenya.

CHAPTER 2

KENYA: A SITUATIONAL ANALYSIS

This chapter presents background information about Kenya in relation to traffic "accidents", the subject of the thesis. It has eight sections. A general description of geographic and demographic characteristics of the country is given in sections 1-2, followed by an overview of the health care system, including morbidity and mortality profiles in sections 3 and 4. The next section (5) describes the transport system. A detailed analysis of epidemiological characteristics of road traffic "accidents" in Kenya is presented in section 6, followed by an outline of current road safety interventions (section 7). The final section gives a summary of the rationale for the study.

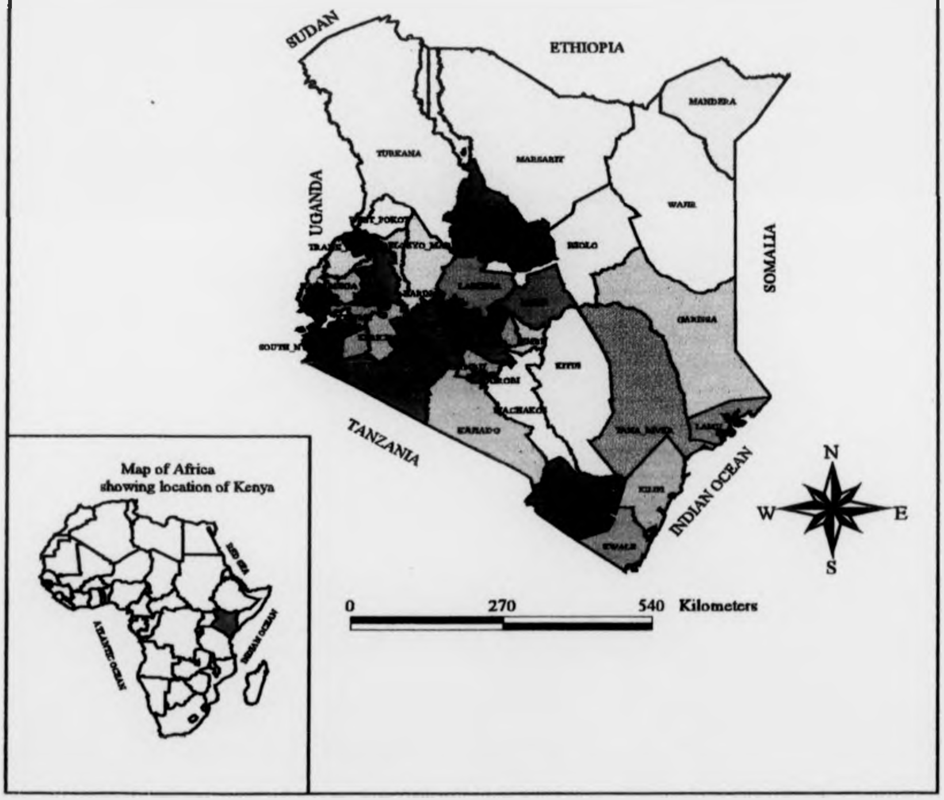
2.1. LOCATION, CLIMATE AND ADMINISTRATION

Kenya is situated in Eastern Africa, between latitudes 3 degrees North and 5 degrees South, 34 degrees East and 41 degrees West. It is almost bisected by the equator and the 38 degrees East longitude. Its boundaries include Indian Ocean on the East, Lake Victoria and Mt. Elgon on the west, and Mt. Kilimanjaro on the south. It is bordered by five countries: Tanzania to the south, Uganda to the west, Sudan to the north-west, Ethiopia to the north, and Somalia to the east; and covers an area of 583,000 square kilometres (see Figure 2. 1).

Kenya has diverse topography with altitudes rising from the sea level at the coast, to 5,200 metres on the summit of Mt. Kenya, thus creating different ecologic and climatic conditions. The low-lying coastal plains and lake basin regions are hot and humid, interior lowland plateaus and northern plainlands are semi-arid, while the highlands enjoy a cool tropical climate. The Great Rift Valley bisects the inland region into western and eastern highlands. The mean annual rainfall varies considerably between geographical regions, from under 250 mm in lowland regions to over 1,500 mm in the highlands. There are two wet seasons; long rains in April to June, and short rains from late October to November. January and February are the driest months of the year.

Administratively, Kenya is divided into eight provinces which are in turn divided into 41 districts. Figure 2.1 illustrates the location of the districts. Nyanza and Western provinces occupy the land around Lake Victoria; Central Province is on the highlands east of the Rift Valley; Eastern, Coast and Rift Valley provinces occupy areas with diverse geographical characteristics; while North-Eastern province lies within the most arid and semi-arid areas of the country. Rift Valley Province is the largest with 14 districts, including Uasin Gishu in 1994 (2 new districts have since been created through sub-division of Elgeyo Marakwet and Baringo districts). Eldoret town, located 320 kilometres north-west of Nairobi, is the district headquarters of Uasin Gishu District.

Figure 2.1 Map of Kenya showing the Administrative boundaries and the location of Uasin Gishu District (shaded red)



2.2. POPULATION AND DEMOGRAPHIC PROFILES

Kenya's population was estimated at 27.5 million in 1995, with an average annual growth rate of 2.8%, a decline from 3.2% in 1990 (CBS, 1996). Demographic indicators in 1963 and 1993 indicate declines in crude death rate from 20 to 12 per 1,000 population, infant mortality rate from 120 to 67/1,000 live births, and crude birth rate from 50 to 46 live births/ 1,000 population. Over the same period, life expectancy increased from 44 to 60 years (Table 2.1). The age-specific structure of the population is similar to that of other developing countries: under fives comprise 18% ; 0-14 years, 47%; 15-49 years, 43%; and those aged 50 years and above, 10%. The overall sex distribution is nearly even, 49.6% male and 50.4% female.

Table 2 1: Demographic indicators, Kenya, 1963-1993

Indicator	1963	1989/90	1993
Total population (millions)	8.9	21.4	24.5
Population Growth rate (%)	3.0	3.0	3.4
Total Fertility rate (births/ woman)	6.8	6.7	5.4
Population aged 0-14 years (%)	46.0	47.0	47.0
Population aged 15-49 years (%)	42.0	43.0	43.0
Population aged 50 years and above (%)	10.0	10.0	10.0
Crude Death Rate	20/1000	12/1000	12/1000
Crude Birth Rate	50/1000	49/1000	46/1000
Life Expectancy (years)	44	58	60
Infant Mortality Rate	120/1000	74/1000	67/1000

Source. Ministry of Health. Kenya's Health Policy Framework, 1994a

A vast majority (82%) of Kenya's population live in rural areas, with only 18% in urban centres[6]. The average annual rate of increase of the urban population is 7%, mainly as a result of migration. Nairobi, the capital city, has an estimated population of 1.5 million, and Mombasa, the second largest city, has approximately 800,000 residents. High density rural settlements with high agricultural potential, comprising only 18% of the total land surface, are located on arable land along the coast, the central highland region and in the western part of the country.

2.3. HEALTH CARE SERVICES

Health services in Kenya are provided through a multifaceted system that includes central government, local authorities, non-governmental organizations, church missions, and a wide array of private medical practitioners and traditional healers. Both curative and preventive health services are organized in a hierarchical pyramid-shaped system, with dispensaries and health centres at the base, district and provincial hospitals at the intermediate level, and referral hospitals at the peak. Patient referrals are supposed to originate from the bottom to the facility above, but in practice other factors, such as accessibility, cost, quality and efficiency of services, dictate a patient's choice.

Public and private health services are provided through 1,882 dispensaries, 697 health centres, 279 hospitals (including 71 nursing homes), and numerous private clinics. 56% of all health institutions are government-owned, 25% are private, 14% are mission while a small proportion is run by the local government (3.4%) and institutions or companies (MOH, 1994a).

Government funding of the Ministry of Health has declined from 9.2% of the total recurrent budget in the 1979/80 financial year to an estimated 7.6% in 1996/97, with the corresponding

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[6]Defined by the Central Bureau of Statistics (1994) as a centre with 2,000 or more inhabitants.

fall in per capita expenditure on health from US$9.50 to US$3.50 over the periods (MOH, 1994a). Of the total health sector expenditure in 1983/84, the Ministry of Health provided 42%, out-of-pocket payments by individuals represented 41%, and 5.3% was provided by the Local Government. Mandatory health insurance for salaried and self-employed workers mediated through the National Hospital Insurance (NHIF) provided approximately 4%, while donor inputs were less than 3%. Since 1989, financing mechanisms of previously fully funded government health facilities have considerably shifted directly to health-care users through the introduction of cost sharing (user fees) policy, as part of the health care reform programme. The components of the health care reform include expanding cost sharing in government facilities, increasing the role of social insurance in funding public health care, and increasing the efficiency of resource use (MOH, 1994a, Mwabu, 1995). The proportion of revenue collected through user charges in 1990 represented about 7% of the non-staff recurrent expenditure or 3.4% of the total recurrent budget of the Ministry (Republic of Kenya, 1990): and during the financial year 1993/94, user fees revenue was estimated to be equivalent to 37% of the total Treasury allocation for non-staff recurrent expenditure at provincial hospitals, 20% at district hospitals, and 21% at health centres (Collins et al., 1996). 75% of user fees revenues are supposed to be used at the collecting health facility to improve quality of care, with the remaining 25% for district-level primary and preventive health care. In practice, however, owing to inadequate government allocations, most of the cost sharing revenue have been used to prevent deterioration of services (including maintenance of buildings and vehicles, procuring cleansing materials, drugs and dressings) rather than improve quality of service (Mwabu et al., 1995; Collins et al., 1996).

Private health care providers operate in two categories. Church and missionary groups run dispensaries, health centres and hospitals which complement government services in rural areas. They are financed by user fees, donations from their parent overseas offices and some grants from the government. Profit-making individual and corporate hospitals, operating on a fee-for-service basis are located largely in urban centres. Some hospitals require prior arrangements or advance deposit of part of the charges, with full payment of the balance at discharge, a system that suits well established companies or institutions, but is often a hindrance to individuals requiring emergency treatment, such as traffic-involved casualties. Incidents of patients, without reliable financial guarantors, being denied prompt medical care have often appeared in the press. Private and mission hospitals are, in general, better equipped and provide a higher quality of care than most government facilities. Although the cost of private medical care is high (affordable by a small proportion of the population), the role of the private sector in curative services is projected to increase, as the Ministry of Health's stated policy (MOH, 1994a) is to reduce its direct participation in the provision of both outpatient and inpatient services. This is likely to adversely affect accessibility of traffic-affected patients to a range of post-injury care.

The contribution of traditional practitioners is little documented. These practitioners are located largely in rural areas and are thought to be widely used due to their physical accessibility, cultural acceptability, low cost and flexibility in terms of forms of payment accepted. There are indications that this sector plays an important role in health care provision, though the picture is still inconclusive (Kimani, 1988).

2.4. MORBIDITY AND MORTALITY PATTERN

The burden of disease in Kenya reported by the health information system is estimated from out-patient morbidity statistics from government health institutions, and represent an underestimate of the true situation due to incomplete reporting. In addition, substantial regional variations that exist are masked by the aggregated national statistics. Nevertheless, according to Ministry of Health's reports (MOH, 1994b), malaria and respiratory diseases account for nearly 50% of all diagnoses in patients attending government health facilities (Table 2.2). "Accidents", including burns, represent 2.7% and rank 7th among the top causes of out-patient presentations.

Table 2.2: Out-patient Morbidity Statistics, 1990-92

Disease	1990	1991	1992
Malaria	25.1	23.4	26.6
Respiratory Diseases	22.3	20.8	23.2
Skin diseases	8.2	8.0	9.1
Intestinal Worms	4.2	3.8	4.5
Diarrhoeal Diseases	4.1	3.8	4.4
Urinary Tract Infections	2.4	2.4	2.8
Accidents (incl. burns)	**3.0**	**2.3**	**2.7**
Eye Infections	2.3	2.2	2.5
Rheumatism	1.9	1.8	1.9
Pneumonia	2.0	1.7	1.6
Ear Infections	1.7	1.4	1.5
All others	22.8	28.4	1 9 . 7

•(N=22,556,899)

Of the reported admissions in 1992, injuries accounted for 2%, and ranked 8th; 70% of all injury-related hospitalizations were male, but the distribution was not disaggregated by age and sex. Despite a requirement that all health care providers submit both monthly and annual morbidity statistics to the Ministry of Health, these are rarely forwarded by private and non-governmental institutions. Thus, available data are derived from the public sector only and may lead to some biases in identifying priorities.

From hospital statistics, the leading causes of death are reported as: malaria, (accounting for 14% of all deaths); bronchopneumonia, (11%); anaemia, (8.5%); tuberculosis, (4%); intestinal infections, (4%); and congestive heart failure, (3%). Trauma-related deaths registered in hospital records represent less than 1%. Most trauma deaths, from traffic and violence, occur outside health care institutions and therefore are not included in hospital statistics. Unfortunately, mortality data from the national vital registration system were not available, although road traffic "accidents" are known to be the most common cause of trauma-related deaths.

2.5. THE TRANSPORT SYSTEM

2.5.1 Road Transport

Kenya's road network consists of 63,662 km of classified and 87,276 unclassified roads. Only 14% or 8,803 kilometres of classified roads are tarmacked (CBS, 1995), most of which are highways connecting various urban centres. An all-weather road links Mombasa with Addis Ababa (Ethiopia), and there is also a 670 kilometre road link between Eldoret and Juba in Sudan (see Figure 2.2). Although good roads exist in many parts of the country, there are variations in the distribution of road network between regions and within cities. The development of paved roads, in general, increased by 3.1% over the last 5 years, from 7,686 kilometres in 1989, indicating an annualized increase of only 0.8%. This low growth in the road network has led to severe overloading of certain key highways, especially between Mombasa, Nairobi and the Uganda border. The extensive use of road transport coupled with the relative lack of sustained maintenance have contributed to serious deterioration of the road surface.

According to the Central Bureau of Statistics (CBS, 1995), the total number of registered vehicles in Kenya at the end of 1994 was 398,204, of which 43% were cars, 25% pick-ups and vans, 8% lorries and trucks, 7.5% buses and minibuses, 5.4% motorcycles, 3% trailers, and 8% tractors and others. This was a 15% increase over the numbers (347,400) registered in 1989, indicating a mean increase of 3% per year. The overall level of vehicle ownership is approximately 16.6 vehicles per 1,000 population (less than 2 vehicles for every 100 people), while for cars the figure is much lower, 7 per 1,000 people. But there are substantial differences in vehicle ownership between incomes of individuals, with higher rates among high-income groups. A large majority of the population therefore rely on public transport which is operated entirely by the private sector in the form of buses and *matatus* (see Box 2.1).

Buses are an important mode of road-based transport between cities and rural areas, as they accommodate substantial numbers of passengers as well as their personal belongings. There are many individual and company passenger bus services operating in various parts of the country, but the traffic is heaviest on the major profitable urban routes. For instance, in Nairobi and Mombasa, the Kenya Bus Service (KBS) with a total fleet of about 360 buses strive to meet the ever increasing demand for transport, whereas other towns lack conventional commuter bus services. The Government, in response, launched a public bus service (the Nyayo Bus Corporation) in 1986 to complement private passenger transport, and perhaps also to provide an alternative to *matatus* and reduce their monopoly and "power". By 1990, the corporation had purchased over 350 buses which were operational countrywide. It had a promising start, but soon began to experience numerous operational problems. It is not clear what exactly affected the performance of this project, but it is postulated that some of the problems included over employment with a high staff/bus ratio, low staff morale due to frequent delays in payment of salaries as well as lack of incentives, poor vehicle maintenance resulting in frequent crashes and court attachment of buses for insurance claims, and possibly inefficient management.

Matatus remain the most common form of transport system that operates in all cities, towns and rural parts of the country; and it is estimated that they provide about 50% of motorized transport in Nairobi (Simon, 1996). The evolution of *matatus* stemmed from inadequacy and rising cost of conventional public transport in both rural and high-density urban areas. Although public transport is liberalized, there are certain criteria that transporters have to be comply with; these include possession of a valid PSV road licence, insurance cover for passengers, annual vehicle inspection certificate prior to renewal of licence, and operation by a qualified driver with a valid PSV driving licence. Compliance to these conditions and their enforcement by the police present daunting tasks. In general, the government and local authorities remain uncomfortable with *matatus* and several attempts to introduce regulatory measures in the past resulted in strikes, adversely affecting all facets of commercial, educational, social and civil activities.

Box 2.1: *Matatus*: a powerful public transport industry

Matatus are converted pick-ups and minibuses that provide public passenger transport in both urban and rural areas. They originated as private vehicles that were illegally used to provide unconventional passenger services without licences. A Presidential decree in 1973 ended their originally illegal status, but the legislation, defining a *matatu* as a public service vehicle (PSV) with a seating capacity of not more than 25 passengers, was only passed 10 years later in 1984. This legislation, however, created an anomaly as *matatus* were exempted from the Transport Licensing Board (TLB) Act, the licensing authority for goods and passenger vehicles. Conditions for TLB licensing include specified maximum number of passengers allowed, speed limit for the vehicle, specific route of operation and a timetable. *Matatu* operators have exploited this loophole through overloading, rushing for passengers, making as many trips as they wish on variable routes, and making frequent stops anywhere on the road. Police checks and roadblocks are common on the outskirts of towns and along trunk roads, subjecting overspeeding drivers and those driving overloaded or poorly maintained vehicles to fines, arrests and even impounding of the vehicles. These actions are often regarded by the operators as police harassment and have contributed to the building up of tension between them and the government. When, for instance, in 1986, the government directed all public service vehicles to be installed with safety devices and speed governors, *matatu* operators responded by calling a nationwide strike. The government was forced to rescind implementation of the directive after it had been gazetted as a legal notice of amendment of the Traffic Act. The then powerful Matatu Vehicles Owners' Association (MVOA) and Country Bus Owners' Association were subsequently disbanded, and their bank accounts frozen. This action fragmented *matatu* operations even further, the business became a free for all affair, as wealthy individuals, politicians and professionals flooded this transport industry with various types of imported used-vehicles mainly from Dubai, South Africa and Britain.

Lack of safety design guidelines, poor maintenance, unsafe practices in operation and the rising congestion on urban roads have contributed to the increasing road accident rates in the country. However, an attempt to re-introduce fitting of speed recording devices (tachographs) for PSVs in March 1996 was again met by severe resistance and a countrywide strike, backed by an influential government politician. The operators sought audience with the President, who intervened by suspending the rule and directing the Minister for Transport and Communications to involve representatives of *matatu* operators in exploring alternative ways of addressing the issue.

Sources: 1. Laws of Kenya: The Traffic Act, Cap 403; The Transport Licensing Act (Cap 404); The Kenya Gazette Supplement No 72, Legal Notice No.352 (The Traffic Amendment Rules, 1995); 2. Simon D., 1996; 3. Sunday Nation, June 25, 1995.

2.5.2. Railways

Kenya railways provide complementary but limited passenger transport. The railway system comprises 2,085 kilometres of one gauge single track. Slightly more than a half (1,085 km), constitutes the main line which runs from the port of Mombasa through Nairobi, Nakuru, Kisumu and Eldoret to the Ugandan border. The railway network is old, and is used mainly for conveyance of goods and freight from Mombasa to inland towns as well as to bordering countries.

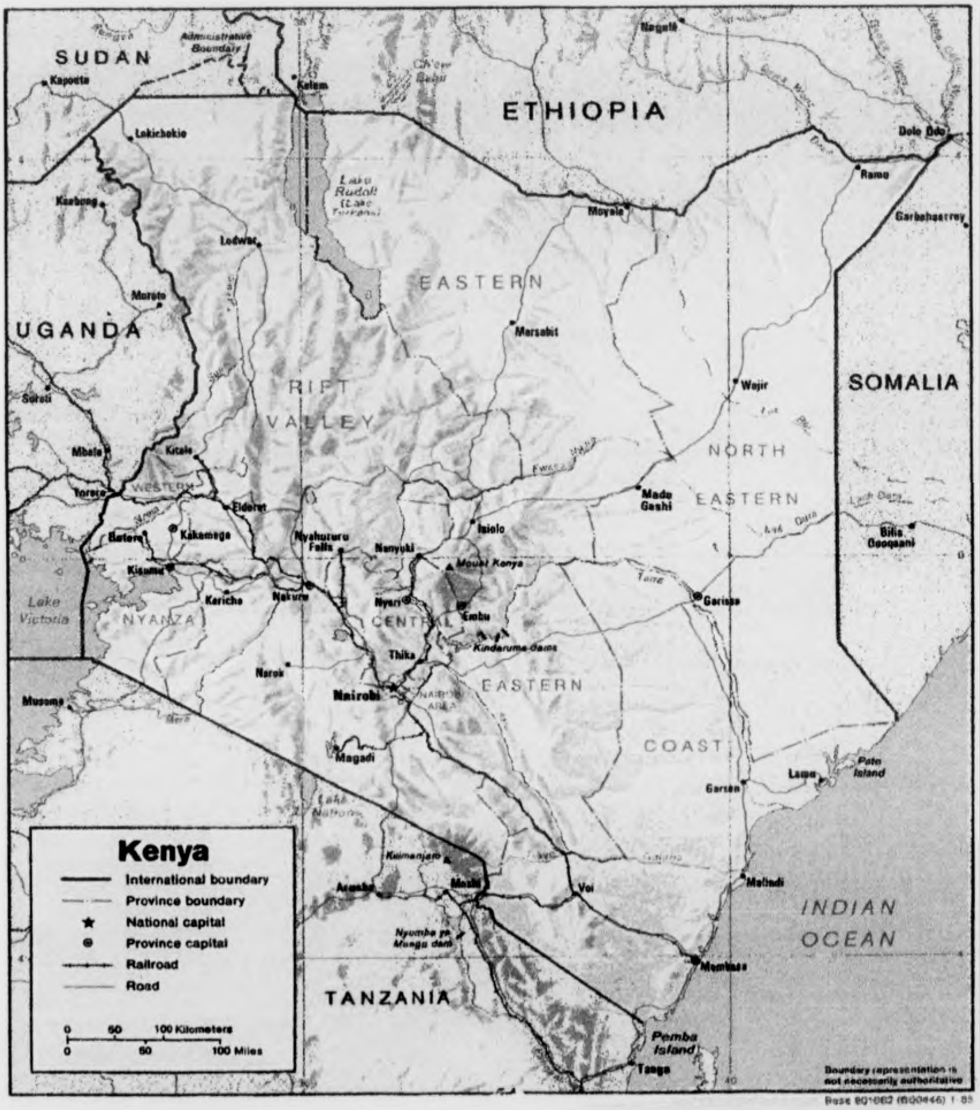
2.5.3. Air Transport

Air transport is generally less developed. There are two main airports in Kenya which provide services to many of the world's major airlines; the Jomo Kenyatta International Airport in Nairobi, and Moi International Airport in Mombasa. Services between Nairobi and Europe are the most numerous; there are a number of services that connect with other parts of Africa, the Middle and Far East, Asia, and North America. Medium sized airports for internal flights exist at Kisumu, Malindi and Eldoret.

2.5.4. Shipping

Kenya's main port is situated at Mombasa, an island that shelters the deepest natural harbour in Africa. Its facilities are important not only for the country's economy, but also to the neighbouring landlocked countries in the East African region (Uganda, Rwanda, Burundi, southern Sudan, and eastern Zaire), whose freight trade uses the port.

Figure 2.2. Map of Kenya showing Administrative Provinces, Road and Railway Transport Networks



2.6. EPIDEMIOLOGY OF ROAD TRAFFIC ACCIDENTS IN KENYA

2.6.1. Magnitude and Trends

Road traffic accident (RTA) statistics in Kenya are collected routinely by the traffic police based on reported "accidents" involving personal injury as most crashes and collisions will not involve injuries or fatalities. Although some of the numerous non-injury vehicle only crashes also get recorded by the police, mainly for prosecution and insurance compensation purposes, these are not reported in the road accident statistics. For each reported injury-producing crash event, a record of circumstances, probable cause(s), and personal data of the victim is noted in a standard Accident Report Form (see Appendix 2.1). The organization of the police force that collects this information extends to all police stations in the country. Traffic police headquarters prepare monthly, quarterly, and annual national summary statistics of all reported road "accidents". On the basis of these reports, the numbers of road "accidents" dramatically increased from 3,562 in 1965 to 12,960 in 1995, and the numbers killed rose from 552 to 2,617 between the periods (increases of 260% and 370%, respectively) (NRSC, 1992; CBS, 1991& 1995). Over the last 10 years, road deaths increased at a mean annual rate of 9.1%, while case fatality rates, calculated as the percentage of deaths to the total number of casualties, showed little change (Table 2.3). However, there is an increasing trend of the mean number of casualties per crash over the years, this possibly reflects the frequent involvement of *matatus* and buses with a high passenger load. According to the Minister for Transport and Communications[7], Kenya is one of the leading countries in the world (ranks 6th) with the highest road fatality rates in relation to vehicle ownership, with a daily average of 7 deaths from the 35 road crashes that occur on the roads each day.

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[7] Daily Nation, June 8, 1995

Table 2.3 Trends in road traffic accidents in Kenya, 1965-1995 ‡

Year	No. Accidents (a)	No. Injuries (b)	No Fatalities (c)	Total casualties (b+c)	Mean cas/acc. (b+c/a)	CFR (c/b+c)
1965	3562	4146	552	4698	1.3	11.7
1970	5163	6812	944	7756	1.5	12.2
1975	6534	8283	1338	9621	1.5	13.9
1980	6162	8900	1413	10313	1.7	13.7
1985	8474	13583	1800	15383	1.8	11.7
1990	10306	17074	1856	18930	1.8	9.8
1992	12735	23454	2673	26127	2.0	10..2
1993	12355	21884	2516	24440	2.0	10..3
1994	11785	20536	2424	22960	1.9	10.5
1995	12960	N/A	2617	N/A	*	*
%increase	**264%**	**395%†**	**374%**	**389%†**	1.7	mean=11.5 %

† calculated for years 1965-1994; * denominator figures unavailable;

Source: Data from: National Road Safety Council (1992, 1994); Personal communication (1995 data).

As shown in Table 2.4, over the last 10 years, fatality rate per 100,000 population ranged between 7.8 and 10.6, while the rate in relation to numbers of vehicles was 50.7-64.2 per 10,000 registered vehicles. These rates do not reflect any significant variations over the period despite the phenomenal increase in traffic deaths. This can partly be explained by the combined effects of population growth and the increase in the numbers of motor vehicles.

Table 2.4 Trends in traffic fatality rates in Kenya, 1985-1995

Year	Total population	Fatalities	Fatality rate /10^5 population	Number of registered vehicles*	Fatality rate/ 10^4 vehicles
1985	20,298,000	1,800	8.9	280,216	64.2
1986	21,008,000	1,832	8.7	299,435	61.2
1987	21717,000	1,889	8.7	320,000	59.0
1988	22,430,000	1,919	8.6	329,403	58.2
1989	23,150,000	2,014	8.7	347,400	58.0
1990	23,715,000	1,856	7.8	366,100	50.7
1991	23,477,000	2,216	9.1	382,008	58.0
1992	25,240,000	2,673	10.6	397,524	67.2
1993	26,002,000	2,516	9.7	412,308	61.0
1994	26,752,000	2,424	9.1	424,728	57.1
1995	27,519,000	2,617	9.5	442,656	59.1
Mean rates	-	-	9.0	-	59.4
95% CI.			8.6-9.5		56.6-62.2

* data from CBS (1991 and 1995)

2.6.2. The Burden of Road Traffic Injuries

RTAs are a major cause of morbidity, mortality and disability in Kenya. Casualties from traffic "accidents" are estimated to comprise between 45% and 60% of all admissions in surgical wards, and up to 75% of patients at the National Spinal Injury Hospital (Ating'a, 1990), thus placing high demands on hospital resources. In addition to being a human tragedy, RTAs present serious economic losses to individuals, society, companies and the nation as a whole. They exert a huge cost burden on Kenya's economy in terms of insurance, vehicle maintenance, health care and related expenses by affected individuals and families, as well as lost production and death. According to the National Road Safety Council, in 1984, the annual economic cost of RTAs was estimated at K shs 1.5 billion (Mwasi, 1984), an equivalent of 1.6% of GNP for that year. This rose to K shs 2.9 billion or 3.6% of the

GNP in 1989 (Makau et al, 1990; Gekonge, 1990), and to 3.8 billion or 5% of the GNP by 1991 (Ministry of Public Works, 1992). In 1995, for instance, the insurance industry was reported by the press[8] to have spent a colossal sum of K shillings 20 billion (an equivalent of 5.5% of the year's GNP) on road accident-related payments (comprising costs of vehicle damage, medical care, and compensation for injuries and fatalities). Such payments have led to large financial losses by the industry, causing many insurance firms to run out of business, and at the same time, necessitating steep increases in motor vehicle insurance premiums. Press reports attributed to the insurance industry indicate that, of approximately 50 insurance companies operating in Kenya, only two are currently willing to offer any form of insurance cover for public service vehicles.

2.6.3. Crash Characteristics

a) Causes:

The main categories of causes of RTAs, based on the Accident Cause Code classification used by the Kenya police (see Appendix 2.2) are; human factors (85.5%), vehicle defects (5.1%), road environment (2.9%) and other factors (6.4%) (Table 2. 5). The relative contribution of these factors remained unchanged over the time period 1985-1990. Driver errors such as losing control, overspeeding, misjudgment, and improper overtaking accounted for the greatest proportion (44.4%) of all causes attributed to human factors. Alcohol is hardly looked for, and almost never reported, as a contributing factor.

b) Temporal distribution:

Traffic crashes are more frequent during daytime than at night. Police reports indicate that 66% of all reported crashes occur during daytime, between 7am and 7pm; only one third of crashes are reported to occur at night (NRSC, 1992; Raval, 1972). The incidence is also

[8] Kenya Times, April 9, 1996

greater during weekends than weekdays, with Saturdays having the highest proportion (15.3%) of the total reported weekly figures.

Table 2.5: Causes of road accidents in Kenya, 1990 and 1985-1990

Cause		**Year and % of all causes**	
		1990	1985-90
I. Human	Driver & motor cyclists	44.4	44.3
	Pedestrian	27.1	27.4
	Passenger	6.8	6.7
	Pedal cyclists	7.2	5.9
Sub-total		**85.5**	**84.3**
II. Vehicle	Tyres or wheels	2.5	2.2
	Other defects	2.6	3.9
Sub-total		**5.1**	**6.1**
III. Traffic Environment	Road defects	1.3	1.4
	Animals	0.7	0.9
	Obstruction	0.5	0.8
	Weather	0.4	1.4
Sub-total		**2.9**	**4.5**
IV. Other causes		**6.4**	**6.2**

c) Location:

According to road "accident" statistics published by the National Road Safety Council (1992), 60% of all injury-producing "accidents" happen on roads in rural areas, mostly trunk roads, whilst 40% occur within urban areas. The distribution of crashes vary by geographical location: a third of all crashes reported between 1988 and 1990 were in Nairobi, whereas Central and Coast Provinces had 15% each; the rest of the provinces reported lower proportions. Of the casualties injured on rural roads, Central and Rift Valley

Provinces had the highest rates, 32% and 28%, respectively; probably this can be attributed to the greater number of buses and *matatus* often involved in the crashes. Nevertheless, it is difficult to interpret these data in the absence of information on traffic volume and flows through these areas.

The average number of casualties per motor vehicle crash or collision occurring on rural roads is greater (1.8) than on urban roads (1.2). A study by Jacobs and Sayer (1976) also showed that case fatality rate is higher (16%) for crashes on rural roads than for those occurring in urban areas (10.6%). This is perhaps due to high vehicle speeds on inter-urban roads, long distances travelled resulting in driver fatigue, lower police presence, inadequate emergency medical services in rural areas, and greater distances to hospitals.

d) Vehicles involved:

In 1990, cars, pick-ups and vans were involved in 41% of the reported crashes, buses in 10%, lorries 12%, *matatus* 11%, taxis 2%, tractors 2%, trailers and tankers 1%. Vehicle registration figures for the same year show that cars comprised 45%, pick-ups and vans 25%, buses 3.7%, and lorries 9.2% (CBS 1991). These figures indicate that, on the basis of their proportion, involvement of buses is three times greater than would have been expected. It is however impractical to make a similar comparison for *matatus* since vehicle registration system is based on the make of vehicle, and not whether they are used for carrying passengers (different types of vehicles, such as station-wagon Peugeot cars, pick-ups and vans are used as *matatus*). These data are imprecise as they do not take account of vehicle kilometres travelled: buses, for example will be in use throughout the day and will cover substantial distances while cars may be immobile most of the time.

2.6.4. Casualty Profile

a) Age:

In the police-derived RTA data, ages of persons killed or injured are classified into two broad groups; children under 16 years, and adults, aged 16 years and above. The statistics for 1983-1990, for example, show that children accounted for 10% of all casualties, and a large majority (90%) comprised of adults. Between 14% and 19% of the juvenile casualties were killed, while for adults the fatality rate was lower, ranged between 10% and 14%. The high mortality in young people is probably because most of the victims involved are likely to have been pedestrians, whereas a greater proportion of affected adults are drivers or passengers. Other data indicate over-involvement of a young proportion of the population in non-fatal crashes: for example, 76% of admissions at the Nakuru Provincial Hospital in 1992 (Limbalala and Chirwa, 1992) were aged between 19 and 49 years, a majority (36%) of whom were in the 20-29 year age-bracket. An earlier study by Jacobs and Bardsley (1977) at two referral hospitals in Nairobi (Kenyatta National Hospital and Agha Khan Hospital), showed that 11.4% of crash victims admitted were under the age of 15 years, while 76% were aged 15-44 years. At the trauma rehabilitation centre of the National Spinal Injury Unit, the mean age of traffic-involved inpatients was found to be 31 years (Atinga, 1990). These figures reflect the adverse impact of traffic crashes on the young economically productive population.

b) Sex:

Routine traffic "accident" records lack information on the gender of victims. The sex-specific distribution of affected casualties from police-derived statistics cannot therefore be established. The hospital survey in Nakuru, referred to above, however showed that males were over represented, comprised 92% of all traffic-related admissions, equivalent to a sex ratio of 3:1; but males admitted at the Spinal Injury Unit outnumbered females by 11.5:1.

c) Road-user:

Pedestrians are the most vulnerable and pay a heavy toll for exposure to traffic. They represented 42% of all crash victims killed between 1971 and 1990, whereas passengers accounted for 38%, drivers 12% and pedal cyclists 8%. As illustrated in Table 2.6, it is evident that no significant changes in proportions of the different classes of road-users killed on Kenyan roads have occurred over the last 20 years. Unfortunately, the figures were not presented by age and gender to allow for assessment of relationships of these demographic variables with the various road-users.

Table 2. 6: Trends in traffic fatalities by class of road-user, 1971, 1972 and 1983-1990

Year	Class of road user, in percentages.			
	Pedestrian	Passenger	Driver	Cyclist
1971	40.2	32.9	13.8	13.1
1972	45.0	32.5	8.0	11.8
1983	42.3	40.3	10.3	7.1
1984	40.7	40.4	12.8	6.4
1985	39.6	41.9	12.4	6.1
1986	42.6	37.6	12.3	7.5
1987	42.8	38.1	12.8	6.3
1988	39.8	42.9	11.3	6.0
1989	40.1	39.5	12.6	7.9
1990	41.5	36.7	13.5	8.3
Mean % (95% CI)	**41.5 (40.2-42.7)**	**38.3 (35.8-40.8)**	**12.0 (10.7-13.2)**	**8.1 (6.3-9.8)**

Source: Adapted from Raval, 1974 and NRSC, 1992.

d) Injury severity:

Severity of injury is classified as fatal, serious or slight, on the basis of information available to the police within a short time of the accident. This, in general, may not reflect results of a medical examination, and is often influenced by whether a casualty is hospitalized or not. Injury is reported as fatal if death occurs on the spot or after hospitalization, there is no strict definition of the time limit. On average, 10.3% of crash victims die, 32.5% are seriously injured, and 57.2% slightly injured annually (Table 2. 7).

Table 2.7: Distribution of RTA casualties by level of injury severity, 1992-94

Injury severity	1992 No. (%)	1993 No. (%)	1994 No. (%)
Killed	2673 (10.2)	2516 (10.3)	2424 (10.5)
Serious injury	8495 (32.5)	7734 (31.7)	7652 (33.3)
Slight injury	14959 (57.3)	14150 (58.0)	12884 (56.1)
Total	**26127**	**24400**	**22960**

The time interval between accident event and death is not clearly defined. The criteria for classification of non-fatal injuries are also not standardized, but are based on the subjective assessment of the investigating police officer and whether a casualty is admitted or not, and may not be consistent with the actual clinical condition. Most severe injuries resulted from vehicle-pedestrian collisions with a high case fatality rate of 24%, while the rates in other types of collisions were lower (18% in single vehicle, 17% in vehicle-bicycle, 12% in vehicle-vehicle, and 8% in vehicle-motorcycle).

e) Geographical Distribution of Fatalities by Class of Road-user

Table 2.8 illustrates frequency distribution of fatalities and case fatality rates (CFR) by province and class of road-user. Of the total road deaths reported in 1990, 55% occurred in Nairobi, Central and Rift Valley Provinces; Eastern Province (9.2%) and North-Eastern Province (1.3%) had the lowest proportions. The proportion of road-users killed also varied by region; for instance, 68% of fatalities in Nairobi were pedestrians, whereas in North-Eastern, Rift Valley and Eastern provinces, the majority killed were passengers, representing 71%, 47% and 46%, respectively. A greater proportion of drivers fatalities, exceeding the country mean of 13.5%, occurred in Rift Valley (18.1%) and Eastern (20.5%) provinces than in all other regions. Pedal cyclists comprised the smallest of proportion of road-users killed in nearly all provinces as their numbers in the general traffic are small.

Case fatality rates similarly varied by province with North-Eastern Province leading with 12.6%, and Nairobi having the lowest rate (7.3%). As explained earlier, these differences are likely to be caused by many factors, such as differences in types of vehicles involved (buses, *matatus* or cars) and their passenger load, speed of travel, as well as the availability and effectiveness of emergency medical treatment.

Table 2.8: Fatalities by class of road-user and Province, 1990

Province	Class of road-user, in percents				Fatality	
	Pedestrian	Passenger	Driver	Cyclist	N (%)	CFR(%)
Nairobi	67.9	16.9	8.8	3.2	308 (16.6)	7.3
Central	42.9	37.9	12.6	6.6	364 (19.6)	10.0
R/Valley	22.9	46.6	18.1	15.3	354 (19.1)	12.5
Coast	42.7	34.5	12.3	10.5	220 (11.9)	7.8
Eastern	29.5	45.5	20.5	4.5	200 (10.8)	10.2
Nyanza	42.3	36.7	8.4	12.6	215 (11.6)	11.5
Western	43.9	37.4	8.8	9.9	171 (9.2)	11.9
N/Eastern	20.8	70.8	-	8.3	24 (1.3)	12.6
All provinces	41.5	36.7	13.5	8.3	1856(100)	10.8

Source: Adapted from NRSC, 1992

2.7. ROAD SAFETY INTERVENTIONS

2.7.1. The Traffic Act

Road safety interventions in Kenya are governed by traffic laws and their enforcement. The Traffic Act, Chapter 403 of the Laws of Kenya (see Box 2.2), defines the various legal requirements for safe road use to be observed by motorized road traffic, it also specifies corresponding penalties for each violation. Drivers are expected to learn traffic rules and the Highway Code during the course of their training.

Box 2.2: Traffic Legislation

The Traffic Act, Chapter 403 of the Laws of Kenya, is an Act of Parliament that consolidates the law relating to traffic on roads. It was first enacted in 1953, and has since undergone numerous amendments. The latest version, revised in 1993, is divided into 12 Parts, which are further divided into 120 sections. The Act sets the legal basis for road safety interventions, as illustrated in the following examples:

Section 105 empowers *"any police officer in uniform to stop any vehicle... for the purpose of carrying out any inspection...with a view to ascertaining whether the vehicle is being used in contravention of this Act."* Section 36 deals with conditions for taking a driving test, while section 42 regulates vehicle speed by stating that *"no person shall drive a vehicle on a road at a speed greater than such speed as may be prescribed as the maximum speed for that class of vehicle."*

Section 44, last revised in 1986, is of particular relevance to this thesis, as it prohibits driving under the influence of alcohol, but fails to define the legal limit of blood alcohol concentration or procedures for obtaining evidence of intoxication. This section vaguely 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 shs 10,000 or imprisonment for a term not exceeding 18 months or both such fine and imprisonment."*

Section 93 is perhaps one of the most controversial aspects of the Act with respect to road safety work, as it says that *"the highway authority shall not be liable for any loss or damage that may be caused to any person or property through the condition of a road or the failure of a road to sustain the weight of a vehicle."* It thus confers the highway authority (in this case, the government) immunity from being sued by the owner or driver of a vehicle for any loss, damage or injury that result from an accident caused by poorly maintained roads.

Source: Laws of Kenya, Cap 403 (Revised 1993).

The Traffic Police are principally responsible for enforcement of traffic laws throughout the country and have established Traffic Highway Patrol Bases in every district. The role of the police in accident prevention work include: carrying out road tests for driver licensing, conducting speed checks and vehicle inspections, removal of defective and unroadworthy vehicles from the road, and prosecuting drivers carrying excess passengers and those who violate traffic laws.

2.7.2. The National Road Safety Council

The establishment of the National Road Safety Council (NRSC) in 1982 was a response to the increasing numbers of road "accidents" and lack of co-ordinated road safety efforts in the country (Mwasi, 1984). Its functions at inception were defined as, to set national policy on road safety, develop relevant implementation strategies, co-ordinate the work of all organizations involved in the promotion of road safety, acquire sufficient resources and personnel for road safety work and monitor their use, and formulate a long term programme for effective road safety work in the country. The goal set by the Road Safety Council was to reduce traffic fatalities by 30% from 1,515 in 1983 to less than 1,000 deaths in 1993. The Minister for Transport and Communications (Okondo, 1984), in his address at the First African Road Safety Congress held in Nairobi in 1984, reiterated the government's commitment to achieving this objective and improve the overall road safety situation in Kenya. This was a clear message of government support for road safety interventions.

NRSC membership is multi-sectoral and comprises representatives of 12 government ministries, organizations and institutions involved in road safety work (Box 2.3). The Ministry of Transport and Communications is responsible for co-ordinating the Council's activities and advising the government on relevant policy changes. The Ministry also houses the secretariat and chairs all meetings of the Council. The Council has four sub-committees each of which is assigned a specific task: Education and Information, Traffic Legislation,

Box 2.3: Membership of the National Road Safety Council

Ministry of Transport and Communications
Office of the President (Department of Police)
Ministry of Public Works
Ministry of Health
Ministry of Education
Ministry of Finance
Ministry of Information and Broadcasting
Ministry of Local Government
Attorney -General's Office
Nairobi City Council
University of Nairobi
Automobile Association of Kenya

Motor Vehicle Driving Instruction, and Accident Investigation. Over the past years, the emphasis has been on primary preventive measures focused on public information through radio broadcasts and television programmes, road safety education in primary schools, training of children on safe road use at the specially constructed children's traffic parks in Nairobi and Kisumu, and identification of hazardous road locations. Implementation of specific interventions, such as road maintenance and development works, vehicle safety inspections and law enforcement, are the responsibility of relevant government Ministries (Ministry of Public Works and Traffic Police department).

Following complaints by Members of Parliament about the deteriorating state of roads, a private member's motion seeking parliament to establish a select committee to investigate factors contributing to the increasing road carnage in the country was recently (July 1996)[9] debated and passed (with amendments). Although no Parliamentary Select Committee was appointed, a new parastatal body, the Road Safety Authority (RSA), was subsequently established by the government to coordinate and implement road safety interventions, including ensuring effective enforcement of traffic rules, and increasing public awareness and compliance to traffic laws. The organization will receive public funding from a special petrol tax, the Petroleum Levy Fund (introduced by the Treasury in 1995 as revenue for road maintenance expenditure). So far, RSA is not functional and it is still unclear how the new body will relate to the existing Road Safety Council.

[9] Daily Nation, July 25, 27, and 31, 1996

2.7.3. Non-Governmental Organizations and Road Safety

Road safety work has not attracted the interest of NGOs or donor agencies in Kenya. The Automobile Association (AA) of Kenya, which draws membership from private motorists, is the only organization which has long been involved in advocacy for safe road use through public education and quarterly newsletters distributed to the Association's members. It has branches in all major towns in the country and runs driver training courses. The AA has a road safety sub-committee whose chairman represents the association at the National Road Safety Council.

The first NGO to be specifically established for road safety work, the Road Safety Network (RSN), was launched in June 1995. The attendance of senior government officials at the function including the Minister for Transport and Communication, and the Minister for Health, with extensive media publicity is perceived by the public to reflect government's support for the organization. Activities of the RSN are focused on four main areas: provision of First Aid treatment and evacuation of crash victims using their free ambulance service, carrying out on-the-spot accident investigations, compiling and analysing road accident statistics in liaison with the traffic police, as well as participating in public education on safe road use. The funding mechanisms of the organization are still unclear, and it is at the moment uncertain whether it has sufficient resources to sustain these activities.

2.8. RATIONALE FOR THE STUDY

There is evidence from published literature of wide differences between developing countries in terms of traffic fatality rates, road-users involved (their road use behaviour, culture and knowledge), conditions of roads, types and conditions of vehicles, and characteristics of the traffic using roads. Whereas many road safety interventions have proved to be effective in industrialized countries, the appropriateness of transferring some of them to developing countries needs to be considered in relation to specific problems and conditions prevailing in the individual countries. It is therefore desirable that studies are initiated that would help in understanding road traffic problems faced by a specific country, and in identifying priorities for interventions and making choices on appropriate solutions.

Kenya has very high traffic-related fatality rates, and road "accidents" constitute a serious economic and public health problem. Given the fact that human error is recognized as a major cause of most "accidents" (85%), any reduction of that error would make a significant contribution to the overall improvement in road safety.

The justification for this study therefore is as follows:

a) Little information is currently available from health care facilities to quantify the incidence of traffic injuries and their impact on health services, as a proportion of all injuries caused by external mechanisms. The routine hospital statistics are incomplete, inappropriately recorded, and lack essential information about casualty and injury characteristics that can aid the formulation of focused intervention policies.

b) As road "accidents" are infrequent and geographically dispersed events, efficient data collection in a large area may be expensive and time-consuming. With limited resources, a detailed study on a limited sample of a defined population would generate data sets that can help in identifying some critical risk factors and developing strategies for addressing them. Eldoret town is the location of this study, but it is expected that the results will provide baseline data that can be of use at a national level.

c) The links between alcohol use and road traffic "accidents", although suspected, have not been epidemiologically documented in Kenya, and there are no measures to discourage drink-driving. It is also uncertain how road users might respond if new legislation and enforcement measures were introduced, and what actions may be required to encourage their compliance.

d) Previous legislations for mandatory wearing of safety-belts by drivers and front car passengers, and for installation of speed limiters in public service vehicles failed for unexplained reasons. There is therefore a need for policy analysis research that will explore the feasibility of success of road safety policy for preventing driving under the influence of alcohol, as well as ways of encouraging support of the public and stakeholders with interests in road transport and the alcohol business.

The study objectives and methods used to achieve them are described in the next chapter.

CHAPTER 3

OBJECTIVES AND METHODS OF THE STUDY

In this chapter, objectives, methodology of the study and data management procedures are described. The aim of the study, and its main and specific objectives are presented in the first section. The second section begins with a description of the study setting, then proceeds to discuss the various methods and procedures employed in each of the components of the main study; and finally, an outline of the approach to data management and analysis is presented.

3.1. STUDY AIM AND OBJECTIVES

The aim of this study was to generate local data providing an estimate of the contribution of alcohol in motor vehicle crashes, as a basis for planning and developing a policy for preventing driving under the influence of alcohol in Kenya.

The study had eight main objectives:

1. To determine causes and characteristics of non-fatal injuries presenting to hospitals in Eldoret.

2. To estimate the impact of injury-related workload on hospital services, and the proportion attributable to road traffic "accidents".

3. To determine the levels and distribution of blood alcohol in injury-related hospital presentations.

4. To estimate the relative contribution of alcohol consumption in motor vehicle crashes (in comparison with blood alcohol concentration data from a roadside

survey).

5. To obtain a population-based estimate of the general levels of alcohol consumption by drivers in Eldoret that can be of guidance in the formulation a drink-driving policy in Kenya.

6. To explore the knowledge, attitudes and perceptions of key individuals and groups of informants to causes of road traffic accidents, current road safety measures and impediments to their implementation, and identify preferred interventions.

7. To establish the level of knowledge, as well as attitudes and perceptions to alcohol and driving, of key informants and members of groups influenced, by or involved in, road safety policy decisions.

8. To explore the potential for developing a rational policy to prevent driving under the influence of alcohol in Kenya.

The specific objectives of the study, derived from each of the above general objectives, were:

Objective 1.

a) To determine the pattern of injury-related presentations by cause and type of injury, and their distribution by time and day of occurrence.

b) To describe demographic characteristics of casualties by cause and type of injury.

Objective 2.

a). To determine the extent of injury-related hospital workload in terms of outpatient attendances, admissions, length of stay, and use of surgical facilities and X-ray services.

b) To estimate proportions of injury-related hospital workload attributable to traffic crashes.

c) To measure levels of injury severity in relation to injury mechanism and length of hospital stay.

Objective 3.

a) To determine alcohol prevalence in presenting casualties by age, sex, cause, time and day of injury event.

b) To assess the effect of alcohol on injury severity and length of hospitalization.

c) To assess the sensitivity and reliability of a breathalyser in evaluating alcohol consumption status of trauma-affected patients attending hospitals in Eldoret.

Objective 4.

a) To estimate the contribution and attributable risk of alcohol in traffic crashes by comparing BACs of crash-involved drivers with those of the general driving population, using prevalence data from the roadside survey.

Objective 5.

a) To determine the proportion of drivers on the road who had been drinking in the previous six hours, and the distribution of blood alcohol levels in the driving population.

b) To determine demographic characteristics of drinking drivers by age, sex and occupation.

c) To describe the circumstances of drink-driving trips in terms of; type and age of vehicle, direction of travel, road location, distance to destination, number of vehicle occupants, time and day of week.

d) To obtain alcohol prevalence data for comparison with figures from crash-involved drivers attending hospitals.

Objective 6.

a) To determine the extent of awareness of causes of road accidents.

b) To assess the extent of awareness of current road safety measures and identify impediments to their implementation.

c) To determine the range of additional road safety interventions preferred and identify potential impediments to their implementation

Objective 7.

a) To assess attitudes towards drinking and driving, and whether alcohol is perceived to be an important causal factor of road "accidents".

b) To explore the feasibility of introducing drink-driving countermeasures and identify potential constraints to implementation.

Objective 8.

a) To describe the processes involved and networks of factors that have the potential to influence decisions in formulating public policy on alcohol and driving.

b) To identify strategies for change in the decision-making process that can increase the probability of success of a policy on drink-driving in Kenya.

3.2. METHODS

3.2.1. The Location of the Study

This study was conducted in Eldoret town, situated 320 kilometres north-west of Nairobi. It has an estimated population of 120,000, and is one of the major commercial centres in western Kenya, as well as being the administrative headquarters of Uasin Gishu District (see Chapter 2, Figure 2.1). Four hospitals are located within the town: the Eldoret District

Hospital, a public referral hospital with a bed-capacity of 450 which also serves as a teaching hospital for Moi University's Faculty of Health Sciences; and three private hospitals - the Uasin Gishu Memorial Hospital (135 beds), Eldoret Hospital (120 beds) and Pacifica Hospital (60 beds). They all provide accident and emergency services, and serve a large catchment population that includes the entire population of Uasin Gishu District (445,530), as well as parts of the neighbouring Nandi, Elgeyo-Marakwet, Trans-Nzoia and Kakamega Districts. Although the actual size of their catchment population is unknown, most patients who use the Eldoret hospitals originate primarily from Uasin Gishu District. All the above mentioned hospitals participated in the study.

According to the 1989 census (CBS, 1994), the age-sex structure of the district's population shows that males comprise 51.2%, and females 48.8%; children aged 0-14 years 48%, adolescents aged 15-19 years 11.1%, adults aged between 20 and 40 years 33.8%, while those aged 50 years and over represent 7% of the total population (Table 3.1).

Table 3.1 Percent distribution of population of Uasin Gishu District by age and sex

Age (years)	Male	Female	Total (and % of total pop.)
0-14	50.2	49.8	213,874 (48.8)
15-19	49.2	50.8	49,670 (11.1)
20-29	51.2	48.8	79,745 (17.9)
30-39	55.5	44.5	44,486 (10.0)
40-49	54.9	45.1	26,114 (5.9)
50+	53.1	46.9	31,230 (7.0)
Unknown	50.4	49.6	411 (0.1)
Overall	**51.2**	**48.8**	**445,530 (100)**

Source: Central Bureau of Statistics, (1994). Kenya Population Census 1989.

The district's morbidity pattern is quite similar to that of the overall national statistics, with malaria and respiratory infections being the most common (each accounting for 25.7%). Diseases of the skin rank third (4.9%), followed by diarrhoeal diseases (4.3%), eye infections (3.3%), urinary tract infections (3.2%), and injuries (reported as "accidents") ranking 7th, and accounting for 2.5% of all outpatient attendances reported in the district in 1992 (MOH-UG, 1994). Although data for in-patients were not available, traffic casualties are likely to represent a large proportion of trauma-related admissions.

The road transport network in the district covers nearly 1,200 kilometres of bitumen and gravel roads. Three major National trunk roads, including the Trans-Africa Highway from Tanzania through to Uganda, Sudan and Zaire, converge in Eldoret making it a major communication hub in the region. The traffic mix comprises heavy commercial vehicles (trucks, lorries), utility vehicles (pick-ups and vans), public service vehicles (buses, *matatus* and taxis), private cars and government vehicles; motorcycles are relatively rare. A high concentration of pedestrians and cyclists are common near marketplaces, in the town's commercial centre and along roads leading to industrial locations.

Two main railway lines running from Mombasa to Uganda, and Nairobi to Kitale, traverse the district through Eldoret, facilitating transportation of goods and a limited number of passengers.

3.2.2. Preparation For The Study

A variety of research activities were undertaken in the process of examining the above objectives; these were spread over three phases. In the first phase, the theoretical basis of the study was developed which entailed designing the research protocol, planning the study and reviewing literature, over a period of 12 months, while based at the London School of Hygiene and Tropical Medicine. Selected courses on research methodology, qualitative study designs, epidemiology and statistics were also attended. At the end of the period, the final research proposal was presented at a departmental seminar for assessment by the Ph.D research committee. Useful discussions were held, and feedback was obtained from the committee; a formal approval to proceed to the field work phase of the study was subsequently given by the School.

The next phase (fieldwork) of the actual collection of pertinent data was spent in Kenya (12 months), during which a number of activities were undertaken including preparation, pilot testing, conducting main surveys, data entry and cross-tabulations, preliminary analysis and feedback to administrators of participating institutions. The initial step involved contacting relevant authorities in government institutions (Office of the President, Ministry of Transport and Communications, Ministry of Health, the Police Department, the local District Commissioner) and administrators of hospitals in Eldoret for permission to conduct the study. Ethical approval for the research was sought from the Government (Office of the President, and Ministry of Research, Training and Technology) and Moi University's Research and Ethics Committee. Approval to proceed with the fieldwork was obtained from both institutions, after being satisfied that all ethical considerations had been addressed, within three weeks of submitting the proposal. In the next stage, survey assistants were recruited and trained in interviewing and questionnaire completion. Pilot studies were then conducted for each of the sub-studies to test the questionnaires (developed with the protocol) as well as to assess the logistics for carrying out the main study and how to address problems that might occur during the actual surveys. In consultations with the research supervisor (Dr. Anthony Zwi), the questionnaires were revised and the final versions prepared. The actual data collection for the entire study took a period of twelve months, with the data entry being done concurrently.

The last phase of this research comprising data analysis, interpretation of findings and writing up of the thesis was done over a period of 12 months while in London.

3.2.3. Study Design And Procedures

In order to fully accomplish the proposed study objectives, this research employed both quantitative and qualitative study designs. These methods have been shown to be complementary (Glik et al, 1987; Yach, 1992), and were intended to provide relevant information that can guide the formulation of public policy on traffic injury prevention. Evidence from the surveys were systematically used to explore the potential for successful development of a policy on drink-driving through a political mapping process.

3.2.3.1. Quantitative Surveys

Quantitative study methods were used to collect data on the magnitude and some characteristics of road traffic injuries. For this purpose, structured questionnaires were administered to collect information sought by the main objectives 1, 2, 3, 4 and 5, in two separate sub-studies described below.

a) A Hospital-based Injury Incidence Survey

This was a cross-sectional hospital-based survey of trauma victims presenting to all four hospitals in Eldoret. The study was conducted from registration desks and examination rooms in outpatient departments of the participating hospitals. Consecutive trauma patients presenting to the hospitals, over a six-month period (between December 1, 1994 and May 30, 1995) were recruited. Patients dead on arrival and those referred from other hospitals directly to the wards or surgical clinics were not included.

On arrival, all trauma-affected patients were informed of the study by the registration clerk: after being seen by either a doctor or a clinical officer, they were interviewed by a survey assistant who completed a structured questionnaire eliciting personal and injury circumstance details (see Appendix 3.1). Seriously injured casualties that required admission were interviewed as soon as it was practicable after their condition had been stabilized. Demographic information such as; age, sex and occupation were noted. Information relating to the injury, including cause, time, day and month of injury, type of treatment, and whether the patient was admitted or not, was recorded. For admissions, the duration of hospitalization, calculated as the difference between discharge and admission dates, type of treatment given and injury outcome were recorded from the inpatient notes. Casualties who were admitted and discharged on the same day were calculated to have been hospitalized for one day. For each casualty, an estimate of the severity of injury sustained was made by the researcher using the Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS) scale on the basis of the clinical diagnosis (see Appendix 3.2). The AIS, developed by the Scientific Committee of the American Medical Association, uses six scores to assess injury severity in terms of its threat to life (Committee on Medical Aspects of Automotive Safety, 1971). The ISS, calculated as the sum of the squares of the highest AIS score in each of the three most severely injured body parts, provides an assessment of morbidity status and the likelihood of survival or death from multiple injuries (Baker et al, 1974).

Evidence of alcohol consumption was determined in patients aged 16 years and above, who arrived within an interval of 10 hours from the time of injury. The restriction in age was to allow the inclusion of all potential drivers, as the legal licensing age in Kenya is 16 years for riders of motorcycles and 18 years for operators of cars and other motor vehicles. As many casualties normally present to hospitals in a period of up to several hours after sustaining an injury, and because of changes that occur in blood alcohol concentration (BAC) with time after ingestion as a result of alcohol metabolism[10] (Dubowki, 1974; Gilman et al., 1990), an interval of ten hours from injury was taken as the maximum allowed for a casualty to be included in the sample for BAC assessment.

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[10] Absorption occurs in the first 1-2 hours followed by elimination phase which may extend to 12 hours or more.

Both subjective and objective methods of alcohol assessment were undertaken. A clinical subjective evaluation of every casualty was done by the examining clinician, based on the presence of any of the following four specific signs and symptoms of recent alcohol consumption; smell of alcohol in breath, slurred speech, red conjunctivae and abnormal motor co-ordination. For each patient, a doctor or clinical officer recorded the signs as present or absent, and made a judgement as to whether the patient had taken alcohol or not. Objective measurements of blood alcohol concentration were done by either a breath test or blood sample analysis, and in a sample of patients both procedures were employed. For breath tests, four portable breathalyser devices, the *Lion Alcolmeter-SD2* manufactured by Lion Laboratories (Cardiff, UK) and accessed prior to the start of the study, were used. The *Lion Alcolmeter-SD2* is a hand held battery operated, digital read-out device that measures the alcohol concentration in alveolar air. The accuracy of this equipment in giving a direct measurement of blood alcohol concentration has been well established (Wiseman et al, 1982; Tomson, 1983: Gibb et al, 1984; Wenzel and McDummont, 1985; Falksson et al, 1989). The device was calibrated by the researcher weekly, against a standard alcohol vapour (NALCO) provided by the manufacturers. Survey assistants trained in the proper operation of the equipment administered breath tests to consenting patients and promptly recorded BAC readings.

Blood samples for the determination of BAC levels were taken from consenting patients, and those unable to correctly blow into the breathalyser because of the nature of injuries or for some other reason, such as being too intoxicated, and those with serious types of injuries. After cleaning the skin with a hibitane-soaked swab, 2.5 ml of venous blood was drawn by a casualty nurse into a sterile plain bottle and stored at 4° C. The blood samples were transported, in a cold-box, to a central forensic laboratory in Nairobi (Government Chemists' Department) weekly, where blood alcohol assays were performed by gas-chromatography. The method has been shown (Curry et al, 1966) to be highly sensitive to blood alcohol concentrations of 5 mg% or greater.

All measurements, for both breath tests and blood analysis, were presented as milligrams of alcohol per 100 millilitres of blood (mg%). Levels of 5 mg% and greater were taken as representing a positive blood alcohol concentration. Of the subjects testing positive, those with BACs of 50 mg% and above were considered as intoxicated. At the time of this study, there was no legal definition of intoxication in Kenya.

b) A Roadside Alcohol Prevalence Survey of Drivers

This sub-study aimed to obtain an estimate of the prevalence of drink-driving in a sample of the driving population in Eldoret. As it involved stopping motorists on the road, assistance for police support was sought from the Eldoret traffic police chief, in whose jurisdiction the proposed study was to be undertaken. In particular, the services of four police officers were requested to help in stopping drivers and regulating traffic flow, and a standby patrol vehicle was required. Meetings were held with traffic police officers during which the purpose of the study, its organization, procedures for data collection and how the data will be used were discussed. The police department's views were also sought with regard to timing of the survey, selection of road locations, sampling of drivers from traffic, and breathtesting procedures. The police agreed to co-operate fully and to provide all the necessary support. On their advice, seven sites on different roads within the town boundaries were selected (see Figure 3.1). It was also agreed that the survey would be conducted between 19.00 hours and midnight, to allow for consistency in allocation of the same police officers after their normal day duties.

Eight medical students (in their 3rd and 4th years of studies) were selected and trained on interviewing techniques, filling a survey questionnaire, pre-designed with the proposal (Appendix 3.3), and the operation of a hand-held breathalyser device (the *Lion Alcolmeters*

SD-2 similar to the ones used in the casualty). Four two-hour training sessions were held over a period of two weeks. A pilot field test was done for three hours on a Friday evening (between 7 pm and 10 pm), in collaboration with the traffic police; to assess the response of motorists, driver sampling process, validity of questions, administration of breathtests, reading and recording BAC values, field logistics and co-ordination aspects of survey activities. The pretest findings were used to modify the final questionnaire as well as to make appropriate organizational decisions.

The survey was carried out at times when drinking is known to be common in Eldoret, between 7 pm and 12-midnight, for seven consecutive days, from Monday, March 27 to Sunday, April 2, 1995 (the week before Easter holidays). No publicity was made of the intended survey as this may have influenced drinking and driving habits, including evasion of the survey sites. The police also had no advance knowledge of the exact sampling location; they were informed by the researcher every evening, just a few minutes before the start of the day's session. Four uniformed traffic police in a patrol car helped to stop drivers, and to maintain orderly traffic flow and security at the survey sites. A police officer stopped the first approaching vehicle from either direction as soon as we arrived at a sampling site. After conducting a routine traffic check (for road licence, vehicle insurance and a general vehicle inspection), the policeman informed the driver about the research on road safety, that was being undertaken by a lecturer from Moi University; he politely sought the driver's cooperation and directed him/her to interviewers. Interviewers, working in pairs and wearing white coats and identification tags, approached the driver who, in most cases, remained seated in the car, introduced themselves and stated the general purpose of the study without specifically mentioning alcohol.

The introductory statement read as follows:

> *"Good evening. We are from The Faculty of Health Sciences of Moi University. We are carrying out a road safety survey to find out some of the factors that contribute to road*

accidents. This study is being carried out in Eldoret and all drivers on the road are involved. This is voluntary, your name will not be noted and the results will remain confidential. We would be grateful if you could answer a few questions about yourself, then blow into this equipment for measuring your breath".

A short interview was then conducted to elicit the driver's personal particulars and information about the journey (see Appendix 3.3). Age of the driver, gender, number of passengers, type of vehicle and registration number (for estimating vehicle age) were recorded. A breath test was then administered to consenting drivers. They were also asked whether they had taken alcohol, and if so, how long it was since the last drink. Those breathalysed were informed of their breath test results immediately. The time taken in interviewing and getting a breath test took two minutes on average. For all drivers sampled, a subjective assessment was made by the interviewer to judge whether he/she had been drinking or not. No action was taken against drivers found to have been drinking, with the exception of one very drunk driver who was detained overnight at the police station.

The survey team worked in two groups under the direction of the researcher. One set of interviewers and a police officer sampled drivers travelling in one direction, while the second team, stationed on the other side of the road, selected vehicles from traffic flowing in the opposite direction. The next vehicle was stopped whenever interviewers were free, to ensure that no driver was made to wait. We stayed at one spot for two and a half hours, then shifted to another location for the same period of time. This was done in order to minimize evasion of checkpoint sites by drinking drivers or those who wanted to avoid contact with the police for other reasons. Sampling was done on two different road locations on each night, such that each site was visited twice by the end of the survey period (one week). A computed sample size of 354 drivers was estimated as the minimum required to provide a reliable estimate of alcohol prevalence in the driving population (see Appendix 3.4). The actual number of drivers sampled was 479, which under the circumstances would provide a reasonable estimate of the prevalence of night-time drink-driving in Eldoret.

Figure 3.1. Eldoret Municipality: Location of roads for the alcohol prevalence survey of drivers

3.2.3.2. Qualitative Surveys

As the underlying purpose of this study is to contribute to improvement in road safety, an assessment of the extent to which a cross section of people perceive alcohol as an important factor in road accidents is necessary, as this may increase the probability of their participation in alcohol-related interventions. This is consistent with the theory of risk perception (Pidgeon et al., 1992; Adams, 1995), which views perceived risk to involve people's beliefs, attitudes, judgements and values, as well as the behaviour or actions that people adopt towards a recognized hazard, such as injury from road traffic "accidents". To achieve effective compliance with any new road safety or risk reduction intervention, it is important to obtain some information on public perception about the hazard that may be of guidance to policy makers in assessing the potential direction of public response if such measures were introduced. Qualitative ethnographic approaches were therefore used to gather information on knowledge and perceptions about road "accidents", road safety interventions and attitudes towards drinking and driving from a cross section of informants (Objectives 6 and 7). People's views were also sought with regard to the existing road safety interventions, their preferences, as well as perceptions about potential problems in implementation and how these could be overcome. Such information was gathered through focus group discussions (FGDs) and in-depth interviews (ID) of key informants, complemented by other data from document reviews and scanning the national daily newspapers.

a) Focus Group Discussions and In-depth Interviews

Focus groups involve bringing a small group of individuals with certain common characteristics for an informal discussion about a specific subject, with the aim of getting an insight into the perceptions of the group. To avoid possible inhibition by some participants, attempts were made to make the composition of the groups as homogeneous as possible, in terms of gender, age group, occupation and socio-economic status. The groups comprised between 6 and 8 participants, within the range of 6 to 12 suggested by some ethnography researchers (Stewart and Shamdasani, 1990; Krueger, 1991), to permit effective participation by everyone. A limited number of purposely selected key informants and focus groups from a cross section of respondents were identified for an exploratory qualitative survey. The selection was done on the basis of their being in positions where knowledge and involvement in road safety policy decisions were anticipated (by the researcher), as well as their accessibility and willingness to participate.

Key informants comprised representatives from senior government officials (2), the insurance industry (1), medical doctors (1), lawyers (3), the Automobile Association (1), traffic police (1), a bus company (1), *matatu* operators (1) and a non-governmental road safety organisation (1). Fifteen interviews were planned, but 12 were held, as three informants (one policy maker, a representative of the alcohol industry, and an editor of a daily newspaper) failed to honour appointments on several occasions.

Three focus group discussions (FGDs) were held with managers of insurance companies, victims of road "accidents", and nurses and clinical officers working at the outpatient department of Eldoret District Hospital. Two FGDs that were scheduled for bus and *matatu* drivers failed due to logistic and financial constraints.

All interviews were conducted by the researcher using a standard unstructured interview guide with 25 open-ended questions (see Appendix 3.5), which had two parts: the first had more general questions about road transport problems, their causes and prevention; and the second specifically inquired about perceptions towards alcohol and road "accidents". Although the topics were predetermined by the researcher, the discussions were informal and flexible, as respondents were encouraged to talk freely about their views regarding road "accidents" and road safety. The questions were not necessarily asked in a fixed order, this allowed a free-flowing discussion with the moderator following up on interesting leads. A social scientist acted as an observer, took brief notes in the course of interviews and at times asked probing questions.

Key-informant interviews were conducted either at the informant's office or in a hired conference room of a hotel, and lasted for one to one and a half hours. Two focus group discussions were held at the Eldoret District hospital's seminar room, and one in a hotel room convenient for participants; these lasted for between one and a half and two hours. Respondents were assured that their names would not be noted, and that the information collected was confidential and would be used for research purposes only.

All interviews were tape-recorded: none of the respondents objected to the use of a tape-recorder. The texts, transcribed in WordPerfect 5.1, were edited by the researcher through listening to the tapes, and simultaneously counter-checking their accuracy and completeness using the short notes made during interviews.

b) Newspapers

Three national daily newspapers (Daily Nation, The Standard and Kenya Times) were scanned daily for any reports or information on road "accidents", from December 1994 to July 1996. Unstructured analysis of what was published in the press as causes of motor vehicle crashes, as well as reported views regarding current road safety interventions was undertaken. A wide section of people quoted in the press included; ministers, government officials, road engineers, doctors, journalists, organizations and individuals with interest in road safety issues, and those affected by road transport system. Newspaper cuttings about road traffic "accidents" appearing as news headlines, front page articles, editorials, news supplements, inside stories and letters to the editor were obtained and analysed for content.

c) Police Records

In order to get an impression of the range of what was officially recorded as causes of crashes, and relate this to the corresponding information from interviews, records of police-reported injury-producing motor vehicle crashes were obtained monthly from the Eldoret Police Station over a period of 6 months (from December 1, 1994 to May 30, 1995). The data was extracted from the standard police Accident Report Forms (see Appendix 2.1) showing the cause of each road "accident" event investigated, based on a coding system normally used by the police for reporting and compiling road accident statistics (see Appendix 2.2). Summaries of frequency distributions of the reported number of crashes by the corresponding cause and number of casualties involved were made.

d) Document review

Complementary documentary materials available at the secretariat of the National Road Safety Council (NRSC) and the Ministry of Transport and Communication (MOTC) headquarters, excluding confidential working papers, were accessed and scanned. These included minutes of meetings of the NRSC, project reports, proposal documents (Republic of Kenya, 1980) and annual road "accident" statistics (NRSC, 1992). The information gathered provided further insights into the activities of the organization and perspectives of road safety work, and formed the basis for assessing the potential for political support for the introduction of drinking and driving legislation as part of the broader road transport safety interventions.

3.2.3.3. Stakeholder Analysis

An attempt was made to explore the potential for practical application of objective epidemiological data and qualitative information to enhance the decision-making process in the formulation of a policy on drinking and driving, by using a political mapping approach (Objective 8). The method, described by Reich (1994), has been shown to be valuable in helping derive a step-by-step analysis of essential information related to public policy, obtained from decision-makers, key players and interest groups, in order to evaluate the potential impacts of a new policy and its political feasibility. By helping to understand the policy context, including networks and relationships between different organizations, the procedure can assist in the design of effective organizational strategy to influence processes of formulating and implementing a public health policy. It can enable policy-makers to improve the political acceptance of specific policy decisions by identifying factors that affect policy and choosing appropriate strategies of influencing different groups. In addition, it can help interest groups to focus greater attention on an issue and influence whether and how it is placed within the national policy agenda.

The first step in political mapping requires the identification of stakeholders or key individuals and organizations who are in some way connected to the policy as decision-makers, implementors or will be affected by the new policy proposal. The following criteria were applied in deciding whether an individual or group is a stakeholder in a policy regarding alcohol and driving:

a) If an individual, group or organization's support is beneficial or enhances the decision-maker's capacity to implement a policy proposal on driving under the influence of alcohol, such as government ministries, motoring organizations and the press;

b) If an individual, group or an organization is in a position to weaken the authority or political support of the decision-maker or organization (government) in relation to the proposed policy, such as brewers, alcohol retailers and public transporters;

c) If an individual, group or organization is capable of influencing the direction of public response to the policy or achievement of the decision-maker's (government) intentions, for example, deliverers of public services, the press and politicians.

Anticipated views of different stakeholders that have the potential to influence the support for policy on drinking and driving were intuitively made by the researcher. The range of sectors considered included:

a) Government Ministries: - Ministry of Transport and Communications, Ministry of Public Works, Ministry of Health, Ministry of Finance, Traffic Police Department, and the Attorney-General;

b) National groups: - the National Road Safety Council, the Kenya Medical Association and the Law Society of Kenya;

c) Non-governmental organizations: - the Automobile Association of Kenya and the Road Safety Network;

d) Commercial groups and individuals: - such as insurance companies, lawyers, alcohol industry and public transporters (bus and *matatu* operators);

e) Service providers; the traffic police, doctors and other health workers;

f) The media, included press reports in the daily newspapers- the Daily Nation, The Standard, and Kenya Times;

g) The general public, represented by road "accident" victims.

In combination with information collected from qualitative interviews, documents review, newspapers, informal discussions with various individuals as well as personal intuitive assessments, a computer-assisted political mapping exercise was undertaken using software developed by Reich and Cooper (1995). The information was organized and systematically analysed.

3.2.4. Data Analysis

3.2.4.1. Quantitative Data

Each completed questionnaire was checked by the researcher for completeness and accuracy then entered into a computer using EPI-INFO version 5 (Dean et al., 1990). Data cleaning, preliminary cross-tabulations and frequency distributions were done using the same package. SPSS for Windows statistical programme (SPSS Inc., 1992) was used in subsequent analyses that involved assessing differences between proportions for categorical variables by chi-squared tests and means of continuous variables by t-tests (analysis of variance- ANOVA), and to control for confounding variables, linear and multiple regression techniques were applied.

In this thesis, statistical analysis results presented as *significantly different* imply a statistically significant difference at the probability level of 0.05. Where 95% Confidence Intervals (95% CI) of proportions or odds ratios were calculated, the values are shown in parentheses immediately after the computed figures.

3.2.4.2. Qualitative Data

All the transcribed texts of interviews (in WordPerfect 5.1) were converted into ASCII files in a format suitable for analysis using Textbase Alpha ethnographic software (Tesch et al., 1989). A coding scheme of the texts was developed based on the main issues of interest explored in the interviews, as outlined in the interview guide. Each segment of the transcript (textfile) was coded. Through scanning every file, further coding of relevant words, phrases or sentences was done. The coded words and segments, which were then electronically searched and retrieved, formed the unit of analysis.

Content analysis of the coded segments of transcripts was carried out as described by Stewart and Shamdasani (1990), and Miles and Huberman (1994). Summary tables illustrating matrices of frequencies and patterns of emerging issues mentioned by the different informants were prepared. Both descriptive and interpretational analysis were subsequently undertaken.

The findings of the above sub-studies are presented in the next five chapters.

CHAPTER 4

THE PATTERN OF INJURIES IN ELDORET WITH PARTICULAR REFERENCE TO THE EFFECT OF ALCOHOL

This chapter examines the pattern and characteristics of injuries, and evidence of alcohol involvement in casualties, presenting to hospitals in Eldoret. It has three sections: the first presents a description of injury characteristics; the second describes the association of alcohol with different types of injuries; and the final section focuses on effects of alcohol on traffic-involved patients. The chapter concludes with a brief summary.

4.1. THE INJURY EVENT AND CASUALTY CHARACTERISTICS

4.1.1. Causes of Injury

A total of 2,637 presenting injury-affected patients were enrolled; this represented 6.5% (95% CI, 6.2 to 6.7) of all patients seen in the hospitals during this period (N=40,757). Interpersonal violence (assault) was the leading cause of trauma, responsible for 38.6% of all injury-related attendances, followed by road traffic accidents 19.3% (representing 1.2% of the total outpatient attendances during the period). Fall injuries accounted for 17.2%, burns 4%, dog bites 2.6%, poisonings 1% and sports 0.3%; miscellaneous events, such as hitting against or being struck by objects, and self-inflicted cuts caused 17.1% of all injuries. The distribution of casualties by injury mechanism, gender and age is presented in Table 4.1.

4.1.2. Demographic Characteristics

Of all injury attenders 71.4% were male, and 28.6% female. Males were significantly over-represented with a male to female ratio of 2.5 (χ^2 =29.0, $p<0.001$). Although the sex ratio varied by cause of injury and age group, a greater proportion of males was found in nearly every age group (Table 4.2). Traffic-involved casualties had the highest sex ratio of 3.5, especially in the age group of 25-34 years, and as well as among those aged over 44 years (M:F ratio = 4.4). Gender differences among fall- and burn-affected patients were less prominent, with the respective ratios being 1.8 and 1.6. However, greater proportions of girls were found among assaulted children aged 5-9 years, and in those aged 10-14 years who sustained burn injuries.

Table 4.1 Distribution of casualties by age, sex and cause of injury

Casualty category	Male	Female	Total Number	% and (95%CI)
	Number (%)	Number (%)		
Overall	1882 (71.4)	755 (28.6)	2637	100%
Age:				
0-14	347 (66.2)	177 (33.8)	524	19.9 (18.3-21.4)
15-19	164 (63.6)	94 (36.4)	258	9.8 (8.6-11.0)
20-29	608 (72.8)	227 (27.2)	835	31.7 (29.9-33.4)
30-39	463 (76.3)	144 (23.7)	607	23.0 (21.4-24.6)
40-49	188 (73.4)	68 (26.6)	256	9.7 (8.6-10.9)
50+	112 (71.3)	45 (28.7)	157	6.0 (5.0-6.9)
Cause of injury:				
Traffic	395 (77.8)	113 (22.2)	508	19.3 (17.8-20.8)
Assaults	724 (71.0)	296 (29.0)	1020	38.6 (36.8-40.5)
Falls	290 (64.3)	161 (35.7)	451	17.2 (15.7-18.5)
Burns & scalds	64 (61.0)	41 (39.0)	105	4.0 (3.3-4.8)
Dog bite	51 (74.6)	17 (25.4)	68	2.6 (2.0-3.3)
Poisonings	17 (65.4)	9 (34.6)	26	1.0 (0.6-1.5)
Sports	8 (88.9)	1 (11.1)	9	0.3 (0.15-0.6)
Others	333 (74.0)	117 (26.0)	450	17.1 (15.6-18.5)

As illustrated in Table 4.1, children under 15 years of age comprised 19.9%, those aged 15-19 years were 9.8%, 20-29 years 31.7%, 30-39 years 23.0%, 40-49 years 9.7%, while adults aged 50 years and above comprised 6.0%. The mean age was 26.3 years; and nearly two thirds were in the economically active age bracket of between 20 and 49 years. This age group was significantly over-represented among injury-affected attenders as compared with the district's general population (64.4% versus 33.7%; OR=3.5; 95% CI, 3.3 to 3.9; χ^2

=1098.3, p<0.001).

Table 4.2 Male to female ratios by age and main causes of injury

Age group in years	Cause of injury				Sex Ratio for all types of injury
	Traffic	Assault	Falls	Burns	
0-4	2.0	-	1.6	2.3	1.7
5-9	2.8	0.8†	1.6	1.1	1.8
10-14	2.4	2.2	4.2	0.3†	2.5
15-19	1.7	1.3	3.0	3.0	1.7
20-24	3.7	2.4	1.7	1.0	2.6
25-34	**4.4**	2.5	2.0	1.8	**3.0**
35-44	3.0	3.2	1.2	8.0	**3.0**
45+	**4.4**	3.6	0.7	1.0	2.5
All ages	**3.5**	2.4	1.8	1.6	2.5

† age groups with excess females

On the basis of the 1989 population of Uasin Gishu district (CBS, 1994), an estimate of the annual rate of injury presentations in Eldoret was calculated[11] (Table 4.3). The overall annual rate for all injuries was 1183.7 per 100,000 population, with the highest rate being in adult males (2588.4): the male to female rate ratio was 2.4. The estimated injury rate for adolescents and adults aged 15 years and over was nearly four times greater than that of children of ages 0-14 years (1824.2 versus 490 per 100,000/ year; OR=3.75 , 95% CI, 3.4 to 4.1, $\chi^2 = 841.1$, p<0.05). Assaults accounted for the highest rate of injuries in adults (854.7/100,000/year) followed by traffic (405.8/100,000/year), whereas in children, falls were responsible for the highest injury rate (207.6/100,000/year).

[11] Rate per 100,000 population per year = $\frac{C_i \times 100{,}000 \times 12 \text{ mo.}}{P_i \times 6 \text{ mo.}}$ C_i = number of injury presentations in subgroup, P_i = population of subgroup.

Table 4.3 Rates of injury presentations per 100, 000 population* /year by age group, sex and cause

Category	Rate by age group (n)		Rate for all ages (n)
	0-14 years	15 years and above	
Overall	490.0 (524)	1824.2 (2113)	1183.7 (2637)
Sex:			
Male	646.4 (347)	2588.4 (1535)	1650.0 (1882)
Female	332.4 (177)	1022.6 (578)	694.5 (755)
Male:Female rate ratio	1.9	2.5	2.4
Injury cause:			
Traffic	35.5 (38)	405.8 (470)	228.0 (508)
Assault	28.0 (30)	854.7 (990)	457.9 (1020)
Fall	207.6 (222)	197.7 (229)	202.4 (451)
Burn	67.3 (72)	28.5 (33)	47.1 (105)
Other	149.6 (160)	339.3 (393)	248.2 (553)

* based on the 1989 population census data (CBS, 1994)

The effect of age on injury distribution is further illustrated in Table 4.4. Falls and burns were the leading causes of childhood injuries, with burns being most frequent in children aged less than 5 years (38.1%) but declining as children got older. Nearly a half (49.2%) of all fall injuries occurred in children under 15 years of age, with the peak frequency found in the age group 5-9 years (19.5%); whereas assaults were the leading cause of trauma among adolescents and adults, with those aged 25 to 29 years being the most involved (20.9%). Of assaulted patients 70.1% were aged between 20 and 39 years. Traffic injuries were the second most common cause of trauma affecting those aged 20 years and over, with the peak age group being 25-29 years (18.9%). Of all traffic-involved patients, 62.1% were young adults aged 20- 39 years. *Other* causes of injury were more frequent among those aged between 15 and 29 years.

Overall, the data indicate that injury mechanisms and their frequency vary with the increasing age. Children are over-represented in injuries from falls and burns but, from the age of 15 years through to adulthood, assaults become the leading cause, with traffic crashes being the second most common mechanism of injury.

Table 4.4 Percent distribution of injuries by age of casualty and causal mechanism

Age group in years	Cause of Injury										All causes No. (%)
	Traffic		Assaults		Falls		Burns		Other†		
0-4		4.2		1.4		42.7		28.0		23.8	143 (100%)
	1.2		0.2		13.5		38.1		6.1		5.4
5-9		7.6		4.6		44.7		10.7		32.5	197 (100%)
	3.0		0.9		19.5		20.0		11.6		7.5
10-14		9.2		10.3		39.7		6.5		34.2	184 (100%)
	3.3		1.9		16.2		10.5		11.2		7.0
15-19		15.9		38.0		17.1		1.6		27.5	258 (100%)
	8.0		9.6		9.8		3.8		12.8		9.9
20-24		20.2		48.4		10.4		1.4		19.5	415 (100%)
	16.5		19.7		9.5		5.7		14.6		15.7
25-29		22.9		50.7		8.6		0.2		17.6	420 (100%)
	18.9		20.9		8.0		0.9		13.3		15.9
30-34		23.0		50.3		7.1		2.6		16.9	378 (100%)
	17.1		18.6		6.0		9.5		11.6		14.3
35-39		21.4		48.5		7.0		0.9		22.3	229 (100%)
	9.6		10.9		3.5		1.9		9.2		8.7
40-44		30.9		41.7		10.8		5.0		11.5	139 (100%)
	8.4		5.7		3.3		6.7		2.9		5.3
45-49		29.1		41.9		13.7		1.7		13.7	117 (100%)
	6.7		4.8		3.5		1.9		2.9		4.4
50+		22.9		44.6		20.4		*		12.1	157 (100%)
	7.1		6.9		7.1		*		3.4		6.0
Overall	508 (100%)	19.3%	1020 (100%)	38.6%	451 (100%)	17.2%	105 (100%)	4%	553 (100%)	21%	2637 (100%)

†includes poisonings, dog bites, sports and miscellaneous injuries; * no cases

4.2. TEMPORAL DISTRIBUTION OF INJURY OCCURRENCE

4.2.1. Across the Week Variation

The frequency of daily occurrence of all injuries, as a proportion of the total, varied across the week ranging from 12.7% to 16.9%. Overall, proportions of injuries occurring on any weekday (from Monday to Thursday), were lower than on weekends - Friday (14.9%), Saturday (15.3%) and Sunday (16.9%), and less than the daily average frequency (14.3%) across the week. Cause-specific rates also varied by day of week, with traffic-related injuries being more frequent on Monday (19.3%), assaults on Sunday (20.8%), and burns on Wednesday (25.4%). Fall-related injuries were more evenly distributed across the week (Table 4.5).

4.5. Percent distribution of injuries by cause and day of occurrence

Day of week	Cause of injury					All causes (95%CI)
	Traffic	Assaults	Falls	Burns	Other	
Monday	19.3	11.5	15.6	9.8	13.9	14.2 (12.9-15.5)
Tuesday	13.8	13.0	16.3	4.9	10.3	12.8 (11.5-14.1)*
Wednesday	12.6	17.7	13.7	25.4	11.6	12.7 (11.4-14.0)
Thursday	12.6	13.3	13.5	4.9	14.9	13.0 (11.7-14.3)
Friday	13.6	16.1	12.4	13.7	16.4	**14.9** (13.5-16.3)
Saturday	16.7	14.3	13.2	19.6	16.7	**15.3** (13.9-16.7)
Sunday	11.6	20.8	15.2	16.6	16.0	**16.9** (15.5-18.3)
Daily mean (SD)	14.3 (2.7)	15.2 (3.2)	14.3 (1.4)	13.9 (5.9)	14.3 (2.5)	14.3 (1.6)
95% CI	11.3-17.4	12.2-16.5	11.0-17.4	7.6-21.0	11.4-17.2	13.0-15.6

When the days were regrouped into weekdays (Monday to Thursday), and weekends (Friday-Sunday), it became evident that 47.2% (95% CI, 45.3 to 49.1) of all injuries occurred during the weekends. This is greater than the 42.8% expected over the period if the daily distribution were uniform across the week. More than half of assaults, 51.5% (95% CI, 48.4 to 54.5); 41.9% (95% CI, 37.6 to 46.2) of traffic injuries; 41% (95% CI, 36.5 to 45.6) of falls; 49.5% (95% CI, 40 to 59.1) of burns; and 49.1% of *other* injuries, occurred during weekends.

4.2.2. Injury distribution by Time of Occurrence

As illustrated in Table 4.6, nearly two-thirds (64.8%; 95% CI, 63.0 to 66.7) of all presenting casualties sustained injury during the daytime. 74.4% of traffic-involved patients (95% CI, 71.3 to 78.8), and 77.9% (95% CI, 74.0 to 81.7) of fall casualties were affected during the day. Most violence-related injuries (53.7%; 95% CI, 50.7 to 56.8) occurred at night, the majority of which were inflicted between 7 pm and 1 am.

Traffic crashes were more than 3 times likely to occur during the day when compared to assaults (OR=3.3; 95% CI, 2.6 to 4.3, χ^2 = 107.6, $p<0.001$). More than half occurred between 7 am and 1 pm on Mondays (52.9%), and between 1 pm and 7 pm on Fridays (50.7%) and Sundays (54.2%). Of the 131 casualties injured at night, 87.9% were involved in the interval between 7 pm and midnight, and the greatest proportion occurred on Saturdays, representing 25.4% of the total night-time crashes. However, a consistent pattern of variation across the week was not demonstrated.

Burn injuries appeared to be more frequent during the first half of the night, but no significant diurnal variation was observed. Injuries resulting from *other* events happened largely during the day (81.9%; 95% CI, 78.7 to 85.1).

Table 4.6 Temporal distribution of injuries by cause†

Cause	Time interval, number and (%)			
	7am-12.59pm	1 pm-6.59pm	7pm-0.59am	1am-6.59am
Traffic	186 (36.5)	192 (37.7)	115 (22.6)	16 (3.1)
Assault	133 (13.0)	339 (33.2)	490 (48.0)	58 (5.7)
Fall	119 (26.3)	233 (51.5)	88 (19.5)	12 (2.7)
Burn	33 (32.0)	22 (21.4)	41 (39.8)	7 (6.8)
Other	180 (32.5)	273 (26.8)	84 (15.2)	16 (1.6)
All causes	651 (24.7)	1059(40.2)	819 (31.0)	109(4.1)

† shaded cells indicate periods when specified injuries occurred with the highest frequency

4.3 CHARACTERISTICS OF TRAFFIC-AFFECTED CASUALTIES

4.3.1. Demographic Characteristics

The distribution of traffic-involved patients by their demographic characteristics and injury circumstances are shown in Table 4.7. Males were significantly greater than females in each type of road user ($\chi^2 = 25.9$, $p<0.001$). Of the total number of traffic-involved patients, 7.5% were children under 15 years of age, 8% were aged 15-19 years, 35.4% were aged 20-29 years, and nearly a half (48.9%) were aged 30 years and over. The mean age was 30.3 years, with a median of 29 years. On average, drivers were significantly older than all other road-users (mean age 38.7 versus 29.4 years), ($F=25.0$, $p<0.001$). The peak frequency of driver injuries occurred among those aged between 30 and 39 years, whereas it was 20-29 years for other types of road-users.

Overall, passengers were the most affected, comprising 56.1%; pedestrians represented 17.7%, cyclists 13.4%, and drivers 11.4%. Children were involved mainly as pedestrians, accounting for 20%, whereas as passengers, they comprised 5.2%, and 7.4% of all cyclists.

There were a greater number of boys among pedestrians (83.3%) and pedal cyclists (100%), while no significant gender differences were detected in passengers (boys, 53.3% versus girls, 46.7%). Among adult casualties, males were consistently over-represented across all road-users; comprising 72% of passengers, 73.4% of pedestrians, 92.3% of motor vehicle drivers, 94.1% of pedal cyclists, and all motorcycle riders.

Table 4.7 Traffic casualties: distribution by demographic and injury characteristics

Variable	Driver (n=58)	Passenger (n=285)	Pedestrian (n=90)	Bicyclist (n=68)	Other (n=7)	Overall (N=508)
Overall (%):	11.4	56.1	17.7	13.4	1.4	100
Age (years):						
Mean	37.8	29.9	28.2	27.6	36.7	30.3
Median	34	28	27	25.5	33	29
Range	20-75	1-75	4-78	4-58	23-54	1-78
Sex (%):						
Male	93.1	71.0	76.7	94.1	85.7	77.8
Female	6.9	29.0	23.3	5.9	14.3	22.2
Male: Female ratio	13.5:1	2.4:1	3.3:1	16.1:1	6.1:1	3.5:1
Time of injury (%):*						
Day	63.8	71.0	74.4	85.3	85.7	72.9
Night	**36.2**	29.0	25.6	14.7	14.3	27.1
Day of injury (%):						
Weekday	39.7	61.2	65.6	54.4	42.9	58.3
Weekend	**60.3**	38.8	34.4	45.6	57.1	41.7

* 7.00 am-6.59 pm: Day-time; 7.00 pm - 6.59 am: Night-time.

4.3.2. Crash Characteristics

a) Day and Time of Occurrence:

The distribution of traffic-related injuries by day of occurrence and road-user involved showed that drivers were significantly more likely to be involved in weekend crashes than the rest of road-users (OR=2.4; 95% CI, 4 to 6.1, $p<0.05$). They were nearly three times over-involved during weekends as compared to pedestrians (OR=2.9; 95% CI, 1.4 to 6.1), and 2.5 times when compared to passengers (OR=2.4; 95% CI, 1.3 to 4.5), whilst no significant differences were found in comparison to pedal cyclists (OR=1.8, 95% CI, 0.8 to 3.9, $p>0.05$). When the estimated time of injury occurrence was taken into account, a greater proportion of drivers (36.2%) were found to have been involved at night in comparison to passengers (29%), pedestrians (25.6%) and cyclists (14.7%). The probability of crashing during the night was three times greater for drivers when compared to pedal cyclists (OR=3.3; 95% CI, 1.3 to 8.5, $p<0.01$), but no significant differences between drivers and passengers or pedestrians were demonstrated.

b) Vehicles Involved and Road-users Affected:

The frequency distribution of casualties by road-user category and type of vehicle, presented in Table 4.8, shows that approximately 50% of all traffic injuries involved public service vehicles (PSVs) - (*matatus*, 37.6% and buses, 11.8%), with the majority affected (68%) being passengers. Of the drivers injured, a greater proportion (42.3%) crashed while driving private vehicles, mostly cars; 20.3% were PSV drivers, and 13.6% were driving heavy commercial vehicles (cargo trucks and lorries). Twenty-eight per cent of pedestrians and 27.1% of bicyclists were struck by *matatus*. Some 17.7% of pedestrians were struck by cyclists; and nearly half (47.1%) of the injured bicyclists either fell off their vehicles or were hit by other cyclists and not involved in collisions with motorized vehicles. A small number of motorcyclists (riders and pillions) were injured just by falling off or losing control, with no other vehicle being involved.

Table 4.8 Distribution of road traffic injury by type of road user and type of vehicle involved

Vehicle involved	Class of road user, number and (%)								Row total (%)
	Pedestrian		Driver*		Passenger		Bicyclist		
Matatu	25 (27.7)	13.1	9 (15.3)	4.7	138 (48.4)	72.3	19 (27.1)	9.9	191 (37.6)
Car	14 (15.6)	26.9	15 (25.4)	28.8	19 (6.7)	36.5	4 (5.7)	7.7	52 (10.2)
Bus	1 (1.1)	1.7	3 (5.1)	5.0	56 (19.6)	93.3	-	-	60 (11.8)
Pick-up	17 (18.9)	28.3	10 (16.9)	16.7	26 (9.1)	43.3	7 (10)	11.7	60 (11.8)
Lorry/ trailer	12 (13.3)	27.3	8 (13.6)	18.2	20 (7.0)	45.5	4 (5.7)	9.1	44 (8.7)
Tractor	2 (2.2)	6.7	7 (11.9)	23.3	20 (7.0)	66.7	1 (1.4)	3.3	30 (5.9)
Bicycle	16 (17.7)	32.7	-	-	-	-	33 (47.1)	66.7	49 (9.6)
M/cycle	-	-	6 (10.2)	66.7	3 (1.1)	33.3	-	-	9 (1.8)
Unknown	3 (3.3)	30.0	-	-	3 (1.1)	30.0	-	-	10† (2.0)
Total	90 (100)	17.7	58 (100)	11.4	285 (100)	56.2	68 (100)	13.4	508 (100)

* inclusive of motor-cycle riders
† inclusive of 3 others (sitting on the roadside)

4.4 ASSOCIATION OF ALCOHOL WITH INJURIES

4.4.1. Sample Characteristics

Of the 2073 trauma- affected casualties aged 16 years and above, 1223 (59%) presented within an interval of 10 hours from the time of injury occurrence and were eligible for alcohol assessment. Of these, 778 or 63.6% were breathalysed; this represented only 37.5% of the total number of casualties aged 16 years and over (see Box 4.1): 596 (76.6%) were male, and 182 (23.4%) female. The mean age was 31.3 years with a median of 29 years, ranging from 16 to 89 years. Both breath and blood tests were available for 179 participants.

Most subjects (95.6%) who provided a breath test arrived within six hours of sustaining injury (Figure 4.1). A greater proportion of patients presenting within 4 hours and were breathalysed tested positive in comparison to those arriving between 4 and 10 hours (32.2% and 26.8%, respectively): the differences were however not statistically significant (OR=1.3, 95% CI, 0.8 to 2.0; χ^2=1.39, p=0.23).

Box 4.1: Flow chart of sample size of adults aged 16 and over

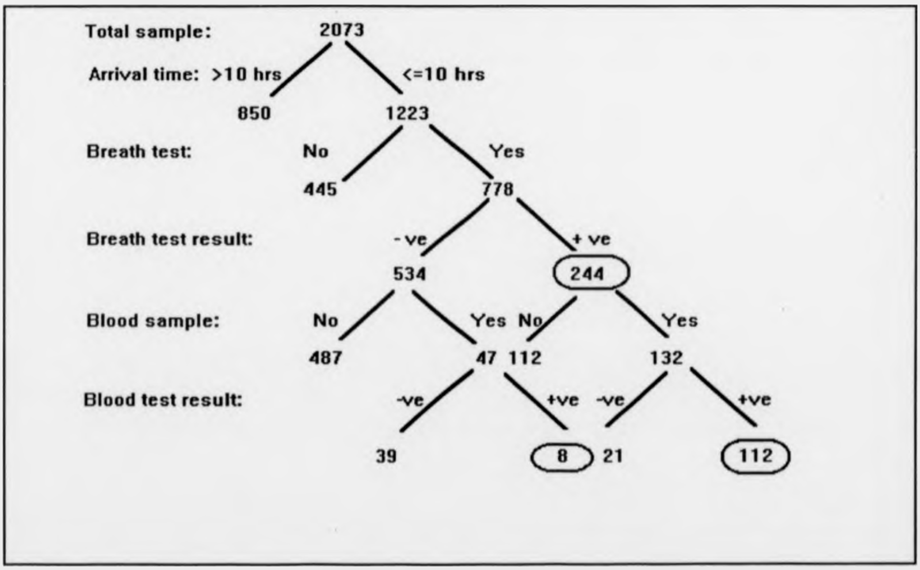
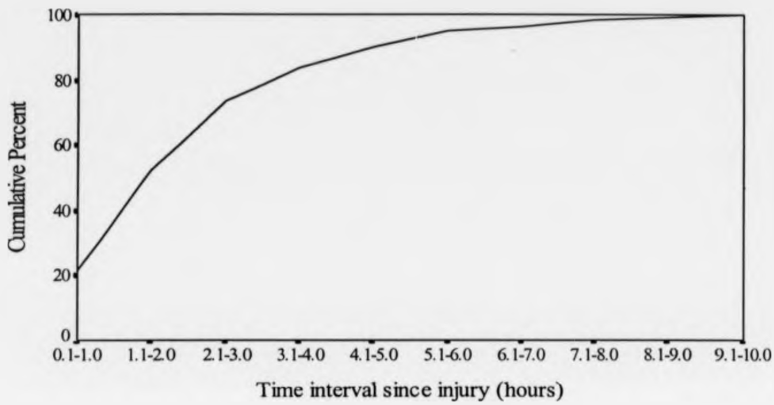


Figure 4.1. Percent distribution of breathalysed patients by time interval since occurrence of injury



4.4.2. Blood Alcohol Concentration Levels by Breathalyser Measurements

4.4.2.1. Alcohol Prevalence

a) Alcohol Prevalence by Age and Sex:

Table 4.9 illustrates the distribution of the number of patients who were alcohol positive (BAC≥5 mg%) and those intoxicated (BAC≥50 mg%) by sex, age, cause of injury, day of week and time period of injury occurrence. Overall, 244 or 31.4% (95% CI, 28.2 to 34.7) had a positive breath test; and of these 171, or 70%, had BACs of 50 mg% or over. Males were significantly more likely to test positive than females (OR=1.8; CI, 1.2 to 2.6, p=0.02), they were also more likely to be intoxicated (BAC≥50 mg%). The preponderance of alcohol positive males was greatest among traffic (26.4%) and assault (47.4%) victims. Traffic-involved males were 2.3 times as likely to test positive as females (95% CI, 0.8 to 6.6, $p>0.05$), while among assaulted victims the likelihood was 2.2 times (95% CI, 1.4 to 3.8); but no significant gender differences were found among fall and *other* injuries.

The mean age of breath test positive patients was 32.3 years and median 31 years; the mean age of those with negative tests was lower, 29.8 years, with a median of 28 years. Those aged 30 years and over were nearly twice as likely to test positive as younger patients aged between 16 and 30 years (37.8% versus 25.6%; OR=1.8; 95% CI, 1.3 to 2.4; $\chi^2=13.3$, $p=0.001$). Over half (57%) of BAC positive patients were aged 30 years and above. When compared to those aged 16-19 years, alcohol prevalence was significantly greater among casualties aged 30-39 years (40.7% versus 14.3%; OR=4.1; 95% CI, 2.0 to 8.7, $p=0.001$). Heavy drinking (BAC≥50 mg%) was also nearly twice as common in patients aged over 30 years as in those below this age limit (OR=1.7; 95% CI, 1.2 to 2.5; $\chi^2=10.0$, $p=0.001$), and the most affected age bracket was again 30-39 years. These age-specific differences were significantly greater among traffic-involved ($\chi^2=10.29$, $p=0.001$) and assaulted patients ($\chi^2=5.5$, $p=0.02$), than among falls and *other* injuries ($p>0.05$).

Table 4.9 Comparison of breath test results with subjective assessment for alcohol in trauma patients presenting to hospitals in Eldoret.

Category	Number tested	Number, proportion affected by alcohol and mean BAC			
		Positive test No. (%)	BAC≥50mg% No. (%)	Mean BAC mg% (95%CI)	Subjective n (%)
All cases	778	244 (31.4)	171 (22.0)	106 (96-117)	1223 (20.8)
Sex:					
Male	596	203 (34.1)	144 (24.2)	108 (97-120)	933 (23.2)
Female	182	41(22.5)	27 (14.8)	97 (75-121)	290 (13.1)
Age (years):					
16-19	77	11 (14.3)	5 (6.5)	71 (35-107)	123 (10.6)
20-29	333	94 (28.2)	67 (20.1)	108 (90-125)	511 (19.0)
30-39	226	92 (40.7)	64 (28.3)	110 (93-127)	357 (28.0)
40-49	99	32 (32.3)	24 (24.2)	103 (77-130)	153 (19.6)
50+	43	15 (34.9)	11 (25.6)	110 (68-152)	79 (17.7)
Cause:					
Traffic	188	44 (23.4)	23 (12.2)	81 (55-107)	388 (9.5)
Assault	405	174 (43.0)	125 (30.9)	110 (98-122)	538 (34.9)
Fall	28	5 (17.9)	4 (14.3)	113 (25-201)	57 (14.0)
Other	157	21 (13.4)	19 (12.1)	127 (95-160)	240 (8.7)
Day of week:					
Monday	95	20 (21.1)	12 (12.6)	105 (64-145)	178 (11.2)
Tuesday	102	28 (27.5)	18 (17.6)	110 (71-148)	157 (19.1)
Wednesday	89	29 (32.6)	20 (22.5)	107 (75-140)	152 (19.7)
Thursday	93	38 (40.9)	23 (24.7)	88 (64-112)	166 (18.1)
Friday	128	37 (28.9)	29 (22.7)	113 (83-143)	192 (19.8)
Saturday	135	35 (25.9)	24 (17.8)	104 (80-129)	190 (20.5)
Sunday	136	57 (41.9)	45 (33.1)	115 (96-133)	188 (35.6)
Period of week:					
Weekday	379	115 (30.3)	73 (19.3)	101 (85-117)	653 (16.8)
Weekend	399	129 (32.3)	98 (24.6)	111 (98-125)	570 (25.3)
Time:					
Day(7am-7pm)	452	100 (22.1)	69 (15.3)	111 (93-128)	747 (13.3)
Night(7pm-7am)	326	144 (44.2)	102 (31.3)	102 (91-116)	476 (35.6)

b) Alcohol Prevalence by Injury Mechanism:

Of breath tested patients 188 (24.2%) sustained traffic injuries, 405 (52.0%) were assaulted, 28 (3.6%) had fall-related trauma, and 157 (20.2%) had injuries from *other* causes. The proportion of subjects testing positive for alcohol varied by cause of injury. Of assaulted casualties 43.0% (95% CI, 38.2 to 47.8) tested positive, whereas 23.4% (95% CI, 17.5 to 29.3) of traffic-, and 17.9% (95% CI, 6.0 to 36.9) of fall-related trauma had evidence of blood alcohol. The likelihood of being positive on a breath test was significantly greater among assaulted victims than in those with injuries from all other causes. It was 2.4 times greater when compared to traffic-involved casualties (95% CI, 1.6 to 3.7); 3.4 times greater in relation to those with fall-related trauma (95% CI, 1.2 to 11.8); and nearly 5-fold greater in those with injuries from *other* causes (OR=4.8; 95% CI, 2.9 to 8.2). At BAC levels of 50 mg% and over, the proportion of assaulted patients was 3 times greater than that of traffic-involved casualties (OR=3.2; 1.9 to 5.3; χ^2=23.7, p<0.001). Although alcohol prevalence was significantly lower in traffic-involved casualties than in assaulted victims, it was two-fold higher when compared to those with injuries from *other* causes (OR=2.0; 95% CI, 1.1 to 3.6), but did not differ significantly in comparison to fall- affected patients (χ^2=0.43, p=0.5).

c) Alcohol Prevalence by Time and Day of Week:

Table 4.10 shows daily variations in proportions of casualties that tested positive by mechanism of injury and day of week. Overall, alcohol prevalence was highest on Sunday (41.9%). More than half (55.1%) of assaulted patients attending on Sundays were BAC positive, whereas the greatest proportion of alcohol-affected traffic casualties attended on Thursdays (36.4%) and Fridays (36.7%). There were however no significant differences in the likelihood of a casualty testing positive whether an injury occurred during a weekend or weekday (OR=1.1; 95% CI, 0.8 to 1.5; χ^2=0.36, p=0.6). Significant variations in alcohol prevalence across the week, and between weekends and weekdays, were therefore not demonstrated.

Table 4.10 Breath test alcohol prevalence (BAC +ve)* by cause of injury and day of occurrence**

Day of week	Traffic		Assault		Fall		Other		Overall	
	No.	% +ve	No.	% +ve	No	% +ve	No.	% +ve	No.	% +ve
Mon	3/20	15.0	15/42	35.7	1/7	14.3	1/26	3.8	20/95	21
Tue	4/25	16.0	20/51	39.2	1/8	12.5	3/18	16.7	28/102	27.5
Wed	3/23	13.0	22/50	44.0	1/2	50.0	3/14	21.4	29/89	32.6
Thur	8/22	36.4	26/52	50.0	1/2	50.0	7/17	17.6	38/93	40.9
Fri	11/30	36.7	22/69	31.9	-	-	4/28	14.3	37/128	28.9
Sat	6/36	16.7	26/63	41.3	-	-	3/30	10.0	35/135	25.9
Sun	9/12	28.1	43/78	55.1	1/5	20.0	4/21	19.0	57/136	41.9

* BAC +ve means any amount of detectable alcohol≥5 mg%

** shaded cells denote days with high alcohol detection rates by type of injury

Among casualties who recorded high blood alcohol levels of 50 mg% or more, significantly greater proportions sustained injuries on Sunday, when compared to those involved on Monday (χ^2=12.5, p=0.003), Tuesday (χ^2=7.1, p=0.007), and Saturday (χ^2=8.3, p=0.005), while no differences in heavy drinking were detected with respect to Wednesday (χ^2=2.9, p=0.08), Thursday (χ^2=1.8, p=0.1) and Friday (χ^2=3.5, p=0.06). Nevertheless, the likelihood of heavy drinking was not significantly different at a p-level of 0.05, whether an injury occurred during a weekend (Friday to Sunday) or on a weekday (OR=1.3; 95% CI, 0.9 to 1.9; χ^2=3.1, p=0.07).

Figure 4.2 and Table 4.11 illustrate the diurnal variation in alcohol prevalence by cause of injury. Overall, a significantly greater proportion of patients who sustained injury during the night (44.2%) were affected by alcohol than those injured during the day (22.1%) (χ^2=42.7, p<0.001). The probability of a casualty testing positive was nearly three times greater when injury occurred at night than during the day (OR=2.8; 95% CI, 2.0 to 3.8). The differences were still highly significant when those with BACs of 50 mg% and over were considered (OR=2.5; 95% CI, 1.7 to 3.6, χ^2=28.3, p<0.001). Traffic injury (33.3%), assaults (50.2%), and injuries from *other* causes (35.7%) occurring at night were to a greater extent associated with alcohol (traffic: χ^2=4.5, p=0.03; assault: χ^2=10.0, p=0.001; other: χ^2=24.5, p<0.001). In contrast, most alcohol-related fall injuries (22.2%) occurred during the day, with only one fall patient injured at night being BAC positive. The numbers of fall casualties in the sample were however too small to allow for a meaningful analysis.

Figure 4.2 Variation in alcohol prevalence by day of week and time of day

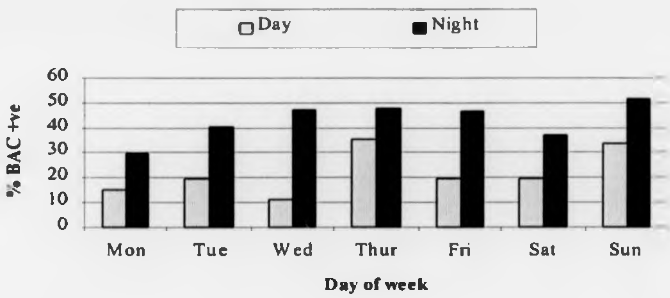


Table 4.11 Variation in alcohol prevalence and mean BACs by day or night and mechanism of injury

Cause	Daytime*			Nighttime**			Odds Ratio, (95% CI), p-value
	BAC positive†			BAC positive			
	No.	% (95% CI)	Mean BAC	No.	% (95% CI)	Mean BAC	
Traffic	25/131	19.1(14.4-5.8)	70	19/57	33.3(21.4-47.1)	95	2.1 (1.0-4.5), p<0.05
Assault	65/188	34.6(27.8-41.4)	128	109/217	50.2(43.6-56.9)	99	1.9 (1.3-2.9), p<0.05
Falls	4/18	22.2(6.4-47.6)	99	1/10	10.0 (0.3-44.5)	170	0.4 (0.01-5.0), p=0.4
Other	6/115	5.2(1.9-11.0)	101	15/42	35.7(21.6-52.0)	139	9.3 (3.0-30.0), p<0.001
All causes	100/452	22.1(18.3-26.0)	111	144/326	44.2(38.8-49.6)	103	2.8 (2.0-3.8), p<0.001

* Daytime - from 7.00 am to 6.59 pm; ** Nighttime - from 7.00 pm to 6.59 am
† BAC≥5 mg%

4.4.2.2. Mean blood alcohol concentrations (BACs)

For the 244 subjects in whom a positive breath test was obtained, the mean BAC was 106 mg% (95% CI, 96 to 116), with a median of 100 mg%. The lowest blood alcohol level was 5 mg% and the highest value recorded was 447 mg%. Males had higher mean BACs (108 mg%) than females (97 mg%) but the differences were not statistically significant ($F_{1,242}$ =0.58, p=0.45), owing to the small number of test positive females. As shown in Table 4.9, the mean BACs in patients with a positive breath test did not vary substantially among the different categories of participants and injury circumstances examined, ranging from 71 mg% to 127 mg%. Significantly greater cause-specific differences in mean BACs were found with respect to assaulted (110 mg%) and traffic-involved patients (81 mg%; $F_{1,216}$ =4.6, p=0.03). Both day- and night-time mean BAC levels were elevated but not significantly different, with the exception of assaulted victims who showed greater diurnal differences

(128 mg% for day- versus 99 mg% for night-time; $F_{1,172}$=5.6, p<0.05). The overall and other cause-specific mean BACs also did not show significant variations by day of week or between weekdays and weekends.

4.4.3. Alcohol Evaluation by Serum Blood Analysis

Of trauma attenders aged 16 years and over, arriving within 10 hours, 267 (21.8%) provided blood samples for alcohol analysis of whom 179 were also breathalysed and 88 failed to provide a breath test. Participants in serum alcohol analysis included seriously injured inpatients, where a breath test procedure was not practicable, and consenting outpatients. Dislike of venepuncture was a common reason for refusal to allow blood to be taken, and in some cases samples of blood were not taken immediately because treatment was urgently needed. Blood alcohol was detected in 157 or 58.8% (95% CI, 52.9 to 64.7), and 53.2 % (95% CI, 47.2 to 59.2) had high BACs of 50 mg% and above; their mean BAC was 169.5 mg%. There were no significant differences in alcohol detection rates by sex (χ^2=0.71, p=0.4). Assaulted patients were nearly 5 times as likely to have detectable alcohol levels (BAC≥5 mg%) as those involved in crashes (OR=4.95; 95% CI, 2.7 to 9.2; χ^2=31.6, p<0.0001).

A further description of characteristics of alcohol-related casualties was done with respect to a sample of patients who participated in both breath testing and serum blood alcohol analysis procedures (Table 4.12).

4.4.4. Comparison of Alcohol Detection Rates by Breath and Serum Blood Tests

Of the 1223 eligible adults, 179 (14.6%) were evaluated for evidence of alcohol by both breath test and blood analysis methods: 145 (81%) were male and 34 (19%) were female. Of the sample, 73.7% (95% CI, 67.3 to 80.2) had detectable alcohol by breath test, against

67.0% (95% CI, 60.2 to 73.9) by blood analysis. BAC readings of 50 mg% and above were recorded by breathalyser in 58.7% of the subjects, whereas the equivalent figure by blood analysis was 60.3% (χ^2=2.68, p=0.1), indicating the similarity of the two measurement methods at high blood alcohol levels. The distribution of alcohol prevalence and mean BACs obtained by the two measurements in the different categories of trauma-affected casualties, presented in Table 4.12, demonstrated no significant differences in the proportion of subjects with any detectable amount of alcohol (χ^2=1.92, p=0.16).

Table 4.12 Alcohol prevalence and mean BAC levels according to breath test and blood analysis in casualties attending hospitals in Eldoret

Category	Number of subjects tested	Method of Measurement					
		Breath test results			Blood analysis results		
		% positive	% with BAC ≥ 50 mg%	Mean BAC (mg%)	% positive	% with BAC≥ 50 mg%	Mean BAC (mg%)
Overall	179	73.7	58.7	123	67	60.3	164
Sex:							
Male	145	75.8	60.0	125	67.6	59.3	165
Female	34	64.7	52.9	111	64.7	64.7	160
Age (years):							
16-19	14	50.0	28.6	69	35.7	21.4	103
20-29	78	67.9	51.3	118	60.3	52.6	150
30-39	55	81.8	67.3	130	78.2	74.5	166
40-49	21	85.7	71.4	122	76.2	71.4	178
50+	11	81.2	81.8	162	81.2	72.7	239
Cause:							
Traffic	46	47.8	32.6	92	45.6	39.1	179
Assault	106	89.6	72.6	132	81.1	73.6	163
Fall	4	50.0	25.0	53	25.0	-	41
Other	23	56.5	52.2	132	52.2	52.2	202
Time of day:							
Day-time	86	67.4	64.0	122	58.1	62.8	172
Night-time	93	79.6	53.8	123	75.3	58.4	159
Day of week:							
Weekday	102	65.7	42.2	132	59.8	43.1	166
Weekend	77	84.4	80.5	113	76.6	83.1	163

Although the proportion of BAC positives detected by blood analysis was generally elevated, there was consistency between breathalyser and venous BAC results; the agreement between the two measurements being more evident at a threshold level of 50 mg%. The overall mean BAC measured by blood analysis was, however, greater than that obtained from breathalyser readings (164 mg% versus 123 mg%), this trend was also consistent across all casualty categories and injury circumstances.

Evaluation of the reliability of breath tests as a screening procedure for detecting blood alcohol was done using blood analysis as the reference 'gold' standard. Of the 179 participants, 112 (62.6%) were positive for both blood and breath test measurements, 39 (21.8%) were negative for both, 8 (4.5%) were positive for blood analysis only, and 20 (11.2%) positive for breath test alone. When compared to blood analysis results, breathalyser readings had a sensitivity[12] of 93.3% (112/120), specificity[13] of 66.1% (39/59), a positive predictive value[14] of 84.8% (112/132) and a negative predictive value[15] of 83.0% (39/47). The reliability of the breath test method increased considerably by raising the BAC threshold level to 50 mg%. This had the effect of eliminating false positives, resulting in a significant increase in the test's sensitivity to 97.2% (105/108) and specificity to 100% (71/71). Optimum levels of both positive predictive and the negative predictive values were also attained, to 100% (105/105) and 95.9% (71/74), respectively (Tables 4.13 and 4.14). These findings demonstrate that breath test measurements provide reliable and valid estimates of actual blood alcohol concentrations (at BAC levels equal to or greater than 50

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[12]- Proportion of true alcohol positives correctly detected by the breath test as positive

[13]-Proportion of true negatives correctly identified by the breath test as negative

[14] -Proportion of true positives amongst the apparent test positives, or the probability of being truly positive when a breath test indicates a positive result.

[15] -Proportion of true negatives amongst the apparent test negatives, or the probability of truly not having any blood alcohol when the breathalyser reading indicates a negative result.

mg%) and can be used as an alternative to venous blood analysis.

Table 4.13 Sensitivity and Specificity of the breath test method in detecting any amount of blood alcohol

		Blood analysis ("standard")		
	Result	+ve	-ve	Total
Breathalyser reading	+ve	112	20	132
	-ve	8	39	47
	Total	120	59	179

Table 4.14 Sensitivity and specificity of the breath test method in detecting blood alcohol at a threshold BAC of 50 mg%

		Blood analysis ("standard")		
	BAC level	≥50 mg%	-ve or <50 mg%	Total
Breathalyser reading	≥50 mg%	105	0	105
	0-49mg%	3	71	74
	Total	108	71	179

4.4.5. Subjective Clinical Evaluation

A subjective assessment of alcohol consumption was made, based on the presence or absence of signs such as smell of alcohol on breath, slurred speech and red conjunctivae. Smell of breath was the criterion most frequently used; all the 1223 eligible patients were evaluated, with 254 (20.8%) being considered to have taken alcohol. When compared with breath test results, the proportion of those assessed as possessing clinical signs of inebriation were substantially lower in all categories of casualties, indicating the unreliability of subjective clinical evaluation. Breathalyser tests were 1.7 times more likely to detect evidence of a recent alcohol consumption than a subjective assessment (OR=1.7; 95% CI, 1.4 to 2.2, χ^2 =

28.5, $p<0.001$). Some consistency in alcohol prevalence rates estimated by the two methods, across the different categories of casualties, was apparent (see Table 4.9). Incidentally, when breath test readings of 50 mg% and over were considered, the proportion found to be affected by alcohol were nearly similar to subjective assessment figures (overall 22% versus 20.8%), suggesting that clinical evaluation is potentially valuable in identifying heavy drinkers with obvious signs of intoxication (see columns 4 and 6 of Table 4.9). An evaluation of the sensitivity and specificity of subjective assessments in relation to blood sample analysis further showed that the method can provide a valid estimate of the presence of alcohol in blood when actual BAC levels are 50 mg% and over, with a sensitivity of 91.7% and specificity of 73.2%; compared to 87.5% and 78%, respectively, for any amount of alcohol (Tables 4.15 and 4.16). This implies that severely drunk crash-involved drivers (BAC≥50 mg%) are more likely to be correctly detected by the police.

Table 4.15. Sensitivity and Specificity of subjective assessment of alcohol consumption

		Blood analysis ("standard")		
	Result	+ve	-ve	Total
Subjective assessment	+ve	105	13	118
	-ve	15	46	61
	Total	120	59	179

Table 4.16. Sensitivity and specificity of subjective assessment at a threshold BAC level of 50 mg%

		Blood analysis ("standard")		
	BAC level	≥50 mg%	-ve or <50 mg%	Total
Subjective	+ve (≥50 mg%)	99	19	118
assessment	-ve (0-49mg%	9	52	61
	Total	108	71	179

4.4.6. Testing for Bias

An attempt was made to assess whether the sample of patients who were breathalysed differed on some characteristics from those who were not. Proportions of those subjectively judged to had taken alcohol among breath test participants and non-participants were compared (Table 4.17). The overall response rate was 63.6% (95% CI, 60.9 to 66.3), with no significant difference between the proportion of men and women who submitted to breath tests (χ^2 =0.12, p=0.7). The mean ages of participants and non-participants also did not differ significantly (30.6 versus 31.8 years; $F_{1,1221}$=3.2, p=0.07). Demographic characteristics had, therefore, no influence on the response to breath alcohol measurements. However, some differences emerged with respect to injury mechanisms and circumstances. Assault victims were three times as likely to be breath tested as traffic-involved casualties (OR=3.2; 95% CI, 2.4 to 4.3; χ^2 =70.3, p<0.001); and subjects injured on weekends were more likely to participate than those involved during weekdays (70% versus 58%; χ^2=7.5, p=0.006). Similarly, subjects injured at night stood a greater chance of being breath tested compared to those affected day-time (68.5% versus 60.5%; χ^2 =18.8, p<0.001).

Of the breathtested subjects, 27.1% had apparent features of inebriation, compared to 9.9% of the 445 patients who did not participate. Patients who participated were more likely to include a greater proportion of subjects who had consumed alcohol than those who failed to provide a breath test (OR=3.4; 95% CI, 2.3 to 4.9; χ^2 =50.9, p<0.001). As shown in Table

4.17 (columns 4 and 6), on the basis of clinical judgement, refusals were less likely to have been drinking; this tendency was consistent across all categories of subjects and injury circumstances examined.

Casualty disposition had a significant influence on participation rates in breath alcohol evaluation. Inpatients were significantly less likely to be breath tested than outpatients (28% versus 42.2%; OR=0.5; 95% CI, 0.4 to 0.7; χ^2 =31.7, p<0.001); this may have occurred as consequences of both the nature and severity of injuries sustained, rendering breathalysing less practical, as well as priority being given to treatment procedures.

Given that participation was purely voluntary, and since a greater proportion of those who participated had apparent features of inebriation than refusals, alcohol detection rates from this study (on the basis of breath test readings) may over-estimate the true prevalence. On the other hand, if the refusals had higher (more severely intoxicated) than average BACs for those breathtested, then the effect of missing their readings could have slightly decreased the overall effect of alcohol.

Table 4.17. Proportions of casualties subjectively judged as having consumed alcohol among breath test participants and non-participants

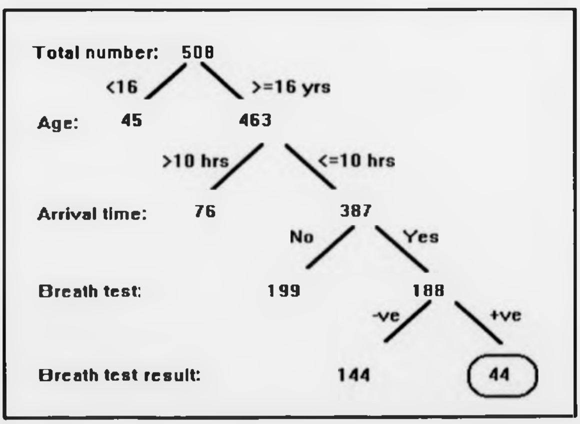
Category	Total No. of patients	Participants		Non-participants	
		No. (% response)	No. (%) affected *	No.	No. (%) affected*
Overall	1223	778 (63.6)	211 (27.1)	445	44 (9.9)
Sex:					
Male	933	596 (63.9)	179 (30.0)	337	38 (11.3)
Female	290	182 (62.8)	32 (17.6)	108	6 (5.6)
Age:					
16-19	123	77 (62.6)	10 (13.0)	46	3 (6.5)
20-29	511	333 (65.2)	80 (24.0)	178	17 (9.6)
30-39	357	226 (63.3)	85 (37.6)	131	15 (11.5)
40-49	153	99 (64.7)	24 (24.2)	54	6 (11.1)
50+	79	43 (54.4)	11 (25.6)	36	3 (8.3)
Cause:					
Traffic	388	188 (48.5)	29 (15.4)	200	8 (4.0)
Assault	538	405 (75.3)	56 (38.5)	133	32 (24.0)
Fall	57	28 (49.1)	4 (14.3)	29	4 (13.9)
Other	240	157 (65.4)	21 (13.4)	83	0 -
Day :					
Monday	178	95 (53.3)	18 (18.9)	83	2 (2.4)
Tuesday	157	102 (65.0)	24 (23.5)	55	6 (10.9)
Wednesday	152	89 (58.6)	26 (29.2)	63	4 (6.3)
Thursday	166	93 (56.0)	27 (29.0)	73	3 (4.1)
Friday	192	128 (66.7)	30 (23.4)	64	8 (12.5)
Saturday	190	135 (71.0)	31 (23.0)	55	8 (14.5)
Sunday	188	136 (72.3)	54 (39.7)	52	13 (25.0)
Period of week:					
Weekday	653	379 (58.0)	95 (25.1)	274	15 (5.5)
Weekend	570	399 (70.0)	115 (28.8)	171	29 (17.0)
Time of day:					
Day-time	747	452 (60.5)	83 (18.4)	295	16 (5.4)
Night-time	476	326 (68.5)	127 (39.0)	150	28 (18.7)

* on the basis of subjective assessment

4.4.7. Alcohol Prevalence in Traffic-Involved Casualties

Of the 508 patients involved in traffic crashes, 463 or 91.1% were aged 16 years and above; of these 387 (83.6%) arrived within 10 hours of injury and were therefore eligible for breath alcohol assessment. One hundred and ninety nine were not breathtested mainly due to refusal, severity of injury or inability to blow correctly into the breathalyser. (See Flow chart-Box 4.2). Alcohol involvement was subsequently evaluated by breath test in 188 casualties, representing 48.6% of all eligible subjects; of these 144 (76.6%) were male, and 44 (23.4%) female. They were aged between 16 and 66 years, with a mean age of 31.0 years and a median of 28.5 years.

Box 4.2: Flow Chart of traffic-involved casualties



a) Alcohol prevalence by Age and Sex:

The effect of alcohol was assessed by age and sex of casualty, type of road user, and time and day of crash (Table 4.18). Males were more than twice as likely to test positive (BAC≥5 mg%) as females (26.4% versus 13.6%; OR=2.3; 95% CI, 0.9-5.8, p=0.08), although owing to the small number of females in the sample the difference was not significant at a probability level of 0.05. Also, a greater proportion of males had blood alcohol levels of 50 mg% and over than females (14.6% versus 4.5%).

The mean age of the BAC positive group was 35.0 years, while that of the BAC negative group was 29.7 years ($F_{1,186}$=9.6, p=0.002). However, a linear relationship between the BAC level and age of casualty was not demonstrated (p=0.5). Comparisons of the mean age of BAC positive subjects by type of road-user showed significant differences among passengers (36.3 vs 29.6 years for the negative group; $F_{1,104}$=6.13, p=0.01), while no differences were found amongst drivers (34.9 vs 36.2 years), pedestrians (32.9 vs 30.3 years), and bicyclists (34.5 vs 27.4 years).

b) Alcohol Prevalence by Type of Road-user (based on breathtests):

As shown in Tables 4.18 to 4.20, proportions of BAC positives varied by class of road-user. Of the drivers breathtested, 60% (95% CI, 38.7 to 78.9) were found to be positive, and all were men. This was higher than the 33.3% in pedestrians, 16% in passengers and 8.3% in pedal cyclists. When compared to passengers, drivers were nearly 8 times more likely to have been drinking prior to the crash (OR=7.9; 95% CI, 2.8 to 22.9, p<0.0001), and 3 times in relation to pedestrians (OR=3.0; 95% CI, 0.9 to 10.6, p>0.05). The distribution of BAC levels by class of road-user further showed that two-thirds (66.7%) of the alcohol positive drivers had BACs in excess of 50 mg%, compared to 60% in pedestrians and 35.3% in passengers. Nevertheless, mean BACs did not differ significantly among the various categories of road-users, although it was more elevated in drivers (108 mg%) than pedestrians (83 mg%), passengers (58 mg%) and bicyclists (68 mg%); ($F_{3,40}$= 0.87, p=0.46).

Table 4.18 Alcohol prevalence in breathalysed traffic-involved casualties

Category	Number tested	Patients affected by alcohol		Mean BAC in mg%
		Breath test positive No. (%)	BAC> 50 mg% No. (%)	
All cases	188	44 (23.4)	23 (12.2)	81
Sex:				
Male	144	38 (26.4)	21 (14.6)	87
Female	44	6 (13.6)	2 (4.5)	43
Age:				
16-19	18	-	-	-
20-29	80	16 (20.0)	9 (11.2)	99
30-39	45	14 (31.1)	7 (15.6)	83
40-49	38	10 (26.3)	6 (15.8)	70
50+	7	4 (57.1)	1 (14.3)	30
Road-user:				
Driver	25	15 (60.0)	10 (40.0)	108
Pedestrian	30	10 (33.3)	6 (20.0)	58
Passenger	106	17 (16.0)	6 (5.7)	83
Bicyclist	24	2 (8.3)	1 (4.2)	68
Other	3	-	-	-
Day of week:				
Monday	20	3 (15.0)	1 (5.0)	31
Tuesday	25	4 (16.0)	1 (4.0)	55
Wednesday	23	3 (13.0)	2 (8.7)	198
Thursday	22	8 (36.4)	2 (9.1)	40
Friday	30	11 (33.3)	8 26.7)	104
Saturday	36	6 (16.7)	2 (5.6)	62
Sunday	32	9 (28.1)	7 21.9)	57
Period of week:				
Weekday	90	18 (20.0)	6 (6.7)	60
Weekend	98	26 (26.5)	17 (17.3)	96
Period of day:				
Day-time	131	25 (19.1)	11 (8.4)	70
Night-time	57	19 (33.3)	12 (21.1)	95

c) Across the week and Diurnal Variation in BAC Prevalence:

BAC positivity rates varied by time and day of injury (Table 4.18). Unexpectedly, 36.4% of crash casualties tested on Thursdays had taken alcohol, a proportion slightly greater than that found on Fridays (33.3%) and other days of the week. There was no consistency in detection rates of alcohol across the week, and the proportion found positive during weekends (26.5%) and weekdays (20.0%) did not differ significantly (χ^2=1.1, p=0.3).

At a cut-off BAC level of 50 mg%, weekend crashes was found to significantly involve a greater proportion of intoxicated subjects than those occurring during weekdays. Overall, the probability of intoxication was three times as likely on a weekend than on weekdays (OR=2.9; 95% CI, 1.0 to 8.8; χ^2 =4.96, p=0.02). Pedestrians were 3 times more likely to test positive (60.0%) during weekends than on weekdays (20.0%), (χ^2 =4.6, p=0.03), while no differences were found among drivers and passengers.

Table 4.19 Alcohol prevalence in traffic casualties by sex and class of road-user

Class of road user	Male		Female		Overall		
	No.	% +ve	No.	% +ve	No.	%+ve (95% CI)	Mean BAC mg% (Range)
Driver	15/23	65.2	0/2	-	15/25	60.0 (38.7-78.9)	108 (5-390)
Pedestrian	8/23	34.8	2/7	28.6	10/30	33.3 (17.3-52.8)	58 (5-340)
Passenger	13/74	17.6	4/32	12.5	17/106	16.0 (9.1-23.0)	83 (5-250)
Bicyclist	2/22	9.1	0/2	-	2/24	8.3 (1.0-27.0)	68 (30-105)
Other	0/2	-	0/1	-	-	-	-

- no BAC positive cases; CI- Confidence Interval

Table 4.20 BAC levels by class of road user

BAC level (mg%)	Driver	Pedestrian	Passenger	Bicyclist	Total (%)
0	10	20	89	22	144*(76.6)
5-49	5	5	11	1	22 (11.7)
50-100	2	3	3	0	8 (4.2)
>100	8	2	3	1	14 (7.4)

* included 3 *others* unclassified

As illustrated in Table 4.21, crashes that occurred during night-time were twice as likely to involve BAC positive road-users as those happening during the day (χ^2 =4.5, p=0.03). A greater proportion of drivers injured at night (70.0%) were affected by alcohol in comparison to those involved during day-time (53.3%), although the differences were not significant at 95% level (χ^2=0.67, p=0.4). No differences were detected among passengers, pedestrians and bicyclists, although the small numbers of subjects that were assessed preclude making a meaningful statistical inference.

Table 4.21 Comparisons of alcohol prevalence by class of road-user, and by day and time of crash

Road user	Weekend No. (%)	Weekday No. (%)	Odds Ratio (95%CI)	Night-time No. (%)	Day-time No. (%)	Odds Ratio (95%CI)
Driver	10/16 (62.5)	5/9 (55.5)	1.3 (0.2-9.3)	7/10 (70.0)	8/15 (53.3)	2.0 (0.3-16.7)
Pedestrian	6/10 (60.0)	4/20 (20.0)	6.0 (0.9-44.0)	7/21 (33.3)	3/9 (33.3)	1.0 (0.1-6.7)
Passenger	10/57 (17.5)	7/49 (14.3)	1.3 (0.4-4.1)	8/34 (23.5)	9/72 (12.5)	2.1 (0.7-7.0)
Bicyclist	0/12 -	2/12 (16.7)	-	1/4 (25.0)	1/20 (5.0)	6.3 (0.06-130)
Overall	26/98 (26.5)	18/90 (20.0)	1.4 0.7-3.0)	19/57 (33.3)	25/131 (19.1)	2.1 (1.1-4.5)*

* $p<0.05$

A comparative analysis of BAC positivity by class of road-user, time of crash or collision and BAC level, presented in Table 4.22, showed that in crashes occurring both during day- and night-times, drivers were eight times more likely to have been drinking than passengers (χ^2=21.0, p<0.001). For pedestrians, the likelihood of testing positive was 3 times greater during day-time, while no significant differences were found at night (in comparison to passengers). Relatively small proportions of pedal cyclists and passengers injured at night were inebriated, and their odds of intoxication were not significantly different. Proportions of casualties with low BACs (<50 mg%) did not significantly differ between the different types of road-users, however, at a BAC of 50 mg% or higher, drivers were eleven times more likely to be intoxicated than passengers (χ^2 =22.0, p<0.001), while for pedestrians it was three-fold (χ^2=3.8, p=0.05).

Table 4.22 Proportions and Odds Ratios of alcohol prevalence by class of road-user, time of injury and BAC level (with passengers as the comparison group)

	Class of road-user	BAC positive No. (%)	Odds Ratio (95%CI)
Time of injury: Day	Passenger	9/72 (12.5)	1.0
	Driver	8/15 (53.3)	8.0 (2.3-27.4)*
	Pedestrian	7/21 (33.3)	3.2 (1.0-10.2)*
	Bicyclist	1/20 (5.0)	0.4 (0.04-3.1)
Night	Passenger	8/34 (23.5)	1.0
	Driver	7/10 (70.0)	7.6 (1.6-36.4)*
	Pedestrian	3/9 (33.3)	1.6 (0.3-8.0)
	Bicyclist	1/4 (25.0)	1.0 (0.1-11.9)
BAC level: <50 mg%	Passenger	11/106 (10.4)	1.0
	Driver	5/25 (20.0)	2.2 (0.6-7.9)
	Pedestrian	5/30 (16.7)	1.7 (0.5-6.1)
	Bicyclist	1/24 (4.2)	0.4 (0.10-2.9)
≥50 mg%	Passenger	6/106 (5.7)	1.0
	Driver	10/25 (40.0)	11.1(3.1-41.2)*
	Pedestrian	5/30 (16.7)	3.3 (0.8-13.8)
	Bicyclist	1/24 (4.2)	0.7 (0.02-6.6)

* P<0.05

4.4.8. The Contribution of Alcohol in Traffic Crashes

In order to assess the effect of alcohol consumption to the risk of accident-involvement, BAC data from the roadside driver survey (see Chapter 6) were used for comparison. The proportion of BAC positive drivers among the crash-involved patients presenting for treatment was compared with that in a sample of the driving population. As a measure of crash probability, odds ratios, calculated by different BAC levels, showed an increasing trend with the rise in BAC threshold; this is demonstrative of a direct dose-response relationship and the strength of association between alcohol consumption and the likelihood of a driver's involvement in a crash (Table 4.23). In comparison to sober drivers, BAC positive ones were six times more likely to be involved in a crash (χ^2 =22.1, $p<0.001$); at low blood alcohol levels, the likelihood was more than 3 times (OR=3.5; χ^2 =5.36, p=0.02), while it was nearly 10 times at BACs greater than 50 mg% (OR=9.6; χ^2 =30.9, $p<0.001$).

The magnitude of association of alcohol with crashes in the study population was estimated by computing attributable risk (AR) and percent attributable risk (AR%), by the formula, shown in Box 4.3, described by Beaglehole et al. (1993), and Sahai and Khurshid (1996). Odds Ratio values from the data were used as surrogate measures of the relative risk: the computations are summarized in Table 4.23. Assuming that all other crash factors were similar in both sober and drinking drivers, the additional probability of crashing was on average 5 times greater among drivers who had evidence of having consumed any amount of alcohol than those with zero BAC, and 83% of their increase in risk of having a crash (risk difference) is attributable to alcohol. This proportion varied with the level of intoxication, being 71.4% at low BACs, and rose to nearly 90% at BACs greater than 50 mg%. These figures illustrate estimates of percentages of driver injuries that would be avoided if all drivers affected drove at zero BAC.

Box 4.3. Attributable Risk Equations (with OR to approximate RR)

$$AR = OR_{exp} - OR_{unexp} \; ; \; AR\% = \frac{OR_{exp} - OR_{unexp}}{OR_{exp}} \times 100$$

$$PAR\% = \frac{p_{exp}(OR_{exp} - 1)}{1 + p_{exp}(OR_{exp} - 1)} \times 100$$

where; OR_{exp} = odds of injury of BAC positive drivers;

OR_{unexp}= odds of injury of sober drivers

p_{exp} = proportion of crash-involved BAC positive drivers

Formulae adapted from Beaglehole et al. (1993); Sahai and Khurshid (1996).

In an attempt to estimate the overall proportion of injuries in the entire driving population that could be prevented if drink driving was eliminated, the population attributable risk percent (PAR%) was calculated. As presented in Table 4.23, approximately 75% of alcohol-related injuries occurring in the entire driving population (consisting of both drinking and non-drinking motorists) could have been avoided if drink-driving were completely eliminated, and up to 70% of the injuries would have been prevented if a BAC legal limit of 50 mg% were introduced and enforced on all motorists.

Table 4.23 Estimates of Odds Ratios (OR), Attributable Risk (AR), Attributable Risk percent (AR%) and Population Attributable Risk fraction (PAR%) associated with alcohol consumption

BAC level	% Injured drivers (N=25)	% Roadside survey (N=433)	OR(95% CI)	AR (risk difference)	AR%	PAR%
Sober	40.0	80.1	1.0	-	-	-
5-50 mg%	20.0	11.5	3.5 (1.0-11.6)	2.5	71.4	33.3
>50 mg%	40.0	8.4	9.6 (3.4-27.2)	8.6	89.6	70.9
Any alcohol	60.0	19.9	6.0 (2.5-15.1)	5.0	83.3	75.0

4.5. SUMMARY

The majority of patients presenting with injuries were young (mean age=26.3 years) and male (sex ratio=2.5:1). The leading causes of injury were assaults (38.6%), traffic crashes (19.9%), falls (17.2%) and burns (4%). Age-specific variation in injury distribution was demonstrated, with burns being more frequent in children aged under 5 years, falls in older children aged 5-14 years, and assaults and traffic-related injuries affecting mostly adolescents and young adults aged 20-34 years. Those aged 20-49 years were the most involved, accounted for 64.4% of all injury attendances. Traffic injuries (74.4%) and falls (77.9%) occurred mostly during day-time, while assaults were more common at night (53.7%) and weekends (51.5%). A greater proportion of passengers (56.1%) were involved compared to drivers (11.4%), pedestrians (17.7%, and cyclists (13.4%); and males were over-represented in each class of road user. Crashes involving public service vehicles resulted in almost half the total number of casualties from traffic, and affected 68% of all passengers, while cars and pick-ups affected mostly drivers (42.3%).

Nearly one-third (31.4%) of patients who attended hospitals as a result of injury had a detectable concentration of alcohol in the blood. Significantly greater proportions of alcohol positive victims were; male (34.1% versus 22.5% for females), aged over 30 years (37.8% versus 25.6% for under 30 years), had been assaulted (43%) or involved in motor-vehicle crashes (23.4%). Amongst traffic casualties, drivers were the most affected by alcohol (60%), all were male and had a greater elevation of blood alcohol levels (mean BAC=108 mg%) than other road users. A third of pedestrians, 16% of passengers and 8.3% of bicyclists were alcohol positive. Crashes occurring during night-time significantly involved intoxicated drivers in comparison to passengers ($OR=7.6$, $p<0.05$). The probability of detecting alcohol did not significantly vary by day of week, but was twice as likely at night ($OR=2.1$, $p<0.05$).

Breath tests provide reliable and valid estimates of blood alcohol concentrations. Both sensitivity and specificity of the breath test method increase considerably, to nearly 100%, at a cut-off BAC level of 50 mg%. The procedure is more acceptable to patients than taking blood samples.

By using alcohol prevalence data from a roadside survey for comparison, drinking drivers were found to be 6 times more likely to be involved in a crash, and a dose-response relationship was evident. An estimated 83% of all driver injuries were attributed to alcohol; 75% could have been avoided if drink-driving were eliminated, and 70% were potentially preventable by imposing a legal BAC limit of 50 mg%.

CHAPTER 5

THE BURDEN OF INJURY ON HOSPITAL SERVICES IN ELDORET

The purpose of this chapter is to examine the impact of injuries on selected aspects of hospital services, with particular reference to the relative importance of traffic injury. It starts by describing characteristics of injury-related attendances and admissions; then presents findings pertaining to hospital utilization, with respect to diagnostic and surgical interventions; and finally provides an analysis of associations of various demographic and injury variables with the length of hospital stay.

5.1. CHARACTERISTICS OF INJURY-RELATED ADMISSIONS

5.1.1. The Pattern of Injury Admissions

Of the total number of injury-affected casualties (2637), 93.3% presented at the Eldoret District Hospital, 4.5% at Uasin Gishu Memorial Hospital, 1.6% at Eldoret Nursing Home, and less than 1% at Pacifica Hospital. The bulk of injury-related workload was therefore borne by the government public hospital. Over three-quarters (76.1%) were treated as outpatients, with only 23.9% (630) being admitted as inpatients. Seven (1.1%) of the admissions died, while eight (1.3%) were transferred to other hospitals.

The leading types and causes of injuries that resulted in a hospital attendance or admission are shown in Tables 5.1- 5.4. Whereas assaults were the most frequent cause of out-patient attendance (38.7%) followed by traffic crashes (19.3%), the ranking order was the reverse for admissions. Traffic injury was the leading reason for admissions (39.2%), while assaults were second (25.5%). Approximately half (48.6%) of all traffic-involved attenders were treated as inpatients compared to 15.8% of assault victims, and 17.2% of those affected by falls. The odds of a casualty being admitted was five times greater for traffic- than for assault-related injury (OR=5.0; 95% CI, 3.9 to 6.5; χ^2=186.7, p<0.001); four and a half times as likely as fall injury (OR=4.5; 95% CI, 3.3 to 6.2; χ^2=105.4, p<0.001) and 5 times more likely than those who presented with injuries from *other* causes (OR=5.0; 95% CI, 3.7 to 6.7; χ^2=130.5, p<0.001). However, admission rates between traffic-involved casualties and those with burns (52.3.%) did not differ significantly (χ^2=0.5, p=0.5).

Table 5.1: Numbers and proportions of injury admissions by cause and rank

Cause	OPD Attendances		Admissions		
	Number & (%)	Rank	Number & (%)	Rank	Percent (95% CI)
Assaults	1020 **(38.7)**	1	161 (25.5)	2	15.8 (13.5-18.0)
Traffic	508 (19.3)	2	247 **(39.2)**	1	**48.6 (44.3-53.0)**
Falls	453 (17.1)	3	78 (12.4)	3	17.2 (13.7-20.7)
Fires/hot fluids	104 (3.9)	4	55 (8.7)	4	**52.3 (43.3-62.5)**
Dog bites	68 (2.6)	5	-	-	-
Poisonings	27 (1.0	6	25 (4.0)	5	92.5 (75.7-99.1)
Other causes	457 (17.3)	7	63 (10.0)	6	13.8 (10.6-16.9)
Total (n)	2637		630		23.9 (22.2-25.5)

Fall injuries ranked third amongst attendances and admissions (17.1% and 12.4%, respectively), while burns ranked 4th in each of the patient disposition categories (3.9% and 8.7%). Nearly all poisonings (92.6%) were admitted; in contrast, all cases with dog bite and snake bite wounds were treated as outpatients. Injuries sustained in *other* circumstances were of minor character, and only a small proportion (13.8%) required inpatient treatment, this represented 10% of the total number of injury admissions.

It is evident from this study sample that traffic crashes resulted in more frequent use of inpatient services relative to all other external causes of trauma.

5.1.2. Types of Injuries by Causal Mechanisms

The frequency distribution of the various types of injuries, based on clinical diagnoses, are presented in Tables 5.2-5.3. Cuts and lacerations (39.3%) and other soft tissue injuries, such as swellings and/or pain, and bruises that comprised the bulk of injury presentations resulted from assaults. Most of the severe types of injuries, such as fractures, dislocations and head injury (respectively accounted for 15.8%, 4.9% and 1.8% of casualties) were caused mainly by traffic crashes and falls.

Table 5.2 Frequency of attendances by type of injury and hospitalization status

Type of injury	Treatment status - number (%)		Row Total (%, 95% Confidence Interval) (N=2637)
	Outpatient (n=2008)	Inpatient (n=630)	
Cuts/ Lacerations	852 (42.3)	185 (29.4)	1037 (39.3, 37.5-41.2)
Fracture	279 (13.9)	137 (21.8)	416 (15.8, 14.4-17.2)
Swelling/ Pain	308 (15.3)	52 (8.3)	360 (13.7, 12.3-15.0)
Head injury	2 (0.1)	45 (7.2)	47 (1.8, 1.3-2.4)
Bruises	255 (12.7)	40 (6.4)	295 (11.2, 10.0-12.4)
Dislocation/Sprain	103 (5.2)	27 (4.5)	130 (4.9, 4.1-5.8)
Burns/ Scalds	51 (2.5)	54 (8.6)	105 (4.0, 3.2-4.8)
Stab wound	11 (0.5)	13 (2.0)	24 (0.9, 0.5-1.4)
Poisoning	2 (0.1)	25 (4.0)	27 (1.0,0.6-1.5)
Spinal injury	-	5 (0.8)	5 (0.2, 0.06-0.4)
Other	145 (7.2)	46 (7.3)	191 (7.2, 6.2-8.3)

Table 5.3 Numbers and frequency distribution of hospital attendances by type and cause of injury

Type of Injury	CAUSE OF INJURY										
	Traffic		Assault		Fall		Fire/ fluids		Other		All causes
	No. %	Row %	No. %	Row %	No. %	Row %	No. %	-	No. %	Row %	No. (%)
Cuts and lacerations	170 (33.5)	16.4	**530 (52.0)**	**51.1**	56 (12.4)	5.4	-	-	281 (50.7)	27.1	1037 (39.3)
Fractures	92 (18.1)	22.1	45 (4.4)	10.8	234 (51.9)	56.3	-	-	45 (8.1)	10.8	416 (15.8)
Swellings/ Pain	92 (18.1)	25.6	**196 (19.2)**	**54.4**	31 (6.9)	8.6	-	-	41 (7.4)	11.4	360 (13.7)
Bruises	104 (20.5)	35.3	**149 (14.6)**	**50.5**	27 (6.0)	9.2	-	-	15 (2.7)	5.1	295 (11.2)
Dislocation /pain	17 (3.3)	13.1	11 (1.1)	8.5	92 (20.4)	**70.7**	-	-	10 (1.8)	7.7	130 (4.9)
Burn/scalds / lightning*	-	-	-	-	-	-	**104 (100)**	99.0	1* (0.2)	1.0	105 (4.0)
Dog bite wounds	-	-	-	-	-	-	-	-	68 (12.3)	100	68 (2.6)
Head injury	26 (5.1)	**55.3**	15 (1.5)	31.9	5 (1.1)	10.6	-	-	1 (0.2)	2.1	47 (1.9)
Pricks, FB hands/feet	-	-	-	-	1 (0.2)	2.1	-	-	46 (8.3)	**97.9**	47 (1.9)
Human bites	-	-	40 (3.9)	**100**	-	-	-	-	-	-	40 (1.5)
Poisonings	-	-	-	-	-	-	-	-	28 (5.1)	100	28 (1.1)
Stab wounds	-	-	24 (2.4)	**100**	-	-	-	-	-	-	24 (0.9)
Snake bites	-	-	-	-	-	-	-	-	10 (1.8)	100	10 (0.4)
Nose bleeding	1 (0.2)	12.5	7 (0.7)	**87.5**	-	-	-	-	-	-	8 (0.3)
Spinal injury	-	-	1 (0.1)	20.0	4 (0.9)	**80.0**	-	-	-	-	5 (0.2)
Miscellaneous injuries	6 (1.2)	35.3	2 (0.2)	11.7	1 (0.2)	5.9	-	-	8 (1.4)	**47.1**	17 (0.6)
Total	508 (100%)	19.3	1020 (100%)	38.7	453 (100%)	17.1	104 3.9 (100%)		554 (100%)	21.0	2637 (100%)

As illustrated in Table 5.3, 56.3% of all fractures, 70.7% of dislocations or sprains, and 80% of spinal injuries resulted from falls (from height, into a ditch or on a level surface); and more than a half (55.3%) of the total number of head injuries were caused by traffic crashes. Nearly all burn injuries resulted from fires (house- and open cooking-fire) or boiling water, of which over a half (52.3%) required inpatient treatment.

Table 5.4: Numbers and frequency distribution of admissions by type and cause of injury

Type of injury	Cause of injury										
	Traffic		Assaults		Falls		Fires/hot fluids		Other		All causes
	No. (%)	Row %	No. (%)	Row %	No. (%)	Row %	No. %	Row %	No. (%)	Row %	No. (%)
Fractures	70 (29.2)	51.9	12 (8.1)	8.8	42 (57.5)	30.7	-	-	13 (17.1)	9.5	137 (21.8)
Cuts/ lacerations	68 (28.3)	36.8	91 (61.4)	49.2	5 (6.8)	2.7	-	-	21 (27.6)	13.4	185 (29.4)
Swellings/ pain	38 (15.8)	73.1	6 (4.1)	11.5	4 (5.5)	7.7	-	-	4 (5.3)	7.7	52 (8.3)
Head injury	24 (10.0)	53.3	15 (10.1)	33.3	5 (6.8)	11.1	-	-	1 (1.3)	2.2	45 (7.2)
Bruises	29 (12.1)	72.5	8 (5.4)	20.0	1 (1.4)	2.5	-	-	2 (2.6)	5.0	40 (6.4)
Dislocation / sprain	10 (4.2)	37.0	1 (0.7)	3.7	13 (17.8)	48.1	-	-	3 (3.9)	11.1	27 (4.5)
Burns/ scalds	-		-		-		54 100	98.1	1 (1.3)	1.9	55 (8.6)
Stab wounds	-		13 8.8	100.0	-		-	-	-	-	13 (2.0)
Poisoning	-	-	-	-	-	-	-	-	25 (34.2)	100.0	25 (4.0)
Other injuries	1 (0.4)	9.1	2 (1.4)	18.2	7 (4.1)	27.3	-	-	5 (6.6)	45.5	15 (2.0)
Total	247 100%	38.7	161 100%	25.6	78 100%	12.4	54 100%	8.7	89 100%	14.1	630 100%

Among admissions (Table 5.4), approximately one-third (29.4%) had cuts and lacerations, of which 61.4% were caused by assaults; over one fifth (21.8%) sustained fractures from crashes and falls (51.1% and 30.7%, respectively). Surprisingly, a large proportion (48.7%) of those admitted with soft tissue injuries (cuts, pain/ swellings, and bruises) were also traffic-related. Those with sprains and/ or dislocations represented less than 5% of admissions, most of which were sustained from falls and traffic (48% and 37%, respectively). With the exception of two, all patients diagnosed as having head injury were admitted, more than half (53.3%) resulted from traffic crashes.

5.2. DIAGNOSTIC AND SURGICAL WORKLOAD

5.2.1. X-Rays Services

Among the injury-related attenders, 30.5% underwent a diagnostic radiological investigation, all of which were plain X-ray procedures. The demand for an X-ray examination varied by cause of injury, being highest for fall-affected patients (47%), and least for those with injuries from *other* causes (9.7%). As shown in Table 5.5, 76.8% of all fall-affected patients had an X-ray; equivalent proportions for traffic-involved and assaulted victims were 40.7% and 11%, respectively, representing 28% and 15.3% of the total number that were X-rayed.

Table 5.5: Frequency of utilization of X-ray services by cause of injury

Injury cause	No. of cases	No. (%) x-rayed	% of cases, (95% CI)
Traffic	508	207 (28.0)	40.7 (36.5-45.0)
Assault	1020	113 (15.3)	11.0 (9.15-13.0)
Fall	453	348 (47.0)	76.8 (72.9-80.7)
Other	446	72 (9.7)	16.1 (21.7-32.3)
Total*	2427	740 (100)	30.5 (28.7-32.3)

* excluded burns (105), dogbites (68), snakebites (10), poisonings (27), drowning (1),strangulation (2)

Casualties with fall-related injuries were five-fold more likely to require an X-ray examination in comparison to those who sustained injuries from traffic (χ^2 =129.8, p<0.001). On the other hand, the demand for a diagnostic radiological examination by traffic-involved casualties was 5.5 times greater than for assaults (χ^2 =180.1, p<0.001); and 3.5 times greater than for those with injuries from miscellaneous causes (χ^2 = 69.0, p<0.001). Traffic crashes were the second most common mechanism causing injuries requiring high demand for and utilization of X-ray services at the hospitals.

5.2.3. Surgical Interventions

Analysis of injury data was done with respect to the range of surgical interventions that were undertaken by external cause of injury (Table 5.6). There was no indication for any surgical procedure in 596 patients (22.6%) who had no visible physical injuries. More than three-quarters of all casualties (77.4%) required a range of surgical interventions that varied from simple cleansing and dressing of superficial bruises to more invasive surgery, such as laparotomy, craniotomy and internal fixation. In cases with multiple injuries, where more than one unrelated procedures, such as skeletal traction and dressing, were undertaken, only the most invasive one was recorded for each patient. This may have underestimated the actual total number of procedures undertaken. Overall, a third (35.4%) of those who required any form of surgical procedure had been assaulted, whereas traffic and fall-affected patients comprised 17.5% and 19.6%, respectively. The type of surgical intervention undertaken varied considerably by mechanism causing the injury. Most assault-related injuries (90.5%) were cuts and lacerations which required only stitching and dressing, whereas a large proportion of fall injuries involved fractures of lower and upper limbs that needed skeletal reduction and immobilization. Of the 400 fall cases where a surgical intervention was indicated, more than three-quarters (78%) had either a closed or open reduction procedure. Nearly a half (48.9%) of patients managed conservatively by either skin or skeletal traction had lower limb fractures from falls.

While the majority of patients with traffic-related trauma needed stitching or surgical toilet and dressing (69.2%), about a quarter (23.8%) had fractures that required reduction and immobilization procedures, including the application of plaster casts. Almost a half (48.6%) of those who underwent a major surgery had sustained a serious injury from a motor vehicle crash or collision, indicating the relative magnitude of the demand placed on operating theatres by crash-related injuries.

Table 5.6: Numbers and proportions of surgical procedures by cause of injury

Surgical procedure	Cause of injury, number and proportions					Row total, % of Total
	Traffic	Assault	Fall	Burns	Other	
Closed reduction & POP	56 (16.4) 15.7	39 (11.4) 5.4	219(**64.0**) 54.8	-	28 (8.2) 6.0	342 (100) 16.8
Closed reduction& arm sling/crepe bandage	11 (10.3) 3.1	14 (13.1) 1.9	70 (**65.4**) 17.5	-	12 (11.2) 2.6	107 (100) 5.2
Closed reduction & skin/skeletal traction	18 (38.3) 5.0	3 (6.4) 0.4	23 (**48.9**) 5.8	-	3 (6.4) 0.6	47 (100) 2.3
Stitching and dressing, surgical toilet	139 (18.5) 38.9	393(**52.2**) 54.4	42 (5.6) 10.5	-	179 (23.8) 38.7	753 (100) 36.9
Dressing only	108 (14.9) 30.2	261(**35.9**) 36.1	40 (5.5) 10.0	97(13.3) 99.0	221 (30.4) 47.7	727 (100) 35.6
Major surgery*	18 (**48.6**) 5.0	9 (24.3) 1.2	5 (13.5) 1.3	1 (2.7) 1.0	4 (10.8) 0.9	37 (100) 1.8
Other† procedures	7 (25.0) 2.0	4 (14.3) 0.6	1 (3.6) 0.3	-	16 (**57.1**) 3.5	28 (100) 1.4
Column Total (%)	357 (17.5)	723(35.4)	400(19.6)	98 (4.8)	463 (22.7)	2041(100)

* surgery done under general anaesthesia in main operating theatres; included, surgical toilet/stitching (13), craniotomy (7), amputation (4), laparotomy (3), closed reduction (3), open reduction (2), internal fixation (1), thoracotomy (1), skin grafting (1), incision & drainage (1), exploration/bullet removal (1).

†comprised; FB exploration (14), application of cervical collar (3), nose packs (2), tooth extraction (2), physiotherapy (2), and orthopaedic bed nursing (5).

5.3. LENGTH OF HOSPITAL STAY

5.3.1. Effects of External Cause of Injury

As a measure of the extent of hospital utilization, the mean length of stay (LOS) and total bed-days were calculated. The overall mean length of stay was 9.4, ranged from 1 day to 118 days, with a median of 3 days. Evidence of cause-specific variation was demonstrated as illustrated in Table 5.7. For instance, fall-related trauma resulted in the longest average duration of stay (15.4 days); those with burns stayed for an average of 12.8 days; traffic-affected patients, 10.6 days; assaulted patients, 4.8 days; and *other* injuries 6.2 days. The mean hospitalization days for traffic, fall and burn injuries were significantly greater than values for assaults and *other* causes ($p<0.01$). The difference in the average length of stay between traffic-involved and assaulted patients was statistically significant (t-test, $F=36.8$, $p<0.001$), while no significant variation was detected between fall- and burn-affected patients ($p>0.05$). Of the total injury-related bed-days (n=5685), traffic-affected casualties accounted for the largest proportion (44%), followed by falls (21.1%), assaults (13%), and burns (12.5%); reflecting the magnitude of impact of traffic crashes on inpatient workload in relation to other types of injuries.

5.3.2. Effects of Demographic Characteristics

In order to examine the effects of demographic characteristics on the duration of hospitalization, casualties were stratified by sex and two age-group categories; as children aged 0-14 years, and adults aged 15 years and over (Table 5.7). Children accounted for 26.7% of the total injury-related hospital-days, of which falls and burns were responsible for over two-thirds, each contributing 33.4% and 35%, respectively: the least proportion was associated with assaults (0.6%).

Table 5.7: Mean length of stay (LOS) and bed-days by cause of injury, age group and sex

Category	Traffic	Assault	Falls	Burns	Other	All causes
Children (age 0-14 years):						
Mean LOS (n) Overall:	11.3 (20)	3.0 (3)	12.8 (39)	11.9 (44)	10.0 (24)	11.5 (130)
Sex: Male Female	 **14.5** (14) 3.3 (6)	 2.5 (2) 4.0 (1)	 13.6 (30) 10.0 (9)	 9.4 (25) **15.1** (19)	 9.7 (16) 10.6 (8)	 11.6 (87 11.3 (43)
Total bed days: (Row %)	226 (15.1%)	9 (0.6%)	499 (33.4%)	524 (35.5%)	240 (16.0%)	1496 (100%)
Adolescents and adults (age ≥15 years):						
Mean LOS (n) Overall:	10.5 (217)	4.8 (152)	18.1 (39)	16.8 (11)	4.7 (60)	8.7 (479)
Sex: Male Female	 11.1 (167) 8.5 (50)	 4.9 (118 4.4 (34)	 12.8 (23) **25.6** (16)	 **16.3** (7) 17.7 (4)	 5.0 (48) 3.6 (12)	 8.5 (363) 9.4 (116)
Total bed days (Row %)	2279 (54.4%)	733 (17.5%)	706 (16.8%)	185 (4.4%)	286 (6.8%)	4189 (100%)
All ages:						
Mean LOS- days Total bed-days (Row %)	10.6 2505 (44.1%)	4.8 742 (13%)	15.4 1205 (21.2%)	12.8 709 (12.5%)	6.2 526 (9.3%)	9.4 5685 (100%)

Although children affected by falls on average were hospitalized for a much longer period (12.8 days), no significant differences were found in comparison to those with burn, traffic and other injuries (11.9, 11.3 and 10 days, respectively; t-test, p>0.05). Only 3 assaulted children were admitted for an average duration of 3 days. No overall gender differences in the length of hospitalization were found (11.6 days for boys versus 11.3 for girls), however, boys who had sustained injuries in road traffic crashes or collisions and girls affected by burns had the highest average lengths of stay (14.5 days and 15.1 days, respectively). This can possibly be explained by differentials in exposure to potentially unsafe circumstances and environment; boys are likely to be knocked by a vehicle while riding a bicycle, or while playing on or by the roadside; whereas young girls often get exposed to open cooking fires or charcoal stoves, it is not uncommon to find girls of this age-group employed as housemaids. However, data relating to exact circumstances and location of injury event were not collected in this study.

Adolescents and adults accounted for nearly three-quarters (73.7%) of injury-related bed-days, mostly from traffic trauma (54.4%), while only 4.4% was attributed to burns. Fall fractures resulted in the greatest mean length of hospitalization (18.1 days), followed by burn (16.8 days), and traffic injuries (10.5 days), but the differences were not statistically significant. When compared to those with injuries from assaults (4.8 days) and *other* causes (4.7 days), the mean duration of hospitalization was significantly greater for fall-, traffic- and burn-affected patients (t-test, $p<0.001$). Gender differences in hospitalization rates were more evident among fall admissions. Women with fractures on average stayed longer than men (25.6 days versus 12.8 days), while no differences were observed for those admitted with other injuries.

5.3.3. Effects of Hospitals

An assessment of the possible influence of admitting hospitals on the average duration of stay revealed marked differences both by hospital and injury mechanism. As shown in Table 5.8, the overall mean length of stay was considerably greater at the Eldoret Nursing Home (ENH) than in the other hospitals combined ($F=3.9$, $p<0.05$). The differences between mean LOS at ENH and at Eldoret District Hospital (EDH), and Uasin Gishu Hospital (UGH) were also found to be statistically significant ($F=8.2$, $p<0.05$ and $F=8.5$, $p<0.05$, respectively); while no difference was detected between admissions at ENH and Pacifica Hospital (PH), ($F=2.3$, $p=0.13$). Cause-specific variations across the admitting hospitals were also evident. Traffic-involved patients showed the greatest variation, as their mean LOS, ranged from 8.7 days at EDH to 24.2 days at ENH (t-test, $p<0.001$). Assaulted victims admitted at PH were detained for significantly more days (13.5) when compared to similar admissions to other hospitals ($p<0.05$). Similarly, fall-trauma admissions tended to stay, on average, for a considerably longer duration at the EDH than in all the other hospitals (16.8 days versus 3, 9, and 5 days, respectively), ($p<0.001$). The majority (90.9%) of burn cases sought admission at EDH with a mean LOS of 12 days, while at the UGH they stayed much longer (22 days). Less variation was observed with respect to patients with injuries from *other* causes, although those admitted at the ENH still tended to stay longer (8.6 days versus 6 days at EDH, 5.3 days at UGH and 2.3 days at PH).

These variations may be explained by differences in admission and discharge policies at each of the hospitals, the nature and severity of injuries, and perhaps selective admission of more severely injured patients to particular hospitals. Higher stays at private hospitals may also reflect knowledge by the hospital administrators that the bills would be paid through the insurance or company.

Table 5.8: Distribution of mean lengths of stay by cause of injury and admitting hospital

Cause	Hospital, mean LOS in days and number of admissions (n)			
	Eldoret District	Uasin Gishu	Eldoret NH	Pacifica
Traffic	8.7 (149)	8.8 (58)	**24.2** (25)	16.0 (7)
Assault	4.7 (135)	3.6 (14)	3.5 (2)	**13.5** (4)
Fall	**16.8** (69)	3.0 (4)	9.0 (3)	5.0 (2)
Burn	12.0 (50)	**22.0** (5)	-	-
Other	6.0 (61)	5.3 (10)	**8.6** (11)	2.3 (3)
Overall	8.7 (464)	8.1 (91)	17.9 (41)	11.4 (16)

5.3.4. Variation in mean Length of Stay by Type of Road-user

A separate analysis of the distribution of the mean lengths of stay of traffic-affected patients, on the basis of road-user category (presented in Table 5.9), showed that drivers stayed for slightly longer days (13.1 days) than passengers (10.1 days), pedestrians (10.7 days), and cyclists (10.9 days). A higher proportion of drivers (37%) stayed for 7 days or more when compared to other types of road-users (pedestrians 32.6%, passengers 30.3% and cyclists 22.2%), although the differences were not statistically significant.

Table 5.9: Traffic injury admissions: distribution of length of stay by type of road-user

LOS	Driver (%)	Passenger (%)	Pedestrian (%)	Cyclist (%)	Overall (%)
1-2 days	13 (48.1)	78 (54.9)	24 (52.2)	9 (50.0)	125 (52.7)
3-6 days	4 (14.8)	21 (14.8)	7 (15.2)	5 (27.8)	39 (16.5)
7 or more days	10 (37.0)	43 (30.3)	15 (32.6)	4 (22.2)	73 (30.8)
Mean LOS (days)	13.1	10.1	10.7	10.9	10.5

5.4 SEVERITY OF INJURY

Injury Severity Score (ISS), as a measure of the severity of an injury, was recorded for all patients presenting with traffic, assault, fall and those due to other external causes (excluding burns, poisonings and asphyxiation). The ISS grades were categorized as: 0-3, minor; 4-8, moderate; 9-15, serious; and 16 and over severe. Because of small numbers of subjects in some ISS categories, regrouping was done into two groups of; ISS 0-8, and ISS equal to 9 or greater, where appropriate, to allow for statistical analyses of proportions by cause of injury and hospital of admission.

5.4.1. Variation in Injury Severity by External Cause

Injury Severity Scores ranged from 1 to 27. The overall mean ISS was 2.5, with a median of 2.0. The majority of patients sustained a minor (76.6%) or moderate (17.8%) level of injury; and as illustrated in Table 5.10, the frequency distribution by ISS varied by injury mechanism. Approximately a half (49%) of all minor injuries (ISS, 0-3) were assault-related, 56.7% of those who sustained moderate injuries were from falls, and nearly three-quarters (73.9%) of all injuries classified as severe or critical resulted from traffic crashes: all the seven inpatient deaths were traffic-related. When the percentage of casualties with ISS of less than 9 was compared to those having ISS of 9 or greater, by type of injury, traffic-affected patients were found to be significantly over-represented among the severely injured group. They were 8 times as likely to have sustained serious and severe injuries as assaulted victims (OR=8.1; 95% CI, 4.4 to 15.2; χ^2=67.8, p<0.001); and nearly 4 times as injuries from miscellaneous causes (OR=3.8; 95% CI, 2.1 to 7.1; χ^2=24.3, p<0.001). No differences in ISS rates between traffic-involved and fall-affected patients were detected (χ^2=0.19, p=0.6).

Table 5.10: Distribution of casualties by Injury Severity Score (ISS) and cause of injury*

ISS	Traffic		Assault		Fall		Other		Total
	No. (%)	Row %	No. (%)	Row %	No. (%)	Row %	No. (%)	Row %	No. (%)
0-3 (Minor)	375 **(73.8)**	19.6	936 **(91.7)**	49.0	146 (32.3)	7.6	462 **(86.9)**	24.3	1919 (76.6)
4-8 (Moderate)	78 (15.4)	17.5	69 (6.8)	15.5	253 **(56.7)**	56.7	46 (8.7)	10.3	446 (17.8)
9-15 (Serious)	38 (7.4)	32.8	12 (1.2)	10.3	51 (11.2)	44.0	15 (2.8)	12.9	116 (4.6)
≥ 16 (severe / critical)	17 (3.3)	73.9	3 (0.3)	13.0	2 (0.4)	8.7	1 (0.2)	4.3	23 (0.9)
Total	508 (100)		1020 (100)		452 (100)		528 (100)		2504 (100)

* ISS assessment excluded burns (105), poisonings (28) and drowning (1) cases.

Among the traffic-affected casualties, a greater proportion of pedestrians had moderate injuries when compared to other road-users (25.5% versus 13.8% of drivers, 12.6% of passengers and 10.3% of cyclists). However, the mean ISS of the various types of road-users was found not to differ significantly (3.0 for drivers, 3.3 for passengers, 3.5 for pedestrians, and 3.2 for cyclists).

Analysis of mean ISS by patient disposition demonstrated significant overall differences between outpatients and inpatients. The mean ISS for admitted casualties was significantly higher (ISS=4.3) than for those treated on an outpatient basis (ISS=2.0; F=401.7, $p<0.0001$). Cause-specific mean injury severity scores between in- and outpatients also differed significantly across all mechanisms of injury ($p<0.001$), being much greater between traffic-involved casualties (Table 5.11). The type of injury sustained and surgical intervention undertaken may partially explain the observed differences. For example, many patients with multiple lacerations, compound fractures or internal injuries sustained from traffic crashes required inpatient treatment, whereas those with dislocations and uncomplicated upper and lower limb fractures from falls were managed as outpatients. Among traffic-involved admissions, the injury severity scores for pedestrians and cyclists were marginally greater (mean ISS = 5.1 and 5.2, respectively) than for drivers and passengers (mean ISS=4.6 and 4.8), although these differences were not statistically significant at 0.05 level (t-test).

Table 5.11: Mean ISS by cause and hospital status

Cause	OP	IP	All cases
Traffic	1.8	4.9	3.3
Assault	1.7	3.0	1.9
Fall	3.4	5.6	3.8
Other	1.3	3.7	1.6
Overall	2.0	4.3	2.5

Whereas no significant differences in admission rates by ISS levels were found between the hospitals (χ^2=0.1, p=0.8), on average, inpatients at ENH had a higher mean ISS (4.9) when compared to those at the other hospitals (EDH, 3.4; UGH, 3.5 and PH, 3.6); however, the numbers of patients receiving treatment at ENH and PH were relatively small (Table 5.12).

5.4.2. Relationship between ISS and Length of Stay

As assessment of the relationship between ISS scores and the mean length of stay in hospitals showed that patients with high ISS levels (ISS ≥9) were hospitalized for significantly longer periods than those with less severe injuries (mean LOS=27.1 days versus 5.3 days; F= 138.4, p<0.001); this relationship was consistent across all categories of injuries. However, when analysed with respect to each participating hospital, the t-test results showed highly significant differences between the two ISS groups (p<0.001); particularly among admissions at EDH (26.5 days for ISS>9 versus 5.6 days for ISS<9), UGH (23.4 versus 3.7 days) and PH (33.3 versus 6.7 days), while no difference was demonstrated at the ENH (29.4 versus 15.5 days; F=2.9, p=0.14). As shown in Table 5.13, there was a tendency to detain even patients with less severe injuries for much longer days at ENH than in the other hospitals. Being a private hospital, it is apparent that there could have been a financial motive for keeping patients longer so as to raise more funds from the daily bed charges.

Table 5.12: Distribution of number (%) of admissions by ISS level and hospital

ISS	EDH	UGH	ENH	PH	Total
1-3	219 (53.7)	50 (61.7)	23 (57.5)	7 (46.7)	299 (55.0)
4-8	110 (27.0)	15 (18.5)	9 (22.5)	5 (33.3)	139 (25.6)
9-15	65 (15.9)	13 (16.0)	4 (10.0)	3 (20.0)	85 (15.6)
16+	14 (3.4)	3 (3.7)	4 (10.0)	-	21 (3.9)
Total	408	81	40	15	544 (100)
Mean ISS	3.4	3.5	4.9	3.6	3.5

Table 5.13: Mean length of stay by ISS level and hospital

ISS category	Admitting Hospital and mean LOS in days				
	EDH	UGH	ENH	PH	Overall
1-3	4.8 (219)	4.5 (50)	7.3 (23)	6.2 (7)	3.5 (299)
4-8	7.1 (110)	6.4 (15)	36.0 (9)	6.6 (5)	8.9 (139)
9-15	28.8 (65)	20.6 (13)	18.0 (4)	33.3 (3)	27.1 (85)
16+	10.1 (14)	35.3 (3)	40.7 (4)	-	22.5 (21)
Overall	8.7 (408)	8.1 (81)	17.9 (40)	11.4 (15)	9.3 (544)

5.4.3. Relationships Between Injury Severity, Length of Stay and Alcohol

A comparison of mean ISS values between BAC positive and BAC negative patients was done using results of breath tests and blood analysis (Table 5.14). Overall, when breathalyser readings were applied, no differences were detected between the mean ISS for the BAC positive (mean ISS=1.8) and BAC negative (mean ISS=1.7) groups (F=1.05, p=0.3). Surprisingly, the results of serum blood analysis showed significantly higher mean scores of injury severity among the BAC negative group (ISS=3.2 versus 1.8 for BAC positives; p<0.001). Higher mean ISS were also evident among the BAC negative admissions (who provided blood samples) than in those with a positive test (ISS=4.4 vs 2.9; p=0.06); this was consistent across all types of injuries, although not statistically significant . On the contrary, among inpatients breathalysed, the mean ISS of BAC positive subjects was greater than in those negative (ISS=3.2 versus 2.5; p=0.09). In particular, of breathalysed traffic-involved and assaulted patients, those testing positive had slightly elevated mean ISS values in comparison to those with a negative breath test (ISS=4.4 versus 3.0 for traffic, and 2.6 versus 1.7 for assaults; p=0.06 and p=0.03, respectively), suggestive that alcohol consumption predisposes road-users and assaulted subjects to sustaining severe forms of injuries in comparison to sober individuals (if breath tests are used to measure blood alcohol). No differences were found among breathalysed fall cases (only two participated).

Table 5.14: Comparison of mean lengths of stay, mean BACs (mg%) and ISS values by cause of injury and blood alcohol test results, by method of measurement

Cause of injury	Mean LOS in days (n)				Mean ISS (n)		
	BAC +ve	Mean BAC	BAC -ve	t-test*, p value	BAC +ve	BAC -ve	t-test*, p-value
A: Blood test							
All cases tested	*N/A*	-	*N/A*	-	*1.8(111)*	*3.2 (164)*	*p<0.001*
Admissions:							
Overall	*6.3 (40)*	*191*	*9.8 (56)*	*p=0.36*	*2.9 (47)*	*4 4 (60)*	*p=0.06*
Traffic	**13.0**(13)	192	5.6 (37)	p=0.1	3.8 (16)	4.4 (39)	p=0.7
Assault	3.0 (22)	190	6.4 (15)	p=0.06	2.6 (24)	3.2 (17)	p=0.5
Fall	4.0 (1)	158	72.3 (3)	-	4.0 (1)	9.0 (3)	-
Other	3.2 (4)	193	29.0 (1)	-	1.0 (6)	9.0 (1)	-
B: Breath test							
All cases tested	*N/A*	-	*N/A*	-	*1.8 (244)*	*1.7 (534)*	*p=0.3*
Admissions:							
Overall	*9.2 (47)*	*99*	*5.0 (81)*	*p=0.17*	*3.2 (52)*	*2.5 (90)*	*p=0.09*
Traffic	**16.8**(15)	70	5.3 (38)	p=0.07	4.4 (16)	3.0 (41)	p=0.06
Assault	2.9 (27)	108	2.9 (28)	p=0.9	2.6 (29)	1.7 (34)	p=0.03
Fall	49.5 (2)	135	67.0 (1)		9.0 (1)	9.0 (1)	-
Other	1.7 (3)	125	3.7 (14)		1.0 (5)	2.4 (14)	-

* difference between BAC+ve and BAC -ve groups

The mean length of stay in the overall sample who provided breath or blood alcohol tests were not significantly different, between test positive and test negative groups. However the two measurement procedures revealed variable results by injury mechanism. Of admissions with a positive blood test, traffic-affected casualties were on average hospitalized for a greater number of days compared to other types of injuries (13 days versus 3 days for assault, 4 days for fall and 3.2 days for *other* causes). It was also evident that BAC positive traffic-involved casualties stayed longer than those negative (13 days vs 5.6 days), whereas for assault, fall and *other* injuries, sober subjects stayed longer than those who had been drinking (Table 5.14). The duration of hospital stay also varied by type of road user, with BAC positive passengers on average remaining in hospital for longer days (15.8 days).

Breath test results showed some elevation of the mean LOS in BAC positive subjects in the total sample evaluated (9.2 days vs.5 days for BAC negatives), though not to a significant level ($p>0.05$). Of those who tested positive, traffic-involved patients stayed longer than assaults (16.8 days vs 2.9 days): and among admitted traffic casualties tested, BAC positive subjects were on average hospitalized for more days than those negative (mean LOS=16.8 days vs. 5.3 days, $p=0.07$), while no differences in LOS by alcohol consumption status were detected among assaulted patients (2.9 days in each group). Sober patients with fall and *other* injuries tended to stay longer than those with a positive breath test, but since only a small number were breathalysed, it was not possible to perform a statistical evaluation of the differences.

The two alcohol evaluation procedures provide consistent evidence of increased length of hospitalization in traffic-involved patients affected by alcohol, while the opposite effect is apparent for assault- and fall-related injuries. However, the effect of alcohol on severity of injury is less clear.

Scatter plots of ISS and LOS of all adult admissions (age≥16 years) done to examine the relationships showed a positive linear correlation ($r^2=0.23$). The proportion of the variability accounted for by ISS was found to decline (to $r^2=0.10$ and $r^2=0.14$, respectively) when only subjects with a positive BAC, obtained by either a breath test or blood analysis, were plotted (Figures 5.1-5.3).

Figure 5.1: Relationship between ISS and LOS in adult injury-related admissions

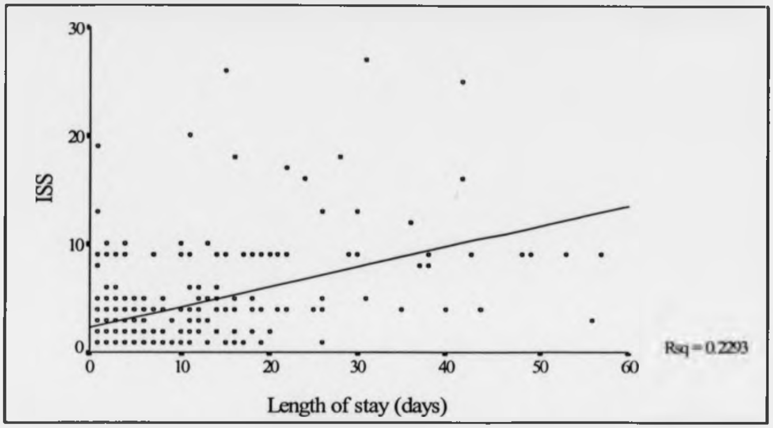


Figure 5.2: Relationship between ISS and LOS in breath BAC positive inpatients

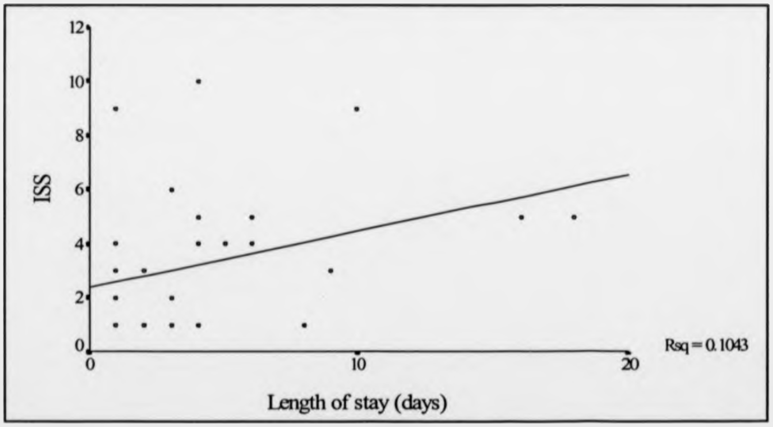
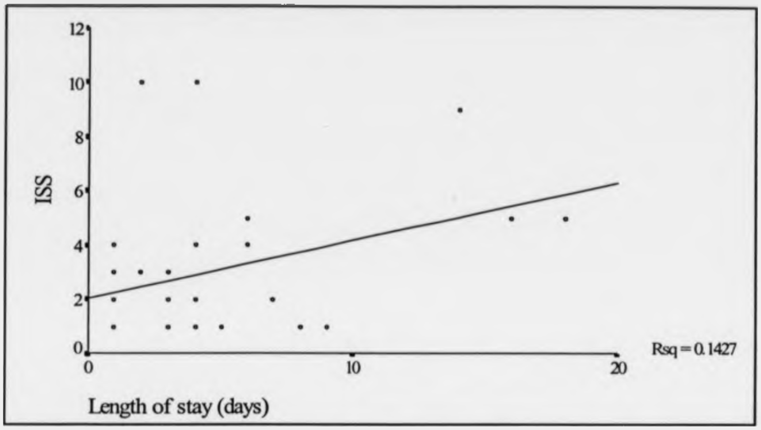


Figure 5.3: Relationship between ISS and LOS in blood alcohol test positive inpatients



The above findings suggest that alcohol in combination with other factors may be exerting some influence on both injury severity and the duration of hospitalization. Linear regression analyses were therefore performed to examine the effect of a number of possible explanatory variables. Using length of stay as the dependent variable, the following independent variables were entered into the regression model: age, sex, cause of injury, ISS, breath (BAC breath) and venous blood (BAC blood) test results. Three sets of analyses were done in sequence. In the first entry, alcohol measurements were not included in the equation so as to allow for assessment of demographic variables in adult injury admissions (excluding burns, drowning and poisoning cases). A strong positive correlation between the level of injury severity and the mean length of stay was demonstrated ($p<0.001$): for each rise in ISS score, the LOS increased by 2.8 days[16]. As summarised in Table 5.15, the effects of age, sex and injury mechanism on the length of stay were not statistically significant ($p>0.05$).

Table 5.15: Matrix of multiple regression analysis (Enter Method): Correlations of mean length of stay, as a dependent variable with ISS, demographic and cause of injury (all adult admissions).

Independent variable	Regression Coefficient (β)	S.E of β	95% Confidence Interval	p-value
Age	0.064	0.037	-0.008, 0.137	0.083
Sex	-0.789	1.052	-2.858, 1.279	0.453
Cause of injury	0.378	0.737	-1.070, 1.827	0.608
ISS	1.120	0.120	0.883, 1.358	0.000
(Constant)	1.752	1.829	-1.844, 5.348	0.338

In the second and third regression models, blood and breath test positive cases were included separately. ISS still emerged in both analyses as the most significant factor, reaffirming injury severity as the main determinant of the duration of time a patient remained hospitalized. The effect of the presence of blood alcohol (measured by analysis of blood samples or breathalyser) on the length of hospitalization was not significant in either instances ($p=0.12$ and $p=0.23$, respectively), but appeared to be in the opposite direction (β=-0.006 and β=-0.01). Thus, the strength of the negative correlation between the presence of alcohol and the LOS varied by method of alcohol measurement. Nevertheless, the increase in LOS for a unit rise in ISS in patients with a positive blood test was slightly greater than in those breathalysed (2.2 days and 1.8 days, respectively). This may have arisen because more seriously injured inpatients were less likely to be breathalysed, and the difficulty in obtaining timely blood samples in those critically injured (several hours may have elapsed before taking blood from patients with severe injuries as treatment procedures were given

[16]Computed by the regression equation: $y = a + bx$; where y=dependent variable (LOS), a= constant (β value), b=β coefficient for the independent variable (ISS), x= unit increase in ISS.

priority) meant that actual BAC readings for such patients were likely to be lower than had the samples been obtained immediately on arrival.

From these results, it is apparent that blood samples would be more appropriate for evaluating associations between alcohol consumption, injury severity and bed-occupancy, if promptly obtained from all adult trauma admissions.

The effect of alcohol by level of intoxication on LOS for those who tested positive was assessed by logistic regression techniques (Backward elimination procedure) using categorical values of the factors examined, with LOS as the dependent variable. The two levels of variables (0,1, respectively) used in the model were: LOS (1-6 days, ≥ 7 days), BAC results (≥50 mg%, 5-49 mg%), age (≥30 years, 16-29 years), sex (male, female), ISS (≥ 9, 1-8) and hospitals (EDH, other); whereas causes of injury were in 4 categories (traffic, 0; fall, 1; assault, 2; other, 3). The results at the final elimination step of the regression process are summarized in Table 5.16. Significantly greater length of hospital stay was found in adult inpatients (presenting within an interval of 10 hours) with ISS equal to or over a score of 9 (OR=2.79, 95% CI, 1.96 to 3.96); approximately 12% of the duration of hospital stay could be explained by the severity of injury. In addition, there was some evidence that admissions at the Eldoret district hospital stayed fewer days than those in private hospitals (OR=0.65, 95% CI, 0.49 to 0.86), as the sign of the regression coefficient is negative (β= -0.430). However, when only BAC positive inpatients (by either breath or blood test) were included in the equation, the effects of ISS and Hospital were less striking and inconsistent. The influence of ISS was still significant where subjects with positive breath tests were included (β=1.228, $p<0.001$), whereas the type of hospital seemed to have a greater influence on the length of stay of intoxicated subjects whose BAC levels were determined by blood analysis (β=-1.194, p=0.02). This is likely to be attributed to differences in levels of severity of injury among patients who consented to alcohol evaluation (by either breath or blood test) in the different types of hospitals, and their intoxication status. No demonstrable effect of the level of intoxication on the duration of hospital stay by patients objectively evaluated by either of the methods was found. The effects of age, gender and external cause of injury were also not significant.

These findings further confirm that ISS is the best predictor of the length of hospital stay among the variables included in this study. The type of hospital providing medical care also has a significant influence on the duration of stay: adult patients admitted in private hospitals stayed longer than those at the public district hospital.

Table 5.16: Logistic regression results*: Analysis of the effect of demographic characteristics, injury mechanism, ISS and hospital of admission on the length of stay (Backward Stepwise Method).

Category of patients and Variable	β coefficient	S.E. of β	p-value	Odds Ratio (95% CI)	R^2
Adolescents and adults age ≥ 16 years: (n=327)					
ISS	1.027	0.179	0.00	2.79 (1.96-3.96)	0.12
Hospital	-0.430	0.143	0.02	0.65 (0.49-0.86)	
(Constant	-0.220	0.184	0.23)		
Breath test positives: (N=48)					
ISS	1.228	0.464	0.00	3.4 (1.37-8.44)	0.16
(Constant	-0.940	0.464	0.04)		
Blood test positives: (N=40)					
Hospital	-1.193	0.528	0.02	0.3 (0.11-0.84)	0.14
(Constant	-0.787	0.528	0.13)		

* only variables with significant regression coefficients at the final step of the elimination process are shown

5.5 SUMMARY

Assaults were the most frequent cause of injury-related outpatient attendances, whereas road traffic crashes were the leading cause of admissions, with assaults ranking second (39.3% and 25.6%, respectively). Traffic crashes and collisions resulted in most severe forms of injuries (more than half of head injuries and 22% of fractures), multiple soft tissue injuries such as bruises (35.3%), internal pains and swellings (25.6%), cuts and lacerations (16.4%) requiring hospitalization. Nearly half (48.6%) of all major trauma surgery were due to RTAs, whereas 90% of assaulted victims needed only stitching and dressing, and 78% of falls (fractures and dislocations) were conservatively treated by closed reduction procedures. The use of X-ray services by traffic-affected patients was 5.5 times greater than assaults ($\chi^2 = 180.1$, $p<0.001$), exceeded only by falls.

The overall mean length of hospital stay (LOS) was 9.4 days. On average, fall-affected patients stayed longer (15.4 days) than those with burns (12.8 days), traffic- (10.6 days) and assault-related trauma (4.8 days). The largest proportion of the total injury-related bed-days was attributed to traffic-involved casualties (44%); those with falls (21.1%), assaults (13%), and burns (12.5%) exerted relatively less impact on the overall bed occupancy. Children under the age of 15 years contributed 26.7% of the total bed-days, mostly due to burns (33.4%) and falls (35%), whereas among adults, more than half (55%) of hospitalization days were attributed to road traffic injuries. No differences in the mean LOS by type of road-user were demonstrated, although drivers stayed slightly longer (13.1 days versus 10.9 days for cyclists, 10.7 days for pedestrians, and 10.1 days for passengers).

A significantly greater proportion of traffic-affected patients sustained severe injuries (ISS>9) than assaults ($\chi^2=67.8$, $p<0.001$), the majority of whom were pedestrians (25.5%), with higher mean ISS (3.5) than other road-users (passengers, 3.3; cyclists, 3.2; and drivers, 3.0), though not statistically significant. ISS was found to be the principal determinant of the length of time a patient remained hospitalized; private profit motivated-hospitals were also likely to retain patients for more days than the public hospital. The effect of alcohol on the mean LOS was found to be marginally negative in the overall sample, but varied by injury mechanism. BAC +ve traffic-involved casualties stayed longer than those negative (13 days vs 5.6 days); on the contrary, sober fall and assault victims stayed longer than those who had been drinking (72.3 vs. 3 days and 6.4 vs. 4 days, respectively).

These findings reflect the potentiating effects of alcohol on the occurrence and severity of road traffic trauma, and the subsequent increased demand on hospital services, relative to other injury mechanisms. Blood tests, on samples timely obtained in all casualties, would provide more accurate BAC data for assessing the effects of alcohol on injury severity and the duration of hospitalization.

CHAPTER 6

THE PREVALENCE OF DRINKING AND DRIVING IN THE GENERAL DRIVING POPULATION IN ELDORET

The results presented in this chapter are from a roadside alcohol prevalence survey of drivers. It has two sections. The first section describes characteristics of the driving population sampled, and in the second, a detailed analysis of blood alcohol prevalence is given. A short summary concludes the chapter.

6.1. CHARACTERISTICS OF DRIVERS

6.1.1. Demographic Profile

a) Age and sex:

A total of 479 drivers were sampled from the general driving population (see Chapter 3, section 3.2.3.1 b), of which 471 (98.3%) were male and only 8 (1.7%) were female, with a sex ratio of 57.8:1. Their ages ranged from 19 years to 65 years, with a mean of 36.3 and a median of 35 years. As presented in Table 6.1, the largest proportion comprised those between the ages of 30 and 39 years (44.6%), and only one driver was aged under 20 years. The mean age of male drivers was 36.2 years; seven others declined to disclose their age. Female drivers were on average slightly older; all were aged between 25 and 54 years with a mean age of 37.1 years. Nevertheless, there were no significant differences in age by gender ($F=0.07$, $p=0.8$).

Table 6.1: Distribution of drivers by age and sex

Age group (years)	Male	Female	Total (%)
16-19	1	-	1 (0.2)
20-24	27	-	27 (5.6)
25-29	71	1	72 (15.0)
30-34	105	2	107(22.3)
35-39	104	3	107(22.3)
40-44	70	-	70 (14.6)
45-49	42	1	43 (9.0)
50-54	32	1	33 (6.9)
55+	12	-	12 (2.5)
Unknown	7	-	12 (1.5)
Total	471 (98.3)	8 (1.7)	479(100)
Mean age (years); Std. dev.	36.3; 8.5	37.1; 7.8	(F=0.07, p>0.05)*
Mode	35.0	35.0	
Range (years)	19-65	25-54	

* no significant differences between mean ages

b) Occupation:

Information about occupation was obtained from 471 respondents. 44.2% were classified as professional drivers, including operators of buses, lorries, trucks, *matatus* and taxis (Table 6.2). The rest (55.8%), driving personal vehicles were grouped as private motorists: although they belonged to diverse occupational categories, the majority being highly educated career professionals, businessmen and managers. Eight motorists refused to state their actual occupation.

Table 6. 2: Distribution of drivers by their occupation

Occupation	No. (N=471*)	%
Driver-professional	208	44.2
Business	81	17.2
Farmer	33	7.0
Mechanic/technician	25	5.3
Manager	15	3.2
Salesman	15	3.2
Engineer/electrician	15	3.2
Accountant/auditor	11	2.3
Civil Servant	10	2.1
Architect/contractor	8	1.7
Lecturer/researcher	8	1.7
Teacher	7	1.5
Bank personnel	6	1.3
Church /priest	5	1.1
Doctor	4	0.8
Student	4	0.8
Foreman	4	0.8
Lawyer	2	0.4
Pharmacist	2	0.4
Surveyor/valuer	2	0.4
Vet surgeon	2	0.4
Housewife	2	0.4
Economist	1	0.2
Secretary	1	0.2

*excludes 8 refusals

6.2. ALCOHOL PREVALENCE

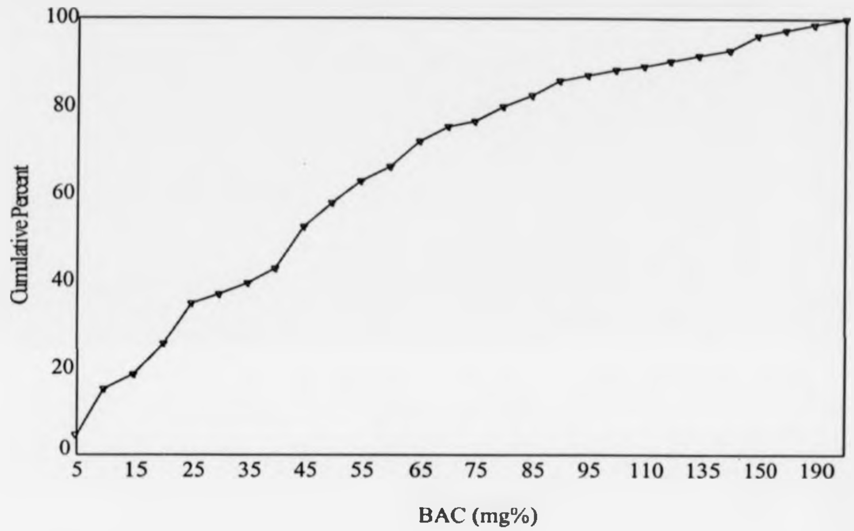
6.2.1. Breath test Response Rate

A vast majority of drivers (90.4%) approached co-operated readily and no obvious hostility to the survey was experienced. Less than 10% (46) refused to provide a breath sample; all were men, most of whom gave no reasons. Five bus drivers cited the inconvenience to passengers as their main reason, four drivers said they were in a hurry, and three priests declined on "religious grounds". Two motorists admitted to have been drinking but they did not want such evidence to be recorded; nine motorists, including five taxi drivers, who had been sampled previously, declined to be breath tested on subsequent occasions. This low refusal rate reflects the potential for acceptance of the procedure if adopted as a drink-driving countermeasure. Subjects who tested positive but not obviously impaired were told so, but those with very high BACs (>100 mg%) were cautioned of the possible consequences of driving while impaired. Only one severely intoxicated driver who registered a BAC of 285 mg% was detained by the police. Blood alcohol readings from this survey were not used as evidence in court for drink-related traffic cases.

6.2.2. Alcohol Prevalence and the Distribution of BACs

A positive blood alcohol test (BAC equal to or above 5 mg%) was obtained in 19.9% (SD 3.7; 95% CI, 16.1 to 23.6); 8.4% had blood alcohol concentrations greater than 50 mg%, and 4% exceeded 80 mg%. BACs ranged from 5 mg% to 285 mg%, with a mean value of 56 mg% and a median of 45 mg%. Of those who tested positive, 41.8% had BACs above 50 mg% and 19.8% exceeded 80 mg%. The cumulative distribution of drivers with a positive breath test is illustrated in Figure 6.1. This curve, in a sense, represents an estimate of the potential percent reduction in drink-driving that would occur if drivers with BACs of a specified amount or more were prevented from driving: over 40% of drinking drivers had a blood alcohol level exceeding 50 mg%.

Figure 6. 1. Cumulative percentage of alcohol prevalence (BAC +ve drivers)



A subjective assessment of signs of alcohol made on all subjects (on the basis of smell of alcohol in breath and/or slurred speech) revealed that a greater proportion of non-responders (30.4%) appeared to have been drinking when compared to those who were breathalysed (20.2%), however, these rates were not significantly different (χ^2 =2.67, p=0.1). This suggests that the levels identified by this survey are likely to be underestimates.

6.2.3. Demographic Characteristics of Drinking Drivers

a) Sex:

Nearly all drivers (98.8%) who had been drinking were male. As shown in Tables 6.3 and 6.4, 20% (95% CI, 16.2 to 23.8) of the men tested positive, and their blood alcohol levels ranged from 5 mg% to 285 mg%, with a mean BAC of 56.2 mg% and median of 45 mg%. All drinkers with BACs in excess of 50 mg% were male, whereas the only female who tested positive had a BAC of 50 mg%. Owing to the insignificant involvement of females, all the eight women[17] were excluded in further analysis so as to obtain a more accurate picture of drink driving characteristics of the driving population likely to consume alcohol.

Table 6.3: Alcohol prevalence in the driving population by BAC level and sex

BAC level (mg%)	All motorists		Men		Women	
	No.	%	No	%	No.	%
0	347	80.1	340	80.0	7	97.5
5-50	50	11.5	49	11.5	1	12.5
51-80	19	4.4	19	4.5	-	-
81-100	7	1.6	7	1.6	-	-
101-150	7	1.6	7	1.6	-	-
>150	3	0.7	3	0.7	-	-

b) Age:

The numbers and proportions of BAC positive drivers varied by age. As illustrated in Figure 6.2 and Table 6.4, the peak age of drivers who had been drinking was lower (30 to 34 years)

[17] occupation of the women: business (2), housewife (2), secretary (1), pharmacist (1), Catholic sisters (2)

than for those who were sober (35-39 years): the second smaller peak observed in older drivers of ages 50-54 years probably comprise of chronic alcohol abusers. Young drivers aged 16 to 24 years were least likely to have been drinking (15.4%), compared to older drivers aged 25-34 years and 45-54 years (21.3% and 23.5%, respectively). All, except one driver, with BACs exceeding 50 mg% were aged 25 years and above. The mean alcohol concentrations in those who had positive breath tests ranged from a low 31 mg% in younger drivers aged 16-24 years to 60 mg% in 25-34 year olds and 63 mg% in those aged between 45 and 54 years, suggestive of heavier drinking amongst older drivers (mean BAC=57 mg% in all aged >24 years). However, owing to the small number of young drivers, the overall variation of alcohol prevalence across the age groups was found not to be statistically significant (χ^2= 1.3, p=0.7). The mean age of drivers also did not significantly differ by their alcohol consumption status (36 years for BAC positives and 37 years for those negative; F=1.0, p=0.3).

Figure 6. 2: Comparison of percent age distribution of BAC positive and sober drivers

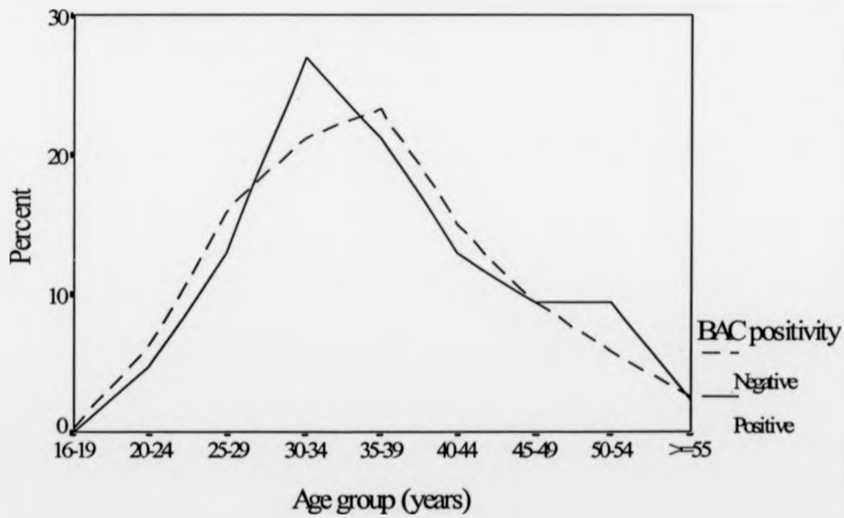


Table 6.4: Characteristics of drinking drivers and the distribution of BACs

Variable (sample size)	No. tested (% of sample)	BAC negative No.	%	BAC positive No.	%	Mean BAC in mg%	5-50 mg% No.	%	> 50 mg% No.	%
Overall (479)	433 (90.4)	347	80.1	86	19.9	56	50	11.5	36	8.3
Sex:										
Female (8)	8 (100.0)	7	87.5	1	12.5	50	1	12.5	0	-
Male (471)	425 (90.2)	340	80.0	85	20.0	56	49	11.5	36	8.5
Age:*										
16-24 *b* (28)	26 (92.9)	22	84.6	4	15.4	31	3	11.5	1	3.8
25-34 (176)	160 (90.9)	126	78.7	34	21.3	60	19	11.9	15	9.4
35-44 (174)	159 (91.4)	130	81.8	29	18.2	53	16	10.1	13	8.2
45-54 *a* (74)	68 (91.9)	52	76.5	16	23.5	63	9	13.6	7	10.3
55+ (12)	11 (91.7)	9	81.8	2	18.2	30	2	18.2	0	-
Unknown (7)	-	-	-	-	-	-	-	-	-	-
				Odds Ratio*=1.7 95% CI=0.5-6.8, p=0.4		t-test*, p=0.7				
Occupation:*										
Drivers *b* (208)	193 (92.8)	163	84.5	30	15.5	43	22	11.4	8	4.1
Others *a* (271)	232 (85.6)	177	76.3	55	23.7	64	27	15.9	28	12.1
				Odds Ratio*=1.7 95% CI=1.0-2.8 p=0.05		t-test* p=0.05				

*comparison of *a* with *b* (males only)

c) Occupation:

As shown in Table 6.4, alcohol prevalence was found to be significantly greater in private motorists driving personal cars (23.7%) than in professional drivers[18] (15.5%). Private motorists accounted for nearly two-thirds (64.7%) of all drivers who had been drinking, while their proportion in the breath tested sample was relatively less (53.6%). They were 1.7 times more likely to have been drinking compared to professional drivers (OR=1.7; 95% CI, 1.0 to 2.8, $p<0.05$), and were also over-represented (83.3%) among heavy drinkers with

[18] driver by employment or business; include drivers of taxis, commercial and public transport vehicles

BACs in excess of 50 mg%. Their mean blood alcohol levels were significantly greater (64 mg%) than that of professional drivers (41 mg%; F=3.8, p=0.05).

6.2.4. Travel Characteristics of Drinking Drivers

The association of alcohol with travel characteristics of male drivers in the survey sample are summarized in Table 6.5.

a) Driving Location:

Proportions of drivers who had been drinking varied by road location where sampling was done, ranging from 27.8% on Sirikwa road to 10.3% on the Nakuru road (see Figure 3.1 - survey sites). Sirikwa and Eldoret West locations yielded the highest prevalence of heavy drinking drivers, 13.9% and 13.2% respectively. The distribution of mean BAC values similarly varied by site of survey though not to a significant extent. The highest mean blood alcohol level of 72 mg% was recorded from the sample of drivers recruited on Pioneer road, while this was much lower (27 mg%) in subjects drawn from traffic along the Nakuru road. Surprisingly, no BAC positive driver was detected on one of the sites (Kapsoya road). These findings might be useful in targeting enforcement of drink-driving checks on locations frequently used by night-time drinking drivers.

b) Direction and Length of Journey:

Analysis of data according to the direction of a journey showed virtually no differences in alcohol prevalence between motorists travelling out of town (19.8%) and those town bound (20.2%); their mean BACs were also nearly similar (53 mg% versus 60 mg%). Some influence of the total distance to destination was evident, with 22.2% of those driving within a distance of 10 kilometres being BAC positive, while only 10.9% in those who intended to travel over 100 kilometres had been drinking. The probability of testing positive was two-fold more likely in drivers on short trips than among long distance (>100 km) travellers (95%

CI, 1.0 to 5.9, $p=0.05$). A linear regression analysis demonstrated a statistically significant inverse relationship between alcohol consumption and length of journey ($\beta=-0.0258$, $p=0.04$): the shorter the journey the greater the likelihood of drinking heavily. The proportion of heavy drinkers (BACs >50 mg%) was greater amongst short distance travellers, being 10.7% in those who intended to make a short journey (<11 km), 5.7% for medium (11-50 km), and 1.6% for long distance drivers (>100 km). However, their mean BACs showed no significant differences.

c) Type of Vehicle:

The likelihood of testing positive was two times greater for drivers of private cars (21.9%) than for operators of public service vehicles (10.8%). Heavy drinking (BACs>50 mg%) was also more common among drivers of private cars (10.6%), while it was 4 times lower in bus, taxi and *matatu* (PSV) drivers (OR=3.8; 95% CI, 1.1 to 5.8, $p<0.05$). The mean BACs of private car and PSV drivers (61 mg% and 49 mg%, respectively) were not significantly different ($F=0.045$, $p=0.8$); in contrast, private motorists on average recorded a significantly greater mean BAC than drivers of lorries and trucks (27 mg%), ($F=4.32$, $p=0.04$).

d) Estimated Age of Vehicle:

The mean age of all vehicles operated by drivers sampled was 10.2 years, with a median age of 8 years. Two-thirds were estimated to have been on the road for 5 years and above since their first registration in Kenya. Of the male drivers of older vehicles (over 8 years old), 28.7% were BAC positive while this was only 17.8% in those driving newer cars (8 years old or less). The mean age of vehicles driven by drinking drivers was marginally greater (11.2 years) than those operated by sober individuals (9.9 years), although the differences were not significant ($\chi^2=1.35$, $p=0.2$; $F=2.0$, $p>0.05$, respectively). Vehicle age was found to be positively correlated with drink-driving ($\beta=1.67$, $p<0.01$), probably reflecting the adverse impact of alcohol consumption on personal expenditure (such as the inability to afford a newer vehicle).

Table 6. 5: Travel characteristics, and BAC distribution in drinking drivers

Variable	Sample size	No. tested (% of sample)	BAC positive						
			No.	%	Mean BAC	5-50 mg%		>50 mg%	
Direction						No.	%	No.	%
Town bound	228	203 (89.0)	41	20.2	60	22	10.8	19	9.4
Outbound	243	222 (91.4)	44	19.8	53	27	12.2	17	7.7
Distance*									
1- 10 km *a*	300	270 (90.0)	60	22.2	63	31	11.4	29	10.7
11-50	56	53 (94.6)	11	20.8	43	8	15.1	3	5.7
51-100	40	38 (95.0)	7	18.4	46	4	10.5	3	7.9
>100 *b*	70	64 (91.4)	7	10.9	31	6	9.4	1	1.6
*(comparison of *a* with *b*)			Odds Ratio=2.3 (1.0-5.9), p<0.05		t-test, p<0.05				
Vehicle*									
Private *a*	346	310 (89.6)	68	21.9	61	35	11.3	33	10.6
PSV *b*	70	65 (92.9)	7	10.8	49	5	7.6	2	3.1
Commercial	55	50 (90.9)	10	20.0	27	9	18.4	1	2.0
			Odds Ratio=2.3 (1.0-6.3), p<0.05		t-test, p=0.1				
Passengers*									
0-1 *a*	232	204 (87.9)	54	26.0	54	32	15.4	22	10.8
2-4 *b*	190	176 (92.6)	24	13.6	60	14	8.0	10	5.7
5-18	38	38 (100)	7	18.4	58	3	7.9	4	10.5
>18	11	7 (63.6)	0	-	-	0	-	0	-
			Odds Ratio=2.3 (1.3-3.5), p<0.05		t-test, p=0.9				
Location									
Eld West Rd	82	76 (92.7)	21	27.6	56	11	14.5	10	13.2
Huruma Rd	109	103 (94.5)	13	12.6	55	8	7.8	5	4.9
Nakuru Rd	36	29 (80.6)	3	10.3	27	3	10.3	0	-
Pioneer Rd	111	102 (91.9)	23	22.5	72	12	11.8	11	10.8
Iten Rd	76	65 (85.5)	15	23.1	45	10	15.4	5	7.7
Sirikwa Rd	43	36 (83.7)	10	27.8	48	5	13.9	5	13.9
Kapsoya Rd	14	14 (100)	0	-	-	0	-	0	-
Day of week*									
Weekdays *b*	250	230 (92.0)	48	20.9	47	31	13.5	17	7.4
Weekend *a*	221	195 (88.5)	37	19.0	68	18	9.2	19	9.7
			Odds Ratio=1.1 (0.7-1.9), p=0.6		t-test, p=0.04				
Time (hrs)*									
19.00-20.00*b*	66	59 (89.4)	11	18.6	42	6	10.2	5	8.5
20.01-21.00	141	133 (94.3)	20	15.0	57	15	11.3	5	3.5
21.01-22.00	122	107 (87.7)	21	19.6	66	10	9.3	11	10.3
22.01-23.00	118	105 (89.0)	27	25.7	56	14	13.5	13	12.4
23.01-24.00*a*	24	21 (87.5)	6	28.6	48	4	19.0	2	9.5
			Odds Ratio=1.8 (0.5-6.3, p=0.26		t-test, p=0.7				

e) Number of Vehicle Occupants:

Nearly half (48%) of the motorists breath tested were travelling alone or in the company of one other person; and 26.5% of them had been drinking, compared to 13.9% and 18.4% found in those driving vehicles with 2-4, and 5-18 occupants, respectively. Drink-driving was two-fold more likely in driver only or single passenger vehicle trips than in those with 2-4 occupants (OR=2.3; 95% CI, 1.3 to 3.5, $p<0.05$). There is some evidence of reduced drink-driving rates where more than one passenger was in the vehicle. The mean BACs of positive subjects, however, did not significantly differ by vehicle occupancy. None of the seven bus drivers tested positive.

f) Time:

The assessment of the distribution of alcohol prevalence by time was restricted to the period between 7 pm and 12-midnight, when sampling was undertaken. In general, the proportion of BAC positive drivers increased as the night advanced. It was 18.6% between 7 pm and 8pm, declined to 15.0% by 9 pm then gradually rose to 28.6% by midnight. Nevertheless, these variations were not statistically significant ($\chi^2=5.2$, $p=0.20$); and a linear correlation of alcohol prevalence with time of the night was not demonstrated, possibly due to the decline in traffic volume late in the night. Heavy drinking was more common between 9 pm and 11 pm (10.3% and 12.4%) than before 8 pm (8.5%) or towards midnight (9.5%). The highest mean BAC (66 mg%) was recorded in drivers tested between 9 pm and 10 pm, while the lowest mean blood alcohol level of 42 mg% was found in those assessed between 7 pm and 8 pm. Although these variations are not statistically significant at 0.05 level, they indicate that, despite the diminished traffic flows, both alcohol prevalence and heavy drinking among drivers in Eldoret increased as the night advanced until about 11 pm when bars normally close.

g) Day of week:

There were two peaks of drink-driving prevalence over the period the survey was conducted; on Thursday (23.4%) and Sunday (25.5%); while the lowest rate was recorded on Friday (15.3%). Heavy drinking showed a similar pattern, but no significant differences by day of week or between weekdays and over the weekend were demonstrated. The daily mean BACs however rose from 43 mg% on Monday to 89 mg% on Saturday, then declined to 45 mg% on Sunday (Table 6.6). A significantly higher mean blood alcohol level was recorded in motorists who tested positive on the weekend (68 mg%) than in those tested during weekdays (47 mg%), (F=4.24, p=0.04), indicating the tendency for excessive drinking at weekends.

Table 6.6: Across the week variation in alcohol prevalence by level of intoxication and mean BACs

Day of week	Mean BAC	BAC positive		5- 50 mg%	Above 50 mg%
		%	(No.)	%	%
Monday	43	17.8	(13/73)	12.3	5.5
Tuesday	44	21.3	(13/61)	14.8	6.6
Wednesday	49	22.4	(11/49)	14.2	8.1
Thursday	53	23.4	(11/47)	12.2	10.6
Friday	71	15.3	(11/72)	6.9	8.3
Saturday	89	18.1	(13/72)	8.3	9.7
Sunday	45	25.5	(13/51)	13.7	11.8

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Saturday	89	18.1	(13/72)	8.3	9.7
Sunday	45	25.5	(13/51)	13.7	11.8

6.3: SUMMARY

The prevalence of drinking and driving in Eldoret was established quantitatively through a roadside survey involving 479 randomly sampled drivers. The majority (98.7%) were male with a mean age of 36.3 years. 90.3% of the total sample provided a breath test. There is some evidence that those who refused breath tests were more likely to have consumed alcohol than those who participated; the overall estimates of drink-driving are therefore likely to underestimate the true rates. Overall, 19.9% (95% CI, 16.1 to 23.6) had taken some alcohol, with 8.4% having BACs greater than 50 mg% and 4% exceeding 80 mg%. BACs ranged from 5 mg% to 285 mg%, with a mean of 56 mg%. Except for one female, all BAC positive drivers were male. A greater proportion of drivers aged 25 years and above were BAC positive than those aged 24 years and below (20.4% and 15.4%, respectively).

A significantly greater proportion (23.7%) of motorists driving personal cars had been drinking compared to professional drivers (15.2%), (χ^2 =5.49, p=0.01), with the likelihood of testing positive being nearly twice as great (OR=1.7; 95% CI, 1.0 to 2.8, p=0.04); they were also overrepresented (83.3%) among heavy drinkers with BACs in excess of 50 mg%, and had higher mean alcohol levels of 64 mg% than professional drivers (mean, BAC= 41 mg%). Drink-driving was twice as likely in driver only or single passenger vehicle trips as in trips with 2-4 occupants (OR=2.3; 95% CI, 2.3 to 3.5). Bus, *matatu* and taxi operators were less likely to drink (10.8%) than drivers of other commercial vehicles (20%). On average, vehicles driven by BAC positive subjects were marginally older (11.2 years) than those operated by sober individuals (9.9 years).

Alcohol prevalence varied by travel characteristics of the drivers, such as survey location and distance to destination, with a greater proportion (22.2%) of drivers on short trips (<10 km) being BAC positive than long distance travellers of 100 km or more (10.9%). Variations by time of night and day of the week were also demonstrated: a greater proportion of drivers had imbibed as the night advanced (from 18.6% between 7pm and 8 pm, to 28.6% by midnight); and on Thursday and Sunday (23.4% and 25.5%, respectively). Heavy drinking was significantly more common during the weekend, with mean a BAC of 68 mg% versus 47 mg% for weekdays (F=4.2, p=0.04).

CHAPTER 7

A QUALITATIVE STUDY OF CAUSES AND PREVENTION OF ROAD TRAFFIC ACCIDENTS IN KENYA

This chapter presents an analysis of road accident information captured by qualitative survey methods. It has eight sections. The first four sections describe findings from key informant and focus group interviews. Sections 5-7 illustrate examples of information captured from press and police reports with regard to causation of road crashes. The final section is a summary of the main findings.

7.1. PERCEPTIONS REGARDING CONTRIBUTORY FACTORS

The multifactorial nature of factors contributing to road traffic crashes is clearly reflected by a cross section of informants (see Box 7.1). In response to the question eliciting their knowledge and views about causes of road "accidents", a range of factors were mentioned: these are summarized in the matrices shown in Tables 7.1 and 7.2, indicating what each informant regarded as a causal factor of road traffic crashes. Most respondents felt than human-related factors are the most frequent cause, representing 48% of 139 citations, followed by poor road conditions (22%) and vehicle-related factors (12%). In addition, circumstances associated with the wider socio-economic and legislative environment were seen to account for a substantial proportion (17%) of all causes; and more than one factor could be cited by a respondent.

Of the specific causes mentioned with the highest frequency, over-speeding and unroadworthiness of vehicles ranked first, each being cited by 87% of the respondents, followed by potholed roads (80%), influence of alcohol (67%), carelessness (60%), disregarding traffic rules 60%, incompetent drivers 53%, corruption by the traffic police (53%), narrow roads (47%), improper overtaking (40%) and driver fatigue (33%). The extent of awareness varied by type of informant. In comparison to other key informants interviewed, a lawyer, branch manager of Automobile Association of Kenya and a manager of one of the insurance companies appeared to be most knowledgeable, as they mentioned more than a half of the total number of perceived causes cited by the total number of respondents. This, in a way, reflects their being involved in road accident-related matters by virtue of either professional responsibilities or organizational activities. Of the FGDs, two focus groups, comprising traffic-involved casualties and managers of insurance firms generated most information regarding what are commonly thought to be causing road traffic crashes.

Box 7.1: Identity codes of respondents

Informant type & Serial No.	Identity	Position
ID1	AAK	Branch manager, Automobile Association of Kenya
ID2	KMA	Chairman, Kenya Medical Association, Eldoret Division; Hospital Superintendent, Eldoret Hospital
ID3	TP	Traffic Police, chief of Eldoret Traffic Department
ID4	DPWO	District Roads Engineer and Public Works Officer
ID5	NRSC	Secretary to the National Road Safety Council, Senior engineer of roads, Ministry of Transport and Communications
ID6	INSUR1	Branch Manager, Insurance Firm
ID7	ADV1	Advocate, individual practice
ID8	ADV2	Advocate, large firm
ID9	ADV3	Advocate, large firm; Chairman, Law Society of Kenya, Eldoret Branch.
ID10	BUS	Traffic manager, large bus company
ID11	RSN	Road Safety Network, Health Coordinator
ID12	CRT	Manager, Eldoret Peugeot *Matatus* (Crossroads Transport)
FGD1	Nurse	Nurses (3) and Clinical Officers (4), Eldoret Hospital
FGD2	RTA	Previously traffic-involved victims (6)
FGD3	INSUR2	Branch Managers of Insurance Companies (7)

Perceptions with regard to what is considered as the underlying cause of the increasing number of road "accidents" varied between informants. Lawyers, for example, felt that the poor state of roads is the principal cause although other factors also play an important role. For instance, when asked what they thought were the main causes of accidents, one lawyer's response was:

> ID8: "I think by far the condition of roads is the major problem. You see, our roads have not been properly maintained. I do not believe that this is because of lack of resources, I think we have sufficient resources which can be used to maintain roads, but they are misdirected to non-priority projects... And one cannot ignore the fact that we have bad roads that are full of potholes and drivers have to struggle to avoid them. I have seen a few cases where vehicles collided because the drivers were struggling to avoid potholes" (ADV2)

Coincidentally, two other lawyers interviewed on separate occasions expressed almost exactly similar views, and even more revealing about the poor road design as well as lack of maintenance.

> ID7: "Well personally, more than anything else, I blame the conditions of our roads for the accidents. I don't blame just the poor maintenance and potholes, but foremost I blame road engineering. There are many sharp bends, and at some places a very steep gradient and I wonder how engineers who design roads fail to see such weaknesses... The roads are also very narrow, from the edge of the tarmac, there is a deep drop into the drainage even cyclists have no place to ride" [ADV1]

> ID9: "The roads are narrow, not well maintained and are full of potholes. Traffic signs are also not there, and there are no yellow lines separating the lanes or indicating the outer edge of the road" [ADV3]

A different view was expressed by the traffic police and senior officials of Ministries of Public Works, and Transport and Communications, who attributed the main cause to human error, encompassing carelessness of drivers, disregard for traffic rules and speed; whereas the insurance industry felt that poorly maintained vehicles, especially *matatus*, is the most common contributing factor.

> ID3: "Most accidents are caused by carelessness of drivers... most of the time drivers do not obey traffic rules... they over speed which actually is part of disregard for the highway code and traffic rules." [TP]

> ID4: "A very high percentage of accidents is caused by human error. This shows that people are careless, they are either in a hurry or they disregard traffic rules..." [DPWO]

> ID5: "According to our statistics, the road-user causes 85% of accidents, the vehicle about 6%, and the road itself is responsible for only about 1.0%" [NRSC]

> ID6: *Matatus* cause a lot of accidents mainly because of careless driving... many drivers do not observe road traffic rules. Secondly, some vehicles are unroadworthy, they are not properly maintained..." [INSUR1]

Table 7.1: Perceived causes of road accidents by type informants

CAUSES	INDIVIDUAL OR GROUP OF INFORMANTS															No.
	ID 1	ID 2	ID 3	ID 4	ID 5	ID 6	ID 7	ID 8	ID 9	ID 10	ID 11	ID 12	FGDs 1	FGDs 2	FGDs 3	
HUMAN FACTORS																
Speed	+	+		+	+	+	+		+	+	+	+	+	+	+	13
Disregard traffic rules		+	+	+		+	+		+				+	+	+	9
Carelessness	+	+	+	+		+			+		+		+		+	9
Alcohol	+	+	+			+	+				+	+	+	+	+	10
Incompetence	+		+			+	+					+	+	+	+	8
Improper overtaking	+	+				+	+					+		+		6
Fatigue				+						+	+			+	+	5
Indiscipline					+		+							+	+	4
Overloading		+	+												+	3
VEHICLE FACTORS																
Poor maintenance (unroadworthiness)	+	+	+	+	+	+	+	+		+	+		+	+	+	13
No safety standards							+		+							2
Unsuitable							+									1
Unstable body design														+		1
ROAD CONDITIONS																
Poor/potholes	+	+	+	+	+	+	+	+	+			+	+	+		12
Narrow	+				+		+		+			+	+	+		7
No road signs/markings	+			+		+			+			+	+			6
Sharp/blind bends					+		+									2
No pedestrian facilities	+														+	2
Inadequate for traffic							+					+				2
Sub-Total	10	8	7	7	6	9	13	2	7	3	5	8	9	11	10	115

Table 7.2: Broader societal factors contributing to the increasing numbers of road "accidents"

SOCIO-ECONOMIC FACTORS	INDIVIDUAL OR GROUP OF INFORMANTS															*No.*
	ID 1	ID 2	ID 3	ID 4	ID 5	ID 6	ID 7	ID 8	ID 9	ID 10	ID 11	ID 12	FGDs 1	FGDs 2	FGDs 3	
Corruption	+	+				+	+	+	+					+	+	8
Greed for money			+				+		+					+	+	5
Poor law enforcement							+		+					+		3
Traffic Act imprecise			+				+									2
Poor knowledge of traffic rules				+										+	+	3
Inadequate/unregulated public transport									+	+					+	3
	1	1	2	1	0	1	4	1	4	1	0	0	0	4	4	24

Among the wider socio-economic and legislative factors, corruption (motorists bribing the police to escape prosecution) was the most frequently cited; a greater motive for monetary profits than safety or passenger comfort, poor law enforcement, poor public knowledge of road use regulations, and the inadequacies of the public transport system (Table 7.2). These were felt to be the key underlying factors in the road transportation environment that contribute to the increasing number of road "accidents", as the regulatory mechanisms for proper road use is weak and compliance with existing regulations is low. Traffic-involved casualties and lawyers were the most reflective: they provided possible explanations of what they perceive as the chain of events and linkages among the various contributing factors leading to crashes.

> FGD2: "The most common causes are over speeding and poor maintenance of vehicles... a vehicle owner sets a target of money to be brought at the end of the day, so drivers compete for passengers, they drive fast to make more trips and in the process overtake carelessly and cause accidents." [RESPO 1- Male adult, textile factory worker]

FGD2: Vehicle owners are not very keen on proper maintenance... Although there are government inspectors who are supposed to check the mechanical condition of vehicles, corruption has ruined everything. A vehicle may be unroadworthy, but money will change hands and it will be certified that everything is in order... Even the police is to blame because so long as they are bribed they just let a driver go no matter the seriousness of the defects that the vehicle may have." [RESPO 2- Male adult, *matatu* conductor]

ID9: "You see, the financier wants his money in say 12 months, this forces the driver and the vehicle owner to look for means of getting the money. A driver therefore makes several trips and gets overworked; these are some of the problems that lead to accidents." [ADV3]

ID10: "Money problems in bus business have no end...prices of buses are very high, spares are expensive so the cost of maintenance is constantly on the increase... We are persistently under financial pressure to service loans, pay insurance and several taxes, and also meet overhead costs."[BUS]

In addition, two informants felt that the present poor public transport system and lack of effective regulatory mechanisms of passenger transport business, to a large extent, contribute to the increasing rate of crashes involving buses and *matatus*.

ID9: "Passenger transport is unregulated, anybody can just buy a vehicle and go into the business. There are no rules governing operation of *matatus*...it is so haphazard, it looks to be free for all. The government should regulate the entire system." [ADV3]

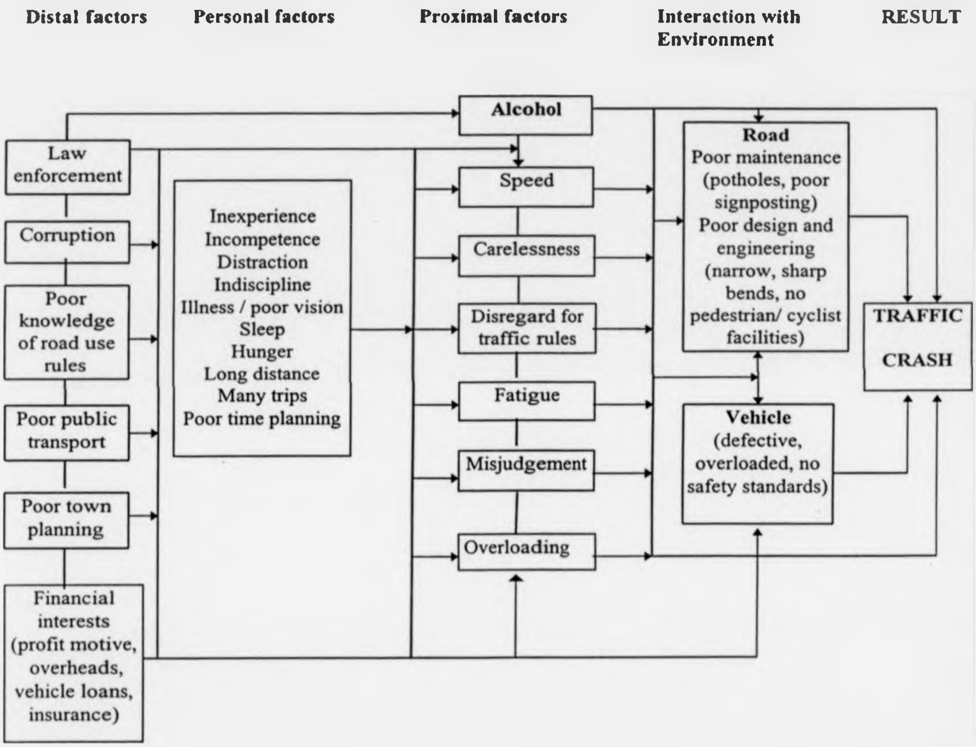
ID10: "You see, buses have timetables and are supposed to operate in accordance with Transport Licensing Board (TLB) requirements, but *matatus* are not subjected to TLB. They operate freely, they can choose any route, depart and arrive at any time, their operation is not regulated by any legislation, so even to discipline them is a problem." [BUS]

In spite of differences in the expressed perception and judgement, the main causes of road "accidents" were seen by all informants to be multifactorial involving interactions of the driver with the road environment, vehicle condition and its operation, and the wider socio-economic and law enforcement factors. Table 7.3 gives a summary and ranking of the different factors perceived as contributory to crashes: the various possible pathways of their interactions are illustrated in Figure 7.1. The networks of potential critical pathways of events and circumstances leading to crashes are also indicative of the various possible points for instituting appropriate road safety interventions, and that a number of strategies are needed to address the problem.

Table 7.3: Ranking of all causes of road accidents as perceived by informants

Rank	CLASSIFICATION OF CAUSES (Total frequency=139)			
	Human Factors (48%)	Vehicle Factors (12%)	Road Conditions (22%)	Underlying socio-economic environment (17%)
1.	Speed	Poor maintenance (unroadworthiness)	Poor condition (potholes)	Corruption
2.	Alcohol	No safety standards	Narrow	Greed for money
3.	Carelessness	Unsuitable for passengers	No road signs and markings	Poor law enforcement
4.	Disregard for traffic rules	Unstable design	No pedestrian/ cyclist facilities	Obsolete Traffic Act
5.	Incompetence/ inexperience		Sharp/blind corners	Poor knowledge of traffic rules
6.	Improper overtaking		Inadequate for traffic volume	Weak regulation of public transport
7.	Fatigue			Inadequate public transport
8.	Indiscipline (touts and drivers)			
9.	Overloading			

Figure 7.1: Networks of critical pathways of road traffic crashes



Source: Author (based on interview data)

7.2. PERCEPTIONS ON THE ROLE OF ALCOHOL AND ATTITUDES TO DRINK-DRIVING

Alcohol was voluntarily cited as a contributing factor in 10 out of 15 interviews (67%). It ranked second, after speed, among the human-related factors (Tables 7.1 and 7.3). When specifically asked what they thought about the role of alcohol in road "accidents", all respondents recognized it as an important contributing factor, and stated that the risk of causing an accident is greater after a driver has imbibed a drink. Some informants explained that alcohol impairs a driver's concentration, reaction time and coordination of driving tasks, which often results in a collision or loss of control. Several cited witnessing crashes caused by drunk drivers, which could have possibly been avoided had the drivers affected were sober:

> ID1: "I have been involved in two accidents. One was in December 1993 on Christmas eve and the cause I would say is the driver who was drunk. We were going fast at 120 kph and suddenly he realized there was a bend, and because he could not react on time, he decided to negotiate the corner at the same speed, he swerved across the road, hit the pavement and an electric post. The driver was quite drunk...according to me the actual cause of the accident was driving at a high speed at a corner while drunk..." [AAK]

> FGD2: "I witnessed a very bad accident... it was at night at about 11.00 pm and it had rained heavily, a woman driver who was very drunk lost control of the vehicle and drove out of the road into a group of workers who were going home, and one man was killed on the spot... Driving while drunk is something drivers do every day, but may only be known when one is tested by a doctor after causing an accident." [RESPO 1- Male adult, textile factory worker]

The police felt that a greater number of drunk drivers get involved in motor vehicle crashes than the numbers actually reported, and expressed dissatisfaction with the current Traffic Act (Laws of Kenya, Cap 403, 1993) which does not stipulate a legal alcohol limit. Lack of breath testing equipment, delays and unavailability of doctors to take blood samples, and their disinterest in performing alcohol assessments are some of the obstacles currently experienced by the traffic police in the process of attempting to establish evidence of whether a crash-involved motorist is intoxicated or not. One informant noted that at times even when there is a high suspicion that a driver involved in an accident has been drinking, the true findings by the examining doctor may not be correctly shown in the police accident report.

The following citations illustrate views expressed by some of the informants with regard to documentation of alcohol involvement in motor-vehicle crashes.

> ID3: "The law does not specify the percentage of alcohol under the Traffic Act... We had such a problem in Naivasha when somebody had caused an accident and we found that he was drunk...we tried to find out if there is a certain specific level of alcohol concentration...but we did not come across such a provision in the law...it is the doctor who knows to what extent somebody should drive or should not drive after drinking...but there are so many problems... I think about 75% of our cases go unattended by doctors." [TP]

> ID2: "We don't do blood alcohol tests... We used to take blood samples of drivers involved in accidents a long time ago and take them to the Government Chemist for analysis, but these days I don't see anybody taking. Nobody is keen..." [KMA]

> ID5: "Doctors at the Casualty Department at KNH say that about 90% of injured patients taken there are drunk, but they usually do not test for alcohol, only a small proportion get tested... police are supposed to indicate in the accident report forms whether alcohol was involved or not, but the problem is that filling the forms is not always complete and sometimes even the forms are not available." [NRSC]

In both in-depth interviews and FGDs, informants were unanimous that drinking and driving is common in the evenings, night-time (mostly before midnight), on weekends, during public holidays and at month-ends. Such a pattern coincides with after duty leisure times and opening hours for bars, and is determined by the availability of cash to spend.

ID5: "Usually a lot of people drink during month-ends because that is the time when they have money... If a person has a lot of money then he drinks more often... most drinking occurs in the evenings after duty and at night" [NRSC]

FGD2: "You see businessmen always have money, they can afford to drink on any day of the month, but the majority of people are employed and cannot afford to drink so frequently, so they drink only at month-ends when they get money." [RESPO 3- Male adult, trader]

ID2: "Drunken driving is usually common early in the night before midnight, during week-ends especially if it falls at month-end, and during public holidays." [KMA]

ID11: "Driving under the influence of alcohol is very common here in Nairobi, most drivers involved in accidents at night are usually drunk, we see them everyday when our rescue teams are called to an accident scene." [RSN]

As summarized in Table 7.4, there is a high level of awareness about alcohol and its contribution to traffic accidents in Kenya. Attitudes to prevention are, in general, favourable across nearly all sectors. Respondents from the government sector seem to be supportive of introduction of specific drink-driving countermeasures, but some informants representing social and commercial sectors are sceptical of the likelihood of its efficient implementation. Potential practical problems likely to impede detection, accurate reporting and punishment of intoxicated drivers were identified as: laxity in law enforcement; lack of trust in the police force; corruption; lack of breath testing equipment and trained personnel; and inadequate funding to ensure sustained implementation.

Table 7.4 Alcohol and driving: A matrix of ratings by type of informant

INFORMANT	Awareness	Attitudes to alcohol-specific interventions	Impediments to random breathtesting
I. Government sector 1. Ministry of Transport	High "we know that alcohol is a major cause of accidents although there are no statistics... doctors at KNH say that about 90% of accident casualties taken there are drunk"	Favourable: "We have made recommendations to the government to set a blood alcohol limit..."	Trained personnel, Administration. "Administration is difficult... you must have well trained personnel and sufficient material resources."
2. Ministry of Public Works	High: "There are two things which I have seen and are important, alcohol and fatigue which are very common but nobody talks about"	Favourable: "it will be better to have breathalysers since it gives immediate results... the public will be very happy because the number of accidents will be reduced."	Costs, Supervision, Trust. "...even if we had breathalysers we still need good supervision of its administration so that it is not misused by the police."
3. Traffic Police Department	High: "Speeding and driving under the influence of alcohol are the major causes of road accidents here"	Favourable: "...if we can have Alcolmeters and the law is amended to enable courts to accept blood alcohol readings, then I think that can help us a lot."	Funds, Trust, Discipline. "lack of funds to buy enough Alcolmeters... secondly, not everybody trusts that if a policeman is given an Alcolmeter, he will actually test a driver and record true results."
II. Non-Government sector 1. AA of Kenya	High: "There are other factors like drunken driving especially at night which may cause people to doze or make eyes fail to focus on the road, so alcohol is also a problem."	Neutral-Favourable: "It is the excessive drinking that is the problem because when you drink two or three beers you can still drive..." "Alcolmeters should be introduced so that we have means to monitor people who drive when drunk.. and should be strictly enforced."	Funds, Trust, Refusal. "...well, the government has many times said that it has no money to maintain roads, so even buying Alcolmeters will be a problem...I know some people will resent being checked because after all they have a right to drink."
2. Road Safety Network	High: "From our experience, driving under the influence of alcohol and drugs is one of the main causes of accidents"	Favourable: "Random alcohol checks should be introduced and drivers found to be drunk should be charged immediately and have licences withdrawn"	Lack of equipment, Law enforcement, Delayed and mild penalties. "We lack breath testing devices, and there is no instant justice."
III. Social/ economic sector. 1. Kenya Medical Association	High: "...the driver is the main problem and when he is under the influence of alcohol, he is even a bigger problem. Alcohol plays a very big role in the causation of road accidents"	Favourable: "I think it should be compulsory for everybody involved in an accident to be tested for alcohol"	Funds, Personnel. "...the police force does not have the capacity to monitor all drinking drivers on the road, it also involves a lot of money."
2. Lawyers	High: "Alcohol is definitely one of the major causes of accidents through fatigue and impaired sense of alertness"	Favourable - Neutral: "...random alcohol tests for drivers on the road would be the most effective measure..., but there is the issue of personal liberty and the issue of road safety..." "There should be an element of self-control, I think if one knows that he is going to drive then he should not drink alcohol in excess."	Funds, Equipment, Trained personnel, Law enforcement, Corruption, Political will. "A drunk driver would buy his way through. It boils down to the integrity of our policemen and the behaviour of drivers." "A law on paper is worthless if there is no spirit or will from the government to see that it is enforced."
3. Insurance	High: "...drinking is a major problem in causing accidents... after a drink you tend to think you have more confidence in yourself."	Favourable: "Drivers, especially those of matatu vehicles, should be prohibited from driving after taking alcohol... a breath testing machine can tell us the amount of alcohol in a driver's blood."	Poor enforcement, Corruption. "A law against drinking and driving already exists but there is lack of enforcement..."
4. Health workers	High: "When drunk, drivers go very fast, they over speed and become more careless..."	Favourable: "...if a driver is found to be drunk, he should be stopped from driving and if possible be prosecuted"	Poor enforcement, Corruption. "...the problem is with the police."
5. Public (casualties)	Moderate: "drivers cause accidents due to over speeding, and this is made worse after drinking alcohol"	Favourable: "...the public will support whatever measures the government will introduce to prevent drunk drivers from driving."	Poor enforcement, Corruption "...some drivers will not be afraid of being caught while driving when drunk, they will just bribe the police and be released."
6. Bus and Matatu operators	High: "Alcohol contributes a lot to accidents, after a drink one gets tired, driving becomes uncomfortable and there is lack of concentration."	Favourable: "If a driver is found to have taken alcohol we stop him from driving on that day, and if he repeats it then we dismiss him."	Poor enforcement, Corruption, Some opposition. "...even drivers who refuse to give bribes may be falsely accused by the police."

7.3. ROAD SAFETY INTERVENTIONS

7.3.1. Awareness of Current Interventions

A total of eleven interventions currently in force were mentioned by different respondents, giving an overall frequency of 63 (Table 7.5). The majority were road-based, mainly in the form of bumps, marked pedestrian crossings, road signs and occasional repairs. Of the driver-related interventions, police checks, posted speed limit signs, and driver training and licensing were the most frequently cited. Nearly all informants knew of traffic police checks and speed bumps, as these are the most common measures seen on Kenyan highways. Two road safety activities focused on the public (road safety education in schools, and radio/television programmes), and one motor vehicle-based measure (vehicle inspections) were mentioned. The extent of awareness varied by type of informant. Those involved in some aspect of road safety work, such as the AA representative, traffic police and an official of the National Road Safety Council, knew a wider range of existing safety measures than the other respondents. No informant mentioned any drink-driving countermeasure although alcohol is perceived as the fourth most common contributing factor in crashes. This is a true reflection of the current situation, since no such measures are in force. Overall, there was a greater awareness of road-based interventions, such as provision of pedestrian crossings, repairs, speed calming bumps (41%); than those directed at drivers (32%), vehicles (11%), and the general public (17%).

These findings indicate apparent discrepancy between the informants' knowledge about causes of crashes and the corresponding preventive measures that are currently being undertaken. As presented in Table 7.6 although nearly half of all causes are thought to result from human error, only a third of the existing countermeasures are driver-related, in form of mainly police checks (thought to be inefficient due to bribery). Bumps are the single most widely known road safety intervention, cited disproportionately more often (19%) than any other measure. This perhaps is a fair reflection of the current measures that focus on road-based speed calming devices rather than address more fundamental road engineering issues.

Table 7.5: Distribution of number of responses about causes of road "accidents" and interventions, by type of informant

Informant	Perceived factor and number of times cited									
	Human		Road		Vehicle		Socio-econ.		Overall	
	Cs*	Int**	Cs	Int	Cs	Int	Cs	Int	Cs	Int
ID1(AAK)	5	2	4	3	1	1	1	1	11	7
ID2(KMA)	6	2	1	-	1	1	1	-	9	3
ID3(TP)	5	4	1	3	1	1	2	1	9	9
ID4(DPWO)	4	-	2	3	1	-	1	-	8	3
ID5(NRSC)	2	3	3	3	1	1	-	2	6	9
ID6(INS1)	6	1	2	1	1	-	1	1	10	3
ID7(ADV1)	6	1	3	1	3	-	3	-	17	2
ID8(ADV2)	1	-	1	-	1	-	1	1	4	1
ID9(ADV3)	3	1	3	1	1	-	4	1	4	1
ID10(BUS)	2	3	-	2	1	1	1	2	4	8
ID11(RSN)	4	-	-	3	1	1	-	1	5	5
ID12(CRT)	4	1	4	2	-	-	-	-	8	3
FGD1(NURS)	5	1	3	2	1	-	-	-	9	3
FGD2(RTA)	6	1	2	1	2	1	4	-	14	3
FGD3(INS2	8	1	1	1	1	-	4	1	14	3
Overall % of Total	67 (48)	20 (32)	31 (22)	26 (41)	17 (12)	7 (11)	24 (17)	11 (18)	140 (100)	63 (100)

*Cs - Cause; Int** - Intervention (currently in place)

Table 7.6: Comparison of perceptions about causal factors and knowledge of current interventions

Perceived causal factor (Total frequency=139)	Existing intervention (Total frequency=63)
Driver error (48%)	Police checks (16%)
	Driver training (6%)
	Speed limit signs (5%)
	Driver licensing (3%)
Roads (22%)	Bumps (19%)
	Road signs (8%)
	Pedestrian crossings (8%)
	Maintenance (5%)
Vehicle (12%	Vehicle inspections (11%)
Socio-economic (17%)	Radio/TV broadcasts (8%)
	Road safety education in schools (7%)

7.3.2. Assessment of current interventions

All respondents agreed that current road safety measures have not been effective and cited a number of reasons. Lack of involvement of key people and interest groups at district and local authority levels in decision-making process as well as in the implementation of interventions, and the apparent lack of commitment to mobilize adequate resources for road safety work were advanced as some of the main reasons. Others included; laxity in law enforcement, imprecise road traffic legislation, lack of vehicle safety standards, poor knowledge and practice of road-use rules by the public, fraudulent licensing of incompetent drivers, and lack of sustained commitment to road maintenance.

Vignettes below highlight the general impression of the public with regard to the current road safety situation and the associated problems.

ID2: "We are not involved at all, in fact road safety work should be extended to all districts, but we only hear of them when a major personality is killed in an accident and they issue statements saying we are going to do this and that, but nothing really happens afterwards."[KMA]

ID1: "There seems to be lack of will to enforce the measures... It appears as if we have no policy governing road use." [AAK]

ID7: "All measures that we have tried have failed and the number of road accidents are increasing.. our laws on road use are very lax, some of them are obsolete, we must tighten them a bit. ...traffic police are also scared of being strict with *matatus* because some of the vehicles are owned by powerful people." [ADV1]

ID8: "Our roads have not been properly maintained, this is not because of lack of resources, I think we have enough resources which can be used to maintain roads but they are misdirected elsewhere... on non-priority projects." [ADV2]

7.3.3. Preferences for Improvement in Road Safety

Twenty additional interventions, directed to a wide range of causal factors, were suggested by different respondents (Table 7.7). Informants representing the insurance industry, the AA of Kenya and public transporters were the most reflective and proposed the largest number of preferred new measures. Seventy five per cent of the expressed preferences required wider legislative and law enforcement actions, followed by improvements in public transport (45%), installation of speed limiting devices in PSVs and commercial vehicles (40%), improvements in driver training and licensing (30%), road maintenance (30%) and vehicle safety measures (15%). Surprisingly traffic police and a senior official in the Transport Ministry were amongst informants who gave the least number of suggestions. This emphasizes the need to include a wide spectrum of informed stakeholders in the process of formulating a road safety policy and its implementation strategies.

Table 7.7: Suggested measures for road safety improvement

Cause (Frequency)	Interventions
Lax legislation and law enforcement (15)	Review Traffic Act Ensure strict enforcement of existing road-use laws Introduce random breath tests and legislation governing implementation Institute stiff and prompt penalties
Unregulated passenger transport (9)	Formulate policy and regulations for all passenger transport Introduce timetables for both buses and *matatus* Limit number of driving hours per day and ensure that all PSVs and long distance vehicles have 2 drivers Replace *matatus* with properly designed buses
Speed (8)	Install speed governors in buses and *matatus*
Incompetent drivers (6)	Improve driver training Institute strict licensing procedures Raise minimum age of PSV drivers to 30 years
Poor roads (6)	Ensure proper maintenance of all roads Design wider roads and dual carriageway highways Expand road network Replace missing road signs and paint road markings Provide pedestrian and cyclist facilities in towns
Unroadworthy vehicles (3)	Ensure strict and regular vehicle inspections by a reliable authority Establish vehicle safety standards and a system for monitoring compliance

7.3.4. Alcohol-specific Interventions

When their views were sought about preferred measures for discouraging drinking and driving, nearly all informants (14 out of 15) felt that random breath tests should be introduced and strictly enforced (Table 7.8). The traffic police, representatives of the insurance industry, legal and medical professions, and the Ministry of Transport were all highly supportive, and suggested that a legal blood alcohol concentration limit be established in law. Such a legislation should explicitly indicate detection procedures and penalties for different levels of intoxication. Public awareness and driver education on the risks of alcohol consumption and driving were also recognized as essential components of drink-driving countermeasures.

Table 7.8: Matrix of suggested drink-driving countermeasures

Measures	Individual or Group of Informants													*Freq*
	ID 1	ID 2	ID 3	ID 4	ID 5	ID 6	ID* 7-9	ID 10	ID 11	ID 12	FGDs 1	2	3	
Random breath tests	+	+	+	+	+	+	+++	+	+	+	+			13
Strict law enforcement	+	+				+	+		+	+	+	+	+	9
Set legal limit			+		+	+	++							5
Stiff penalties	+	+							+		+	+		5
Organizational discipline			+					+		+	+			4
Driver education	+						+				+			3
Courts to accept Alcolmeter readings			+				+							2
Publicity						+	+							2
Ban drunken drivers						+								1
Employ only non-drinking drivers						+								1

* ID7-9 - Lawyers
No. of informants supportive: + (one); ++ (two).

Quotations below illustrate some of the respondents' expressed preferences when asked the question: *"What measures for preventing driving under the influence of alcohol would you personally prefer to be introduced in Kenya?"*

ID3: "If we can have Alcolmeters and if the law is amended to allow courts to accept Alcolmeter readings then I think that can help us a lot." [TP]

ID5: "The problem is that in the Traffic Act, the level of alcohol is actually not quantified, but that one is being looked at... We have made recommendations for a legal alcohol limit...but it cannot be enforced until the law is passed by Parliament" [NRSC]

ID7: "...the degree of impairment varies from one individual to another depending on a person's capacity to tolerate alcohol... that is where a provision that a certain blood alcohol level that should not be exceeded when driving would be useful, because it is very difficult to tell a drunk person."[ADV1]

FGD3: "The Traffic Act does not allow drinking and driving, it is illegal... but as for the level of drunkenness, a breath testing equipment can show that, so that should be introduced... The next step is for the measures to be publicised so that motorists are aware."[INSUR2- Deputy Branch Manager, Stallion Insurance]

7.3.5. Potential Impediments to Implementing Drink-Driving Policy

As shown earlier in Table 7.4, a number of foreseeable obstacles to implementation of drink-driving countermeasures were identified. Of the greatest concern were lack of funds (mentioned 6 times), the high cost of Alcolmeters (6), lack of trained manpower to administer breath tests (5), corruption and lack of trust in the police force (5). Other problems, equally important though less frequently mentioned, included inadequate number of traffic police to cope with the additional workload (2), lack of administrative capacity to monitor a countrywide random breath testing programme (2), refusal by motorists (2), lack of facilities in hospitals for BAC analysis (2), lack of allowances or incentives for the police-force involved in the actual administration of breath tests (1), and unsupportive attitudes and behaviour of some police officers expected to enforce the legislation (1). The following quotations are illustrative of the above impediments.

ID8: "One of the constraints that people will talk about is financial.... You need a lot of breath testing equipment, facilities and trained manpower.... The government might introduce more taxes to raise funds, but people are already overtaxed. If we could properly manage our resources the funds available would just be adequate." [ADV2]

ID3: "There are many problems, you find that some of the police officers and even the doctors are drunkards just like some drivers, so they may not be keen in making sure that somebody found to be driving under the influence of alcohol is examined." [TP]

From these interviews, it is apparent that the public and a number of key informants are aware of potential ramifications of drink-driving policy that are likely to significantly determine the feasibility of its successful implementation. Such information is important to policy makers, as it can aid in designing strategies to overcome them.

7.4. NEWSPAPER REPORTS

7.4.1. Causes of Road "Accidents"

News about road "accidents" prominently featured in the front page headlines of virtually all daily papers in the event of a mass fatal road crash. Such crashes often involved buses, *matatus*, vehicles transporting school children or a specific group travelling to an occasion (see Appendix 7.1). Public statements attributed to ministers and senior government officials about road "accidents" also often appeared as front page news whenever a politician, government official or a prominent personality is killed in a crash. Other press reports attributed to individuals or experts mostly appeared as inside stories or in the letters to the editor. Editorial commentaries often highlighted the worsening state of road safety in the country and advocated for sustained commitment to reduce road deaths through various measures such as road maintenance, strict law enforcement and dealing with corruption in the traffic police force. Such commentaries usually appeared after a road disaster or death of an important person. However, the most regular feature in the press (the Daily Nation, in particular) was the daily report of road accident statistics (usually a short paragraph in the inside pages).

Media reports portrayed the diversity of views of a cross section of people that included senior government officials, journalists, various experts, interest groups, private motorists and public transport operators. The frequency of the various factors contributing to road "accidents", as reported by the press, are summarized in Table 7.9.

Table 7.9. Summary of causes of road accidents reported by the press (December 1, 1994 and July 31, 1996)

FACTOR	Attributable cause
ROADS (10)	i. Potholes (4), slippery surface (1) "...most parts of the road is riddled with depressions, furrows and ruts. Poor roads wear out vehicles fast forcing owners to make up for the losses with inflated fares." ii. No road marks/signs (1) "In most places, not even the white lanes that mark edges of the road are visible, it is hard to know how much of the road there is on either side at night." iii. Narrow (1) iv. Poor engineering (1) iv. Old (1) "...some roads in the country have outlived their life span and are now long overdue for reconstruction... the design life for most roads is between 15-20 years. Most our roads have outlived this span, hence the decay." v. Inadequate (1) "...Kenyan roads have not been expanded to accommodate the increased number of vehicles. Traffic density will double in seven years time." (A City road engineer)
HUMAN (51)	i. Speed (7), Speeding and careless overtaking (1) "Like missiles fired from a rocket launcher, vehicles hurtle down-hill... they overtake carelessly doubling the risk of accidents. I wish authorities could install bumps here to curb the speed..." ii. Wrongful overtaking (6) (Impatience and recklessness)* "Bus and matatu drivers are impatient, they overtake either way recklessly sometimes forcing other motorists out of their lanes. I have seen that madness result in accidents." iii. Error of judgement (1) iv. Distraction , diverted concentration (1) "A driver is unable to look out while on the wheel because he spends most of the time evading potholes. This divided concentration enhances the risk of accidents." v. Overloading (6) (Vehicle instability, loosing control)* vi. Alcohol (4) (Misjudgment, speeding, loosing control, carelessness, recklessness)* vii. Disregard of traffic rules (9) (Carelessness, reckless driving)* xix. Poor or no training (2) (Incompetence)* "...driving schools don't teach you how to drive a car, they teach you how to pass the driving test." x. Incompetent drivers (4) (Poor driving skills, inexperience)* xi. Driving behaviour (4)- Lack of courtesy, inappropriate use of signals (Indiscipline)* "Matatu drivers are generally a danger to other road users...,they have no manners, ignore the highway code and know nothing about decency and courtesy." xi. Fatigue/stressful driving (2) (Decreased concentration)* xii. Dangerous parking on highways (2) (Obstruction)* xiii. Pedestrians (1)- Crossing or walking along the road without due care (poor knowledge, no facilities)*
VEHICLE (10)	Poorly maintained, unroadworthy (Tyre burst, wheels coming off, break failure)* "...bad roads quickly wear the body work and loosens ball joints of vehicles...the owners are unable to keep up with maintenance..."
SOCIAL (5)	i. Poor law enforcement (2) "The root cause of all accidents lies 100% with the traffic police..." (letter, Sunday Standard, Feb 26, 1995) ii. Corruption (1) in vehicle inspections, driver licensing, speed checks, passenger overload "Police accept bribes to overlook dangerously overloaded vehicles." iii. Public transport (2)-Inadequate and unregulated; high court awards for accident compensation "Matatu operators have responded to various Government moves to regulate their operations by calling for strikes."Uncontrolled huge court awards to accident victims have driven individual matatu operators out of business."

()* researcher's interpretation

The official view held by the government that human error is the principal factor in motor vehicle crashes, is illustrated by the following public statements:

> "The main cause of the spate of road accidents is human error which accounts for 83% of the crashes" (Minister for Transport and Communications)[19]

> "Ninety percent of accidents occurring on roads in Rift Valley Province are caused by human error, as seen in speeding, reckless driving and even incompetence of drivers." (Provincial Traffic Base Commander, Nakuru)[20]

> "...people want to blame road accidents on traffic police, but must a police officer be on the road all the time to prevent accidents? The causes have much to do with the courtesy on the road and the attitude of motorists" (Commandant of the Traffic Police)[21]

> "Practices such as driving while drunk, blind overtaking at corners or on hill brows, disregard of important traffic instructions and use of unroadworthy vehicles are to blame for the road carnage." (Chairman, AA of Kenya)[22]

Whereas the Kenya Automobile Association and private motorists concur with the above views, they also assert that the current lack of effective enforcement of existing traffic rules by the police further compounds the already bad situation. As if admitting laxity, the police on their part complain of the serious difficulties they experience in the course of enforcing traffic legislation. Some of these are highlighted in the following press reports.

> "I believe that the root cause of all accidents lies 100 per cent with the traffic police. They do not control drivers' driving examination, or traffic on the road once they have let it loose" (article by a

[19] Daily Nation, Thursday, June 8, 1995

[20] Daily Nation, Tuesday, June 25, 1996

[21] Sunday Nation, February 5, 1995

[22] Daily Nation, Tuesday, June 25, 1996

private motorist)[23]

> "The traffic division does not have a single ambulance, its patrol motorcycles are very few and its mobile bases equipment became obsolete 14 years ago. The road carnage is likely to remain high until the division is equipped with modern facilities" (Traffic Police Commandant)[24]

However, matatu operators and journalists strongly feel that the poor state of roads is the principal cause of crashes, whereas a road engineer, on the other hand, is emphatic that the contribution of the road is minimal.

> "...the biggest operators of matatus plying the Nakuru-Nairobi Road attribute rampant accidents on the roads to its pathetic state and absence of crucial road marks.... No amount of road safety campaigns will yield fruits until the pertinent issue of Kenya's pathetic roads is tackled first. And the possibility of attaining any degree of safety on our roads will remain an illusion." (A Standard Reporter)[25]

> "...poor roads contributed only 1.3% of total accidents last year as a lot of care has been taken in modern road design." (A Consulting Road Engineer)[26]

The above examples are illustrative of the differences in perceptions between decision-makers, individuals involved in road safety work and the public including those directly affected by the current poor road safety situation. Newspaper reports portray both the multifactorial nature and the chain of factors leading to the occurrence of motor vehicle crashes. It is evident that even media reports reflect the existence of interactions among human, road, vehicle, socio-economic and law enforcement factors.

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[23] Sunday Standard, February 26, 1995

[24] Daily Nation, February 17, 1996

[25] East African Standard, Monday, July 8, 1996

[26] Daily Nation, Saturday, February 17, 1996

Views about strategies for prevention often appeared on editorial and correspondence columns. The Daily Nation, in particular, frequently published feature articles on road safety. For instance, a supplement on June 6, 1995 was devoted to road "accidents" to mark the launching of the Road Safety Network (RSN), a non-governmental organization with an objective of providing first aid, evacuation of casualties and public road safety education. Views appearing in the press, in general, showed dissatisfaction with the current road safety measures, and also expressed the need for strict enforcement of existing laws, improvement in road engineering, increasing the road network in the country, adoption of responsible and courteous driving behaviour especially by *matatu* drivers, as well as proper regulation of the public transport system.

7.4.2. Causes of Road Disasters

An attempt was also made to assess which of the causes cited are actually critical and result in greater motor vehicle fatality, through scanning the daily papers on each day for a period of 6 months (Dec 1994-May 1995) for any report of a road disaster[27].

As summarised in Table 7.10, eleven out of 14 road disasters that were reported resulted from head-on collisions while in the process of overtaking (8) or following a front tyre burst and subsequent loss of control (2), or due to misjudgment by the driver (1). Other major fatal crashes occurred as a result of a car failing to stop on entry to a main road, and consequently colliding with a lorry (1), a *matatu* tyre burst (1), and a minibus crushing into the rear of a trailer (1). A total of 131 lives perished in these crashes with the worst single disaster resulting in 35 deaths, being caused by a front tyre burst of a lorry carrying a load of 65 men, loss of control and subsequent head-on collision with an articulated trailer.

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[27] Defined as a motor vehicle crash resulting in 5 or more fatalities

From this sample of reported road calamities, it seems that driver errors were the primary factors responsible for most fatal crashes (78.6%) witnessed on Kenyan roads. Such errors possibly resulted from fatigue, influence of alcohol, speed, misjudgement or negligence; unfortunately such specific underlying factors were not mentioned in the media reports.

Table 7.10. Press reports of road disasters, their causes, vehicles involved and numbers killed in Kenya over a period of 6 months (December 1, 1994 - May 30, 1995)

Month/yr	Vehicle involved	No. killed (Total=131)	Cause or manoeuvre and type of crash
Dec 2, 94	Lorry	35	Front tyre burst, collision with a trailer (worn out tyres and overloading)*
Dec 25, 94	Matatu	7	Overtaking, collision with a pick-up
Dec 19, 94	Car	6	Overtaking, collision with a lorry
Dec 8, 94	Matatu	5	Overtaking, collision with lorry
Jan 6, 95	Bus	5	Collision with pick-up (misjudgment/fatigue/speed)*
Feb 6, 95	Minibus	12	Rear-end collision (speed, misjudgment, failed brakes)*
Feb 2, 95	Matatu	5	Tyre burst, collision (overload, worn out tyres)*
Feb 10, 95	Matatu	5	Tyre burst, (overload, worn out tyres)*
April 9, 95	Bus/Matatu	12	Overtaking, collision - burst into flames
April 8, 95	Bus	5	Overtaking, collision with a bus
April 14, 95	Lorry	8	Overtaking, collision with a pick-up
April 13, 95	Lorry	6	Overtaking at a corner, collision with a car
May 8, 95	Car	5	Failure to stop at junction, crashed into a lorry (speed, misjudgement)*
May 16, 95	Bus	15	Overtaking, collision with a minibus

* Researcher's assessment of the likely primary causes

7.5. POLICE RECORDS

7.5.1. Police-defined Causal Factors

Ninety three injury-producing motor vehicle crashes that occurred within Eldoret town between December 1994 and May 1995 were recorded by the traffic police. Of the 79 crashes, where the likely cause was indicated, 36.7% were attributed to driver error, 32.9% to pedestrians, 16.5% to cyclists, and only 2.5% to road surface (potholes); vehicle defects and passengers were each responsible for 6.3%. Overall, 92.4% of the recorded causes were human-related. As shown in Table 7.11, improper overtaking, disregarding traffic rules, and losing control of a vehicle were the most frequently noted as the immediate causes of collisions. It is not surprising that the contribution of the roads and vehicles was deemed to be so small, as police accident investigations are usually fault-oriented. In addition, there was no record of whether any of the drivers was under the influence of alcohol at the time of the crash; this is most likely because no such assessment was undertaken.

Table 7.11. Police-determined causes of crashes in Eldoret (Dec 1994-May 1995)

FACTOR and actual cause		FREQUENCY (N=93)
I. HUMAN (92.4%)		
i. Driver	Improper overtaking	9
	Disregard of traffic rules	6
	Loss of control	5
	Error of judgement	2
	Reversing without taking due care	4
	Dazzled by lights of approaching vehicle	1
	Forcing way through pedestrians	1
	Speed	1
ii. Cyclist	Careless/misjudgment	7
	Overtaking improperly	2
	Crossing road without due care	2
	Under the influence of alcohol	1
	Skidding	1
iii. Pedestrian	Heedless of traffic (crossing, walking or playing on the road)	21
	Error of judgement	5
iv. Passenger	Boarding or alighting	3
	Falling from moving vehicle	1
	Negligent conductor	1
II. VEHICLE (6.3%)	Mechanical defects	4
	Dangerously placed on highway	1
III. ROAD (2.5%)	Potholes	2
IV. OTHER (2.5%)		2
V. UNKNOWN		14

7.6. SUMMARY

Twelve in-depth interviews and three focus group discussions were held with informants drawn from government Ministries responsible for Transport and Communications, Roads, the National Road Safety Council, and from the insurance industry, legal and medical professions, public transporters, and organizations with interest in road safety work, as well as individuals who have been injured in road crashes.

The perceived leading causes of "accidents" were speed, defective vehicles, poor roads, driving under the influence of alcohol, carelessness, disregarding traffic rules, driver incompetence and fatigue. Of the main groups of factors, human error ranked first, being responsible for 48%, road condition 22%, and vehicle defects 12%; 17% of the causes mentioned were related to the socio-economic environment. In contrast, police records attributed nearly all injury-producing accidents to human error (92.4%), indicating considerable differences between people's perceptions and the official statistics. The press highlighted the diversity of views across different experts, the public and government officials, as well as the multifactorial nature of factors contributing to road crashes. On the basis of press reports, driver error especially improper overtaking, was the most common immediate cause of road disasters, responsible for 78.6% of all reported mass fatal road crashes.

A limited range of road safety interventions were cited; speed bumps and police checks being the most widely known. None of the respondents was aware of any drink-driving countermeasures. Weak law enforcement, obsolete traffic legislation, corruption and the overriding profit motive in passenger transport business were thought to be key factors increasing the risk of road "accidents". All respondents were aware of the effects of alcohol on driving and were in favour of introduction of alcohol-specific interventions, including a drink-driving legislation that incorporates random breath tests. Several potential impediments were noted; these included the high cost of breathalysers, lack of funds, few traffic police and personnel to administer the tests, inefficient law enforcement and corruption to avoid prosecution.

Lack of a meaningful involvement of the public in decision-making process and implementation of road safety interventions were key concerns expressed by most respondents. They suggested a revision of the Traffic Act, strict law enforcement, public education and increased publicity about road safety. In addition, sustained maintenance of roads, upholding vehicle safety standards, improved driver training and licensing procedures, and a better regulated public transport system were suggested.

CHAPTER 8

POLITICAL MAPPING FOR DECISION-MAKING ON A POLICY ON DRINKING AND DRIVING

This chapter attempts to provide a practical approach to understanding processes involved in the development of public policy on preventing drinking and driving in Kenya. It illustrates potential responses of decision-makers, the public and different interest groups to the proposed policy, and strategies for enhancing their support. The findings are based on the researcher's own judgement as informed by epidemiological and qualitative data (Chapters 4-7), as well as taking into account additional contextual information from other sources. A political mapping technique, described in Chapter 3 (section 3.2.3.3), is the principal approach used to systematically organize and present the information.

8.1. THE POLICY ISSUE

A public policy for preventing alcohol-related traffic crashes is one of the key issues under consideration in this thesis. A review of accessible documents in combination with interviews of senior officials of the National Road Safety Council and the Traffic Police, revealed that a proposal to introduce legislation to prevent driving under the influence of alcohol, as one of the strategies for reducing road crashes, was made way back in 1980 (Republic of Kenya, 1980). Implementation was expected to commence by 1982, after being approved by the government. However, in spite of having been developed within the bureaucratic mechanisms of the government (Ministry of Transport and Communications), in collaboration with external experts (Viatek Consultants, Finland), no final decision on the policy was made for reasons which remain unclear. The proposal is presumably still on the policy agenda. It is likely that drink-driving was not perceived by decision-makers as a priority issue in road safety: lack of pertinent information to convince policy-makers to respond may also have influenced the inaction.

8.2. FACTORS INFLUENCING DECISION-MAKING

8.2.1. Stakeholders and Their Objectives

Twenty five players considered to have a stake in a policy for preventing drinking and driving (see Chapter 3, section 3.2.3.3) were identified and characterized according to the Political Mapping technique, by; **type** - individual, social group, organization, sub-organization; **sector** - government, non-government, commercial, social, political and international; **power of influence** - rated as low, medium or high; and **position** - whether supportive, opposed or non-mobilized with respect to a policy proposal for legislation to establish a legal alcohol limit and to promote random breath testing of drivers, as well as penalties for drink-drive offenses. The positions were identified on the basis of stated policies and statements, other documented information, knowledge of the organizations, interviews, and other personal communication (such as public statements and press reports).

In the first step of stakeholder analysis, the underlying motives of key players and their current positions in relation to prevention of road traffic crashes (as judged by the researcher) were identified (Table 8.1- **Stakeholders and their Objectives**). Of key players from the government sector, the Attorney- General (AG), the Ministry of Transport and Communications (MOTC), Traffic Police Department and the National Road Safety Council (NRSC) were felt to consider introduction of a drink-driving policy as high priority, while the Treasury was judged to be less enthusiastic due to budgetary implications in funding the programme. The insurance industry was considered to be highly supportive as a decline in alcohol-related crashes is in their business interest and would boost their profit margin. Other organizations were judged to consider drink-driving policy as of medium or low priority. Medium ranking was assigned to a number of organizations which, although recognizing road safety as important, have other overriding interests; for instance, the principal aim of public transport operators is to generate profits, whereas doctors and other health workers are more concerned with treatment of crash victims and, to some extent, financial gain from traffic injury-related professional services. Brewers and bar owners concentrate on selling alcohol, and therefore were anticipated to give a low priority or to actively oppose measures that they perceived would lead to a decline in alcohol consumption; and for some lawyers, a potential decrease in numbers of accident-involved clients seeking a legal representation was likely to be their main worry. Whereas most stakeholders were judged to have at least some road safety-related objective, a specific motive for discouraging drink-driving is not of high priority.

Table 8.1 Stakeholders and their interests in road safety

Name of Organization	Road traffic objective	Priority
Attorney- General	Review and establish laws governing road use, ensure their enforcement, and institute appropriate penalties for violators.	High
Automobile Association of Kenya	Promotion of safe driving, including advocacy for establishment of drink-driving legislation and random breath testing.	High
Insurance Companies	Generate profits from insurance business through savings accrued from non-payment of accident compensation claims owing to prevented alcohol-related crashes.	High
Ministry of Transport	Formulate effective road safety policy, design implementation strategies including drink-driving countermeasures, mobilize resources and monitor implementation.	High
Motor vehicle crash victims	Promote responsible road use behaviour and ensure compliance with measures for the prevention of injury, deaths and disability resulting from traffic crashes.	High
National Road Safety Council	Advise the government on effective road safety policy and strategies that encompass drink-driving countermeasures, coordinate and monitor their implementation.	High
Road Safety Network	Target drivers in road safety education to prevent crashes due to human error, including driving under the influence of alcohol.	High
Traffic Police	Ensure strict enforcement of all aspects of the Traffic Act and the highway code, and the safety of all road users.	High
Bus & Matatu transporters	Operate a profitable passenger transport business through avoidance of losses resulting from motor vehicle crashes, especially those that are alcohol-related.	Medium
Nurses and clinical officers	Treat road traffic casualties. Strive to reduce hospital workload due to motor-vehicle crashes through education of patients on safe road use, effects of alcohol on driving, and active participation in relevant road safety activities.	Medium
Kenya Medical Association	Improve terms and image of the medical profession. Document traffic injuries and disseminate information on effects of alcohol on driving. Advocate for introduction of a legal limit and mandatory assessment of crash-involved drivers for alcohol.	Medium
Media	Publish road accident statistics. Disseminate road safety information, and views of experts and interest groups to the public.	Medium
Ministry of Finance	Provide funding for road safety work. Generate revenue from taxes (alcohol, fuel, road licenses) and fines (traffic offences), and savings from costs averted from traffic accidents (property damage, insurance claims, loss of production).	Medium
Ministry of Public Works	Design and construct roads with adequate provision for safety of the users; ensure proper maintenance of all roads, including putting up traffic signs and road markings.	Medium
Member of Parliament	Contribute in parliamentary debates on road safety, in support of establishment of drink-driving legislation and other road safety measures. Mobilize the public (constituents) on road safety awareness through public statements.	Medium
Private motorists	Promote safe driving through observerance of all traffic rules, including avoidance of driving under the influence of alcohol.	Medium
Alcohol Industry (brewers and bars)	Operate profitable business from increased alcohol production and sale . (Currently has no identifiable road safety-related interest)	Low
Lawyers	Business (financial) interest. Provide legal representation to crash victims and insurance companies. Collaborate with the AG in reviewing legislation governing road use, public transport, road safety and accident compensation claims.	Low
Embassy of the Rep. of South Africa	Maintain bilateral cooperation. Advocacy and provision of technical support for road safety-related activities in Kenya	Low -to-Medium

8.2.2. Position of Stakeholders in Relation to Policy

Figure 8.1 **(Position Map)** is illustrative of current positions of key stakeholders in relation to the proposed drink-driving policy. Stakeholders on the left side are supportive, those in the middle are still undecided, whereas those to the right of the diagram are likely to be opposed to the policy. Most stakeholders (14) were judged to be currently non-mobilized (because of either not being aware of the magnitude of the problem or not convinced that a drink-driving policy is possible to implement effectively in Kenya). Such players included individuals or institutions in powerful positions (see Box 8.1): with the potential to exert significant influence on both the pace and direction of the decision-making process (for example, the AG, MOTC, Treasury), as well as the policy outcome and the feasibility of its successful implementation.

Box 8.1: Perceptions regarding positions and power of the Minister for Transport and the Attorney General in decision-making in road safety policy

"It is the Minister for Transport and Communications who has the final say on road safety policy... we usually forward our suggestions to the National Road Safety Committee, who in turn reports to him." (AAK)

"The NRSC is just a body to organize road safety work... we have representatives from various ministries including the Treasury and the Attorney General's office, as well as road engineers, doctors and lawyers... we forward our recommendations to the government through the Minister for Transport. The process is long... as the recommendations have to be approved by the cabinet... We have made some recommendations through the Minister to the AG for establishment of a legal blood alcohol limit based on the levels applied in Britain and the United States." (NRSC)

"We could make proposals for suitable legislative changes that can assist to reduce road accidents, but nobody listens to lawyers. It is the AG who has the powers to initiate the process." (ADV1)

"Legally, the body responsible for making legislative changes is the parliament... but in practice the parliament delegates this responsibility to certain government officers, usually the Attorney General". (ADV2)

AAK- a manager of the Automobile Association of Kenya; NRSC- representative of the National Road Safety Council; ADV1 and ADV2- Lawyers.

Of the eight organizations assessed to be currently showing some degree of support, passenger transporters (bus and *matatu* operators), and the insurance industry, were considered to be more supportive because of the potential financial gain associated with the prevention of alcohol-related crashes (given the vehicle repair and insurance costs).
It was also anticipated that international institutions (such as the World Bank, UNDP, EU) and bilateral agencies often involved in financing road development projects and some aspects of road safety programmes would be likely to support drink-driving legislation as a part of efforts to improve the road safety situation in the country. Diplomatic missions and the tourism industry (the increasing numbers of road deaths in the country has had some negative effects on tourism[28]), were felt to be supportive of the introduction of drink-driving countermeasures as part of the strategies for improving road safety, although this was anticipated to rank low among their priorities. The embassy of the Republic of South Africa, for instance, has shown interest to provide some technical and financial support needed to initiate the process of developing comprehensive road safety strategies[29].

It was anticipated that brewers and alcohol retailers would be the main players opposed to legislation that prohibits drinking and driving, due to worries of possible decline in consumption and profits. Overall, as illustrated in Figure 8.1, players on the left are more likely to be allied to the NRSC with regard to the policy than those to the right (opponents), whereas the undecided key players in the middle are potentially influenceable to support new policy, by applying appropriate strategies.

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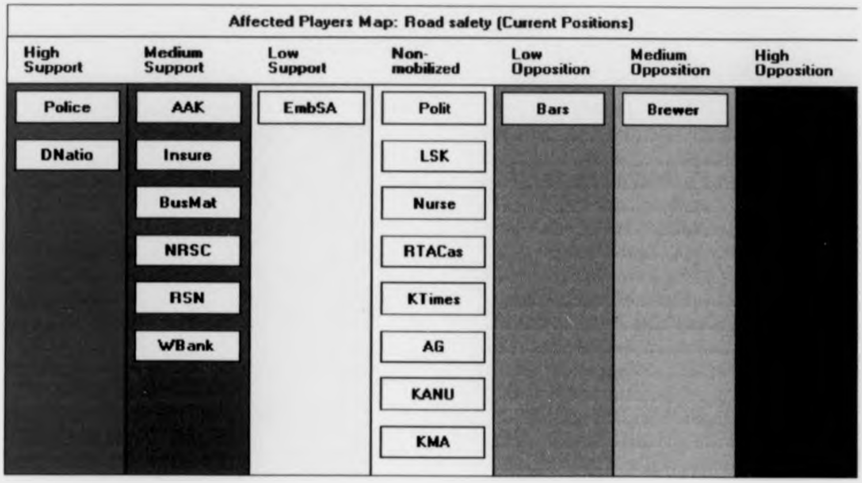
[28] A chief executive of the Kenya Association of Tour Operators in a press interview admitted that road crashes contributed to the decline in tourism business (Sunday Nation, February 5, 1995).

[29] Personal communication (Mulindi S.)

Figure 8.1 Current positions of stakeholders



KEY

Police	Traffic Police Department
DNation	Daily Nation Newspapers
AAK	Automobile Association of Kenya
Insure	Insurance Industry
BusMat	Bus and *Matatu* operators (public transport)
NRSC	National Road Safety Council
RSN	Road Safety Network
WBank	World Bank
EmbSA	Embassy of the Republic of South Africa
Polit	Politicians (MP)
LSK	Law Society of Kenya
RTACas	Road Traffic Accident Casualties
KTimes	Kenya Times Newspaper
AG	Attorney-General
KANU	Government Political Party
KMA	Kenya Medical Association
Bars	Bar owners and alcohol retailers
Brewer	Alcohol distillers and distributors

8.2.3. Policy Consequences

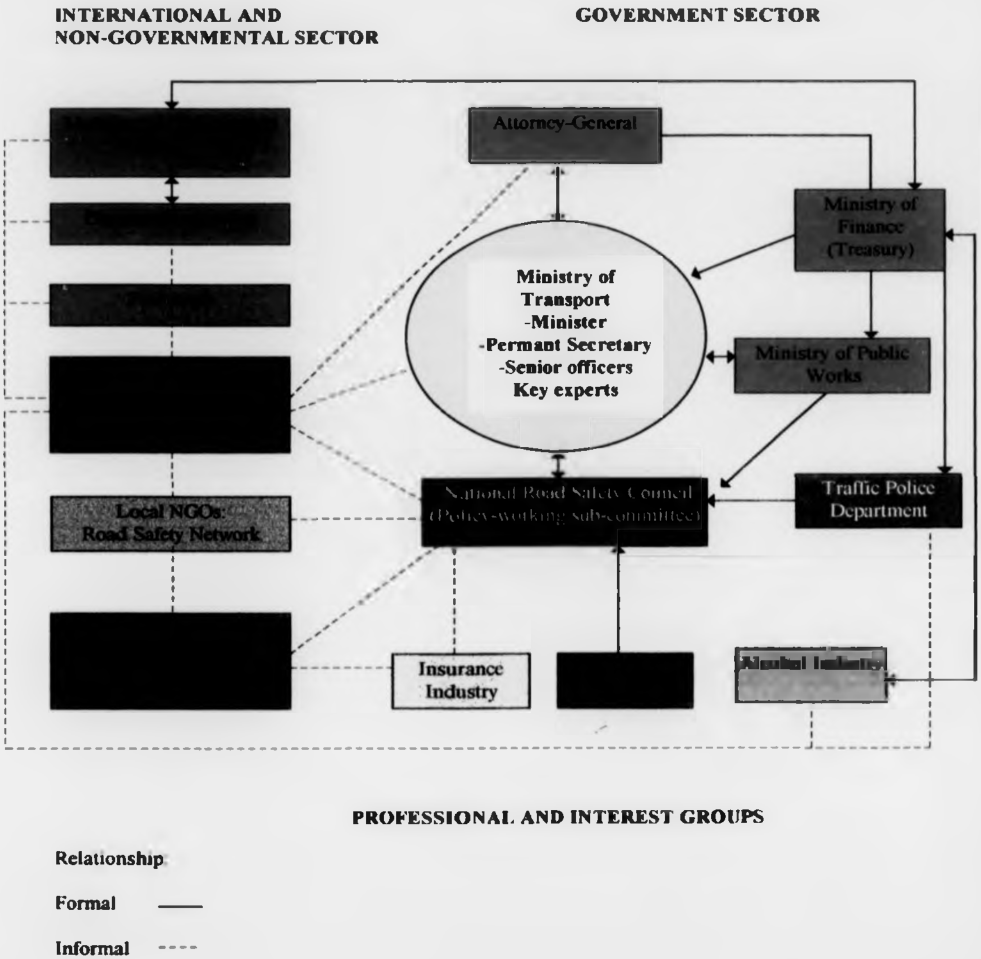
An attempt was made to identify the importance of the policy to different actors in order to determine actions needed to enhance the feasibility of winning their support. A range of the perceived consequences and their impact on respective key actors is shown in Table 8.2 (**Policy Consequences**). Most players were anticipated to be likely to experience beneficial (financial) consequences as a result of reduced traffic crashes following passage of legislation and institution of drink-driving countermeasures, especially the insurance industry, public transporters and private motorists. The Ministry of Transport and the Treasury were judged as likely to anticipate some financial implications in terms of resources needed to initiate the programme, however the long-term burden on the national budget was not anticipated, as the programme would be self-financing from drink-drive fines and possibly supplemented by funds from insurance companies. Practical issues such as increased workload and demand for sufficient numbers of trained police officers, and overwhelmed courts due to increased drink-drive prosecutions were the main administrative consequences likely to be experienced by both the Traffic Police department and the judiciary.

Only two groups of actors, the alcohol industry and a section of practising lawyers (commonly known as "ambulance-chasers"), were judged as likely to anticipate financial losses following the promulgation of legislation and establishment of drink-driving countermeasures (owing to potential decreases in drinking and road crashes). Overall, the anticipated long-term consequences were judged as being potentially beneficial to all stakeholders including brewers, as the image of alcohol would improve as people adopt more responsible drinking behaviours, the industry might eventually reap more benefits. This is a feasible assumption, as brewers have been shown elsewhere, for instance in Zimbabwe (Zwi et al., 1993) and the UK (Royal College of Physicians, 1991), to be actively involved in the promotion of responsible alcohol use and safe driving.

Table 8.2 Anticipated policy consequences to key stakeholders

Type	For whom	Impact	Size	Timing	Importance for policy change
Administrative	Traffic Police	Increased workload, demands sufficient numbers of highly disciplined and well trained police officers	Large- needs adequate number of motivated and trained police force to cover all regions of the country	Immediately after passage of legislation and in the long run.	Very important- a crucial requirement for policy implementation.
Administrative	AG and the judiciary	Overwhelmed courts, special traffic courts may need to be established	Moderate to large, depending on efficiency of the police and magistrates	Immediate on passage of law, decline in the long run	Prompt and strict penalties are key to law enforcement and success of policy
Beneficial	Bus & Matatu operators	Increased profit margin resulting from a reduction in crash-related expenses	Huge - savings from avoided vehicle repair costs, reduced insurance	Once implementation starts	High- economic gain, improvement in safety likely to confer public confidence.
Beneficial	Insurance Companies	Direct financial benefit, reduced compensation awards	Large- business profits	Soon after start of implementation	Crucial for sustenance of safe public transport and survival of motor insurance
Beneficial	Private motorists	Prevented crashes- injuries, deaths and vehicle damage, and the associated costs (medical, insurance, vehicle repairs)	Large- can result in a substantial reduction of number of crashes (depending on strictness of enforcement).	Long-term effects expected	Large- especially if strictly enforced, backed by publicity and heavy penalties
Beneficial	Private motorists	General improvements in driving behaviour and road safety; adoption of designated driver arrangements	Large- prevented crashes (damage, injuries, deaths and disabilities)	Immediately implementation starts and in the long term	Medium - existence of a group of recidivist drink-drivers unresponsive to the countermeasures
Beneficial	Alcohol Industry	Improved image of alcohol; promotion of server awareness; stimulate production of light beer.	Moderate- influence adoption of responsible drinking in society	Several months and years after passage of legislation	Moderate- might influence acceptance of policy in the long run
Beneficial	Traffic Police	Improved police efficiency, their public image and trust.	Moderate- depend on capacity to effectively enforce the legislation.	Soon after start of implementation and in the long-term.	Large- influences overall compliance with traffic rules by motorists
Financial	Ministry of Transport	Substantial initial funding needed for equipment, training and administration.	Large- both for initial and sustenance costs.	Immediately following passage of legislation and in the long run	Large- crucial for the success of the policy
Financial	Treasury	Budget allocation, constraints in public spending	Small- road safety funds already generated from fuel levy. Likely to gain from drink-driving fines.	Immediately and sustained	Crucial for policy implementation
Harmful	Lawyers	Loss of earnings from crash-related court presentations	Small- large - depend on reliance on income from traffic accident-related cases	Soon after start of implementation then level off in the long run	Low- lawyers will diversify their business
Harmful	Alcohol Industry	Possible reduction in alcohol sales	Small- drivers represent a small proportion of drinkers	After start of implementation then level off with time	Low- there is likely to be no significant decline in profits
Symbolic	NRSC	Improved institutional capacity, image and credibility	Large- depending on personnel and resources at the disposal of the Council	Concurrent with passage of legislation	Large- improve efficiency, authority and capacity to influence policy decisions

Figure 8.2 Network of relationships among key players involved in drink-driving policy-making process



8.2.4. Relationships and Lines of Influence between Organizations

An assessment was made of the nature of relationships that exist between the major players involved in the policy, and the direction and strength of influence they exert; these included both formal and informal mechanisms of access to key decision-makers. Figure 8.2 **(Network Map)** illustrates a network of relationships that currently exist between the key stakeholders in relation to policy on alcohol and driving. The strongest influence was apparent where formal mechanisms of direct access exist, such as those between the NRSC, MOTC and the Traffic Police department; as well as between the Ministry of Finance and all actors in the government sector, and donor agencies. The Ministry of Finance seemed to wield considerable power and influence over all ministries concerned. The AG's influence over NRSC was indirect through the Minister for Transport. The Council therefore lacks direct access to the AG's office. This bureaucratic bottleneck may present obstacles to the NRSC's ability to successfully initiate or refine a road safety policy proposal, and subsequently, cause delays in the decision-making process. Funding considerations, capacity to disburse technical resources, and existence of common institutional motives related to road safety work may be the other factors likely to determine the intensity of influence between these organizations.

Although the NRSC is the principal advisory body to the government on road safety matters, it lacks the capacity to effectively influence others, and currently exerts only a low-level informal relationship with most stakeholders. The Council's access to different organizations and individuals is also either limited or non-existent. In particular, no direct mechanisms of influence exist between the NRSC and the alcohol industry: the anticipated relationship between them is likely to be characterized by conflicts as brewers and bar owners are likely to feel that alcohol is unfairly being targeted for road safety interventions, while, in their view, other risk factors contributing to road crashes such as the poor state of roads and inefficient law enforcement have not been adequately addressed.

Links between government sector actors are more direct and formal, especially with the Treasury, whereas most professional and interest groups have no established mechanisms of accessing policy-makers: the exception is the strong link between the alcohol industry and Treasury (owing to financial interest in the revenue generated from taxes on alcohol). Relationships with politicians appear to be only through the media, being seen to be centrally placed in the network. There is a potential for the media to influence a number of players through creating public awareness as well as by acting as communicators within the policy community that include government ministries, the non-governmental sector, legislators, the international community and different interest groups. Thus, the mass media is well placed to draw attention to various policy-relevant road accident issues, and their reports can influence decisions of policy makers (Walt, 1994).

8.3. STRATEGIES FOR CHANGE

8.3.1. Transitional Changes and Opportunities for Influence

In order to identify opportunities for influence as well as obstacles that may interfere with the process of policy development, a list of the key players was constructed; and for each player, a description of recent organizational changes (transition) that have the potential to create a window of opportunity for policy formulation, as well as the form of influence and the rating of prospects for such influence were undertaken. The detail of transitional changes and the envisaged opportunities for influence of different players are shown in Table 8.3 (**Opportunity for policy change**). The greatest prospects of influence were anticipated to result from the political environment, implementing organizations and certain influential individuals. The main transitional events creating most opportune windows for change were associated with changes in key organizations with an interest in road safety: these included recent institutional changes in leadership (such as appointment of a new Commandant of the

Traffic Police[30]); initiation (by the Ministry of Transport) of the process of drafting new regulations covering all aspects of road safety[31]; the establishment of a task force by the Attorney-General to review the entire Traffic Act; the establishment of a new NGO (the Road Safety Network)[32] for road safety interventions; special budgetary provision by Treasury for revenue (the Petroleum Levy) designated specifically for road safety work[33]; and the development of a standard new driver training curriculum with courses on effects of alcohol. In addition, a private member's motion calling for drastic road safety measures[34] which was unanimously passed by parliament (see Chapter 2, section 2.7.2), presented an important opportunity for raising the level of political awareness and public debate. The subsequent creation of a new multisectoral state agency for road safety (the Road Safety Authority[35]) by the government to ensure effective implementation of road safety measures, emanated from parliamentary debate and passage of the motion. Parliamentary debate also reflected the level at which road safety issue is perceived as a problem, and the potential for political support for the introduction of more effective road safety interventions, including those addressing drink-driving. These recent developments present a favourable decision-making environment, enhancing the likelihood of successful formulation and adoption of a policy for preventing drinking and driving.

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[30]Daily Nation, September 6, 1996 (Editorial)

[31]Daily Nation, June 1, 1996

[32]Daily Nation, June 8, 1995

[33]Republic of Kenya. Minister for Finance's Budget Speech for the fiscal year 1996/97

[34]Daily Nation, July 25, 1996

[35]Daily Nation, July 27, 1966 (Editorial)

Table 8.3 Opportunities for influencing policy-making process (for selected players)

Player	Transition	Opportunity for influence	Prospect
Attorney General	AG's stated personal support for road safety improvements. Appointment of a task force reviewing the Traffic Act.	Opportunity for road safety policy review and establishment of drink-driving legislation.	High
National Road Safety Council	Undergoing reorganization to enhance effectiveness, designated to be an autonomous institution (the Road Safety Authority) with more resource allocation.	Strengthened policy-making capacity, ability to use research inputs and disseminate ideas. Identifying new sub-committee for reviewing alcohol and driving policy and proposing a legal limit.	High
Traffic Police	New Commandant of Traffic Police enthusiastic on efficient law enforcement and establishment of a legal alcohol limit. Member of NRSC.	Participation in policy-making process, opportunity to modify legislation and specify legal alcohol limit. Supportive in enforcing drink-driving law.	High
Ministry of Transport	Drafting a Bill on road safety improvements. The Ministry has fuel tax funds for road safety work.	New Bill for Cabinet discussion and parliamentary debate. Some funding available to initiate drink-driving interventions.	High
Bus & Matatu operators	Recent changes in PSV licensing procedures. Selection of influential representatives to negotiate measures for speed regulation.	Opportunity to incorporate drink-driving as a road safety issue in the negotiations.	Medium
Kenya Medical Association	Newly elected officials: strong advocates for improvements in health care and welfare of doctors. Active scientific committee, potential to draw attention of doctors to traffic injury.	Annual scientific conferences set opportunity for identifying injury prevention as a priority for public health action. Representation of KMA in the NRSC.	Medium
Media	Additional air time in the National radio and TV for dissemination of road safety information. Newly licenced independent radio stations.	Encourage a balanced public debate and consensus on alcohol and driving.	Medium
Road Safety Network	A new organization enthusiastic to promote road safety.	Focused activities on road safety work; Has personnel and resources. Representation in the NRSC.	Medium
Private motorists	New standardized driver training curriculum and manual. Newly elected AA leadership, strong advocates of drink-driving legislation.	Driver training and strict licencing procedures. Enhanced role in educating drivers about dangers of drink-driving and stiff penalties.	Medium
Politician (MP)	Parliamentary Bill on road safety; Election of motivated politicians at the next general elections (due later this year)	Enhanced political awareness and opportunity for demonstrating political support; Public statements in press and at political functions.	Low
Lawyers (LSK)	Newly elected governing Council pledging to cooperate with the government in reviewing legislation. Representation of lawyers in the NRSC.	Potential to participate in reviewing traffic legislation, defining legal limit and promoting acceptance of breath alcohol readings in courts. Opportunity to set standardized accident compensation scheme.	Low

8.3.2. Strategies and Actions for Winning Support for Policy

Having identified opportunities that may arise because of the transitional changes in the organizations, political environment or individuals in key positions, potential strategies likely to enhance the acceptance and implementation of a policy on drink-driving were assessed. Strategies and the corresponding actions were classified as: positive if they involved creating a new organization or strengthening the power of an existing organization or creating alliances among supporters; negative if they involved dealing with opponents; and symbolic if it sought to change the public's perception of the problem and the new policy through creating new buzzwords, publicity or changing the organization's name.

The risk associated with adopting each strategy was assessed as high or low depending on whether repercussions of such actions would either increase the chances of failure or not. Ramifications of actions entailed in each strategy was also evaluated in terms of potential problems and benefits to the desired policy change. Three key general strategies were considered likely to have the greatest influence in shifting positions of most players to support the policy: creating alliances with supporters through a wide representation of policy proponents in the working group drafting the policy proposal, mobilizing public support by increasing publicity and education on the effects of alcohol on driving, and winning support of key opponents.

A detailed description of key strategies, relevant actions needed, and the potential problems and benefits of each strategy are shown in Table 8.4 (**Possible Strategies**). Specific desirable actions considered likely to shift the position of key players in favour of the policy are further illustrated in Table 8.5 (**Actions for winning support**). The most critical action judged as potentially likely to be effective in enabling many opponents and non-mobilized players to support a drink-driving policy is extensive publicity with convincing information highlighting local epidemiologic data showing alcohol as a major risk factor in road crashes, as well as evidence of effectiveness of alcohol limit legislation and random breath testing in other countries. This action is anticipated to be potentially powerful in winning the support of most undecided players and weak supporters (to shift to the left) as illustrated in Figure 8.3 (**Affected Players - Future Positions**).

Specific incentives were considered for each key actor: for instance, encouraging brewers to undertake independent research on alcohol and driving was seen as a measure likely to enable them to relax their current opposition; incentives for doctors, such as funding for traffic injury research, and allowances for medico-legal work (performing breath and blood tests) would enhance accuracy of documentation of alcohol-related injury data as well as strengthen advocacy for drink driving legislation.

Table 8.4. Possible Strategies

Type	Action	Problem	Benefit
Develop coalition of supporters	Establish a coalition that includes wide representation of proponents.	May lead to compromises on certain aspects of policy perceived to undermine interests of some groups.	Increased influence over organizations, key players and the public in support of policy.
Mobilize public support	Increase awareness on effects of alcohol on driving through publicity and education. Subsidize costs of educational publications, TV& radio programmes.	Unconvinced with implementation process; interference with personal liberty; inefficient law enforcement; potential for corruption	Likely to promote making informed behavioural change and recognition of risks of alcohol and driving.
Win support of key opponents	Provide scientific and epidemiological data showing the association of alcohol with crashes.	Not perceived to be a key political issue "low-politics". Lack of local convincing data. Overriding economic considerations. Lack of funds to support research activities.	Helps to seek ways of engaging politicians in the policy debate, and to collaborate in programmes that benefit the general population.
Get support of the Insurance Industry	Introduce a clause of no payment of claims for alcohol-related crashes. Encourage insurance to invest in promoting road safety. Rate risk of vehicle and drivers on the basis of condition and drinking habits. Introduce a structured accident compensation scheme.	Might not be effective if enforcement is poor; there is a potential for corruption.	Incentive for more support by the insurance industry.
Get support of Treasury	Generate revenue from drink-drive fines.	Cost of implementation might be higher	Provides new source of government revenue likely to attract interest of Treasury.
Win support of brewers and alcohol retailers	Demonstrate adverse effects of alcohol and driving. Convince brewers of adverse publicity of drink-driving and the need to improve image of alcohol. Educate and inform bar owners /retailers of dangers of excessive drinking for people about to drive.	Lack of data with which to demonstrate adverse effects. Brewers worry about loss of sales.	Good image of alcohol. Adoption of responsible drinking behaviour.
Depict alcohol as a major cause of crashes	Increase media coverage and publicity about the contribution of alcohol in traffic accidents.	Opponents might argue for better enforcement of existing traffic laws and road improvements rather than introducing new legislation.	Focuses awareness and action on alcohol. Increases the potential for support for policy. Helps to place alcohol and driving on the policy agenda. Increases the chances of compliance based on informed decision and change in behaviour.
Win support from the medical profession	Appoint KMA representative in policy working task force. Provide incentives for doctors involved in road safety work. Provide funding for traffic injury research and sponsorship to scientific conferences on injury prevention.	Lack of co-operation by doctors benefitting financially from road crash victims. Time constraints in performing medico-legal breath and blood tests.	Getting support of doctors in policy formulation and implementation. Improving documentation and quality of information on alcohol and its adverse impact on injuries. Advocacy for policy by doctors has a potential for influencing public support.

Table 8.5 Actions needed for winning support of key actors

SUPPORT	NON-MOBILIZED	OPPOSITION

← **Brewers and Retailers**

- Demonstrate to brewers the effects of alcohol on driving, and convince them of the adverse publicity of drink-driving and the need to improve image of alcohol
- Encourage brewers to produce low-alcoholic and non-alcoholic beers and wines (with reduced tax)
- Educate bar owners of dangers of excessive drinking for people about to drive
- Encourage brewers to support research into alcohol problems

← **Attorney-General**

- Show data on drink-driving and legislation in other countries
- Provide convincing local epidemiological data
- Give rationale for choosing a specified legal limit
- Establish coalition s with policy proponents and increase advocacy for change.

← **Treasury**

- Highlight the enormous economic loss from traffic crashes
- Show potential savings that can be accrued if drinking and driving interventions were implemented
- Show drink-driving-related fines as additional source of revenue (to finance the programme)
- Encourage use of alcohol taxation as part of public health measure for reducing alcohol-related injuries

← **Media**

- Provide local data to the press highlighting association of alcohol with crashes
- Contribute articles to encourage informed media debate on alcohol and driving
- Exempt taxation on educational advertisements and supplements on road safety
- Encourage print and audio-visual media not to promote alcohol advertising that is associated with driving

← **KMA**

- Provide incentives for doctors involved in medico-legal breath and blood alcohol tests
- Provide funding to doctors for traffic injury research and sponsorship to scientific conferences
- Improve facilities for accident and emergency care
- Encourage doctors to maintain accurate casualty data including intoxication status

← **Insurance Industry**

- Introduce a clause of no payment of claims for injury and vehicle damage if a driver is guilty of drink-driving offence
- Allow insurance to rate risk of vehicle and drivers on the basis of drinking habits
- Charge higher premiums to drinking drivers
- Encourage insurance to invest funds in promotion of road safety, as they stand to reap more benefits

← **NRSC**

- Broaden responsibilities and authority with direct access to relevant ministries and organisations
- Provide adequate funding, resources and skilled personnel to increase efficiency
- Establish a road safety research Unit to generate data on impact of drink-driving interventions

← **Ministry of Transport**

- Show data on drink-driving and legislation in other countries
- Provide convincing local epidemiological data
- Give rationale for choosing a specified legal limit
- Strengthen capacity to develop comprehensive strategies for discouraging drinking and driving

Figure 8.3 Provide evidence of adverse effects of alcohol on driving

Affected Players Map: Road safety (Future Positions)						
High Support	Medium Support	Low Support	Non-mobilized	Low Opposition	Medium Opposition	High Opposition
Police	RSN	EmbSA	AG	Bars		
DNatio	WBank	Polit	Adv			
AAK	Nurse	LSK				
Insure	RTACas	KANU				
BusMat	KMA	Brewer				
NRSC	PDrive					
KTimes	MinFin					
MinTra	MOPW					

NOTE:

Additional stakeholders shown

MinTra	Ministry of Transport and Communications
MinFra	Ministry of Finance
MOPW	Ministry of Public Works
PDrive	Private motorists

The final anticipated position shifts expected to be achieved through application of the the combined effects of the various strategies envisaged, including media publicity is illustrated in Figure 8.4 **(Affected Players- Future Positions: Establish Coalitions and Provide Evidence of Effects of Alcohol)**. There is a potential for achieving substantial support for the new policy by developing coalitions with wide representation of influential proponents, and increasing the level of awareness of key decision-makers, interest groups and the public through providing local information highlighting the magnitude of risks associated with drinking and driving, and the possible solutions. The subsequent strong support anticipated from mid- and high level bureaucrats, such as those in the Ministries of Transport and Finance, the Attorney-General, and multilateral and bilateral donor agencies, is likely to increase the feasibility of whether the policy will be adopted or implemented. This strategy also has the potential to convince brewers to play a more active role in improving the image of alcohol and reducing its misuse, it can also enable the general public to make informed decisions and shift their attitudes in favour of the policy.

The feasibility of successful adoption of a policy for preventing alcohol-related crashes can be enhanced by simultaneously applying a number of strategies targeted at different key players. Consequently, the outcome of policy debate on drinking and driving is likely to favour public acceptance and compliance with the legislation and the related countermeasures.

Figure 8.4 Establish coalitions and highlight evidence of alcohol.

Affected Players Map: Road safety (Future Positions)						
High Support	Medium Support	Low Support	Non-mobilized	Low Opposition	Medium Opposition	High Opposition
Police	WBank	EmbSA				
DNatio	Nurse	Polit				
AAK	RTACas	LSK				
Insure	KANU	Adv				
BusMat	KMA	Bars				
NRSC	PDrive	Brewer				
RSN	MinFin					
KTimes	MOPW					

8.4. SUMMARY

This chapter has explored how selected stakeholders with interest in road safety and alcohol would influence decision-making in formulating a public policy on drinking and driving, and approaches to increase the political feasibility of such a policy. Key stakeholders (25) were identified from government ministries (MOTC, Treasury, Traffic Police Department and the Attorney-General); national groups (NRSC, KMA, LSK); non-governmental organizations (RSN, AA); commercial groups (insurance companies, public transporters, alcohol industry); the print media (Daily Nation, the Standard and Kenya Times newspapers); and individuals formerly injured in traffic crashes. With the exception of brewers and bar owners, all players were judged to be either undecided or had a low level of support for such a policy. Possible profit loss as a result of a likely decline in drinking was the main reason for opposition by brewers and alcohol retailers.

The nature of relationships that exist between key players determined the direction and strength of their influence. The existence of a formal mechanism of communication was considered as an important determinant of the intensity of influence, and the media are likely to play an important role in establishing communication links within the policy community and with the public. The NRSC seemed to lack capacity to effectively influence other key players; and the promotion of a drink driving policy places it in conflict with the alcohol industry.

Prospects for appropriate policy changes were considered likely to emanate from government institutions, key implementors and certain influential individuals. Specific transitional changes anticipated to creating opportunities for influencing the different players were identified. The key strategies considered as likely to successfully shift positions of players to support a drink-driving policy were creating alliances with supporters, mobilizing public support, and winning the support of key opponents. The most effective actions for promoting support were likely to result from having a wide representation of policy proponents in the task force drafting the new policy, providing convincing scientific and epidemiological information on the effects of drinking on driving, and increasing publicity and education about the proposed interventions. Specific incentives for key service providers such as the police (training, improved facilities, allowances) and medical profession (funding for traffic research, time and monetary allowances for performing breath and blood alcohol tests) were found to be desirable for enhancing the chances of effective implementation.

The simultaneous adoption of multiple strategies targeted at different players is likely to exert a stronger influence on stakeholders and play a greater role in convincing the government and the public that policy response to drink-driving is necessary, and that successful implementation of countermeasures is attainable.

CHAPTER 9

DISCUSSION OF THE RESULTS

This chapter is presented in three sections. The first section is an appraisal of methods of the study. The second discusses the main results in relation to the study objectives, with a focus on the significance of traffic injury and the effects of alcohol. The final section explores the prospects for applying these findings for making policy decisions for the establishment of drink-driving countermeasures.

9.1. METHODOLOGICAL APPRAISAL

The main purpose of this study was to generate information that is potentially usable for decision-making in developing a policy in relation to drink-driving as part of a wider road safety problem in Kenya. The methods employed were purposely designed to provide data that quantify the magnitude of effects of alcohol on injuries, as well as to facilitate an understanding of the perceptions of the public and policy makers with regard to causation of traffic accidents, their association with alcohol and their knowledge and preferences for strategies for specific prevention strategies. The various methodological approaches employed were complementary (see Chapter 3).

9.1.1. Strengths of the Methodology

Alcohol-related injuries are thought to be a burden on the health care systems in many countries (Kaplan et al, 1980; Walsh and Macleod, 1983): although this is hardly recorded in routine hospital statistics. Hospital emergency departments therefore offer opportunities for identifying injured individuals, and to estimate the prevalence of blood alcohol concentration at the time of attendance. For instance, Barancik et al (1983) in a hospital-based trauma study in Ohio, showed that injury rates for traffic crashes and assaults were higher than the figures reported in the official government statistics. The proportion of various types of injuries that are alcohol-related is generally not available in routine hospital statistics. Even for fatal motor-vehicle crashes where obligatory reporting of blood alcohol content of the driver involved is normally required by law, the actual figures reported are often incomplete and inaccurate. Emergency department studies have been shown to provide a better source of data on the association of alcohol with injuries than routine hospital statistics. Many trauma studies in a number of countries, such as those reported by Ryan et al., (1976) in Australia, James et al., (1984) in the United States, Galloway and Patel (1981), and Bradbury (1992) in the UK, Vingillis et al., (1988), McLellan et al., (1990) and Stoduto et al., (1993) in Canada, have been conducted in hospital settings. Few such studies have been undertaken in any developing countries (see Chapter 1, Table 1.9).

In the current study, all hospitals providing both primary and tertiary care in Eldoret town were included, so as to capture relevant information about trauma-affected patients seeking treatment and also to allow for an estimation of trauma case-load at each hospital, and rates for the various types of injuries occurring in the catchment population. It was possible to determine the distribution of different types of injuries and the characteristics of casualties, estimate their impact on hospital workload, the proportion attributed to road traffic crashes as well as to assess the extent of association with alcohol through a hospital-based survey (see Chapters 4 and 5).

To help define the contribution of alcohol consumption in motor vehicle crashes, it was necessary to obtain an estimate of the extent of drinking and driving, and the characteristics of drinking drivers under the general driving conditions. This is a fundamental requirement for understanding the problem, especially for decision-making purposes. The basic means of obtaining such data is normally through a roadside survey of drivers, employing a methodology designed by Borkenstein et al. (1964). The method, adapted in a number of studies in different settings such as the UK (Sabey et al., 1988), Australia (McLean and Holubowycz, 1981; McLean et al.,1991), Canada (Lawson et al., 1981) and recently in Papua

New Guinea (Hills et al., 1996), has been shown to provide valid estimates of the prevalence of drinking and driving in the general driving population. With some modifications, a similar approach was adopted in this study (see Chapter 3, section 3.2.3.1 b). The findings, presented in Chapter 6, compare closely with those from other international studies (see section 9.2.4 of this chapter).

Since a key purpose of this study is to contribute to the development of a policy for the prevention of alcohol-related crashes, it was necessary that some understanding be ascertained of whether the public and decision makers perceive alcohol to be a contributory factor, and how they would respond to interventions that discourage drink-driving. Having established the magnitude of the problem from the epidemiological surveys, as a basis of defining policy content, qualitative techniques were applied to provide a broader understanding of contextual factors that may influence both decision-making process and implementation of the policy. Yach (1992) and Steckler et al. (1992) point out the complementary nature of the two methodologies. This is quite evident in this study: for instance, the fact that two-thirds of respondents interviewed recognize alcohol as an important contributing factor in road "accidents" strengthen the validity of quantitative results. Although in-depth interviews and focus group discussions were carried out on a limited number of respondents, the fact that participants represented a wide section of the public, interest groups, policy-makers and service providers, gives some general indication of the support or opposition likely to be anticipated if a new policy on alcohol and driving were to be introduced. For example, 87% of informants were supportive of the establishment and enforcement of a legal alcohol limit, and virtually all informants cited at least one potential impediment to implementation. These encouraging findings plus others discussed in Chapter 7, in combination with epidemiological data are likely to improve the strength of advocacy for a policy on drunk-driving. In addition, using other sources of information such as the printed media, routine accident statistics and relevant documents, further enhanced understanding of the different factors contributing to the worsening road safety situation in the country.

The final methodological design attempted to link information generated through the above methods to policy-making process. A political mapping approach to policy formulation, described by Reich (1994), that takes into account a range of factors including epidemiological data, organizational, economic and political factors, as well as concerns of different interest groups, was applied. Although published literature that report the use of this method is limited to a few retrospective case studies (Reich et al., 1993; Waits and Reich, 1993; Reich, 1995a), there is evidence that the political mapping approach can assist in understanding the networks and relationships between organizations that influence the process of policy formulation. The procedure may also be used as a means of prospectively analysing policy context, actors and stakeholders, their interests and whether they are likely to support or oppose the policy under consideration. Political mapping in this study was therefore used to identify contextual factors impacting on policy process and as a research tool, to systematically analyse all the information gathered from the various sub-studies (about road accidents, traffic injury burden on health services, alcohol prevalence in motorists, and attitudes and perceptions of the society on drinking and driving). Whereas the method may not identify the most appropriate policy, it has the capacity to enhance the likelihood of successful policy development, especially once a key policy such as that establishing a legal limit has been proposed. It is also likely to improve the political acceptance of the policy by identifying various factors that may affect the policy and identifying appropriate strategies which will help win support or at least undermine the opposition of likely opponents (see Chapter 8).

9.1.2. Study Limitations

a) Hospital-based survey:

Three main limitations were noted in this sub-study. Firstly, there is the hospital bias, as casualties who choose not to attend or those slightly injured who get treated in doctors' surgeries, and those who die on the scene or before reaching hospitals were excluded. This was purposely done in order to focus on casualties with injuries severe enough to actually require hospital treatment: also, outpatient departments provide the best opportunity for capturing data on a wide range of non-fatal injuries. Unfortunately, it limits the application of study findings to hospital attenders only as nothing is known about those seeking treatment elsewhere, the calculated population injury rates from the figures are therefore likely to be under-estimates. Nevertheless minimum incidence rates of those requiring or choosing to use hospitals for treatment can be identified. Because of exclusion of pre-hospital deaths, the mean value of injury severity scores in assessing hospital utilization in relation to various types of injuries is likely to be underestimated. Also, the total burden of injury-related deaths is underestimated by exclusion deaths occurring before arrival. However, these limitations do not invalidate the study, as they have been taken into account in the interpretation of results.

Secondly, due to various reasons, alcohol content could not be measured in all casualties, and the time lag between injury event and measurement of blood alcohol varied. In the absence of ambulance services or a reliable public transport system, considerable delays in reaching hospitals frequently occur, as casualties have to seek help for transportation or hire a taxi: it was therefore necessary to allow for a sufficient time interval for a patient to be eligible for alcohol evaluation (41% of eligible adults presented to hospital after 10 hours since sustaining injury; see Chapter 4, Box 4.1). Unfortunately, extending the time interval to 10 hours increased the probability of a casualty having a negative breath test or registering a lower BAC value, as alcohol levels in the blood rapidly decline with time due to metabolism, at the rate of 15-20 mg% per hour (Gilman et al., 1990). Perhaps future studies should restrict alcohol evaluation to only casualties arriving within the first 6 hours of injury, although this will require a larger sample size, achievable either by increasing the study duration or conducting a multicentre study (at extra cost).

Non-participation for breath (36.4%) or blood alcohol tests (78.2%) is another limiting factor. Perpetrators of assaults or those responsible for traffic accidents are more likely to refuse or intentionally delay to present themselves for treatment (because of guilt or to escape identification and possible consequences). As these are the groups that require more focused interventions, lack of alcohol prevalence data about them may lead to misdirecting efforts and resources to passive victims of trauma, resulting in a negligible effect. In the absence of any legal requirement for casualties attending hospitals to provide a breath or blood sample for alcohol evaluation, any study seeking to estimate the contribution of alcohol to trauma will have to contend with refusals. Also, this study did not enquire about persons judged to be responsible for the injury, so as to be able to establish a causal link between alcohol consumption and injury event. A short interview of the victims, relatives or witnesses could have helped to identify persons considered responsible, whose alcohol levels could then have been specifically analysed. Caution is therefore warranted in interpreting the alcohol prevalence results.

Lastly, in the context of severe injuries or life-threatening situations, administration of BACs is a low priority in casualty departments: this, and the exclusion of those dead before or on arrival, may have contributed to the lack of a significant association between injury severity score (ISS) and the blood alcohol level. Attempt was made to obtain post-mortem BAC data of fatally injured victims taken directly to the mortuary, but this was unsuccessful as blood samples for alcohol analysis were not routinely taken during post-mortem examinations (done by general duty medical officers). The possibility of obtaining BACs at the scene of accident (for traffic injuries) or at the time of death needs to be considered in the design of future studies.

Taking a small drink to calm down after a traumatic injury is uncommon in the Kenyan society, so this is not likely to have distorted results of BAC testing. The results presented in Chapters 4 and 5, describing characteristics of injury presentations, their burden on hospital services and the role of alcohol, should therefore be understood in the light of these limitations.

b) A roadside survey of drivers:

This survey was aimed at obtaining a general idea of levels of alcohol in non-accident involved drivers. It had two main limitations: its timing and duration. In the first place, it involved only drivers on the road between 7 pm and 12 midnight, this implies that alcohol prevalence data obtained tell us nothing about drinking rates of motorists at other times of the day or night. Previous similar surveys elsewhere have been undertaken at times when drinking is known to be common. Roadside surveys in Australia (McLean and Holubowycz, 1981; McLean et al., 1991), UK (Sabey et al., 1988), and Papua New Guinea (Hills et al., 1996) were conducted during night-time (between 10 pm and 3 am), and in Canada, they were carried out in two phases from 9 pm to 12 midnight and between 1 am and 3 am (Lawson et al., 1982). In this study, dependence on the traffic police to stop motorists also meant that survey times had to be adjusted to accommodate police schedules (after their normal working hours): these times also coincide with peak drinking hours when strict enforcement of drink-driving countermeasures will be most needed, if such a policy is introduced.

The restriction of the survey to one period of 7 consecutive days, during the last week of March 1995 (not Easter holiday period), may however constrain the reliability of results, as this may not represent a typical week. Although the original plan was to conduct two one-week surveys (one at month-end and the second at mid-month period), this was not achieved, principally due to logistic and financial reasons. It is acknowledged that repeat surveys would have improved the probability sampling of drivers on different days of the week and increased the sample size. Other studies (cited above) employed repeated surveys on specific days of the week, mostly between Wednesday and Saturday; although one has to note that these were large scale multidisciplinary studies backed by sufficient mobilization of state or institutional resources. Such arrangement was unattainable in the current single-handed research. Some ethical issues also emerged which will need to be addressed in future surveys: for instance, how to handle intoxicated drivers in the absence of a legal BAC limit, and the presence of the traffic police may be seen to coerce motorists into participating. Conducting the survey in conjunction with the police, however, offered a number of advantages (Odero, 1996), including ensuring security of both motorists and the research team, enhancing public acceptability of random breathtesting, attracting cooperation of the police department in defining drink-driving as a problem for policy decision and increasing the potential for future enforcement of drink-driving policy.

Nevertheless, these limitations should not seriously affect the value of the results. Replication of a similar study elsewhere in the country is, however, warranted so as to allow for comparisons and a wider application of findings at a national level.

c) Qualitative surveys:

A range of qualitative research approaches, including a limited number of explorative interviews, were employed. Through triangulation, attempts were made to enhance their validity and credibility, as findings from the different information sources supported each other.

Overall, qualitative interviews were time-consuming and at times frustrating as appointments for interviews, especially with some key informants, were often cancelled at the last minute. Senior government officials were the most reluctant to be interviewed, and were cautious in disclosing information they considered as sensitive or confidential. Although this was minimized by reassuring them of anonymity (names would not be recorded or disclosed) and allowing them to stop tape recording an interview whenever they wanted, it is possible that some biases might have been introduced in the form of deliberate attempts to hide information. Such biases were minimized through counterchecking with information from other sources as well recognizing these limitations in the interpretation.

All interviews were conducted by the researcher. This ensured acceptance by respondents, especially after knowing his professional medical background and institutional affiliation. However, this may have biased informant responses in the direction of views they considered to be of interest to the researcher. Where such bias might have been introduced, attempts to minimize them were taken through probes and follow-up questions, in addition, the second moderator (a social scientist) less known to respondents and present at most interviews helped to seek further clarification.

Since in-depth interviews and FGDs were limited to participants purposely selected by the researcher on the basis of their expected knowledge about the main purpose of this research, this might limit generalizability of the information collected. Such an effect was reduced through recognition of the potential biases, and triangulating with information from other sources in the interpretation of findings.

The political mapping component of this research may have introduced some potential biases, since the analysis was based on the researcher's value judgement of the anticipated responses by different stakeholders. Someone else might view these differently. The actors identified in stakeholder analysis were not interviewed directly about a policy on drink-driving but assessments were made by the researcher on the basis of available contextual information and epidemiological data. There might be some reservations about the validity of some of the judgements, but as this is one of the few attempts to research the potential value of a systemic analysis of decision-making process in the development of a new public policy in Kenya, any limitations are acknowledged. The conclusions drawn should therefore be understood in the light of these assumptions. It is nevertheless desirable that future studies should endeavour to more directly obtain views of the relevant individuals and organizations.

Through linking results from the various components of the research, the strength of the methodology, the validity of findings and their potential application in policy-making process is enhanced.

9.2. INTERPRETATION OF FINDINGS

9.2.1. Characteristics of Injuries

This survey provides data on the incidence of non-fatal injuries over a 6-month period in hospitals attenders in Eldoret town. To date there is no information about the frequency and impact of different types of injuries on hospital services in Kenya. This study shows that injury-related attendances account for 6.5% of all patients seeking hospital treatment in Eldoret, with road traffic "accidents" being the second (after assaults) leading cause of injuries, but are the most frequent mechanism responsible for the largest proportion (39.3%) of injury-related admissions. Falls and burns rank third and fourth, respectively, as causes of injuries requiring hospital treatment. The estimated overall hospital attendance rate for injury per 100,000 population per year of 1,183.7, found in this study, is considerably lower than that reported in studies elsewhere. For instance, in the Western Cape area of South Africa, the annual hospital-based injury rate in 1991/92 was 9,541 per 100,000 population (NTRP, 1994), whereas rates between 2,000 and 3,000 injury-related attendances per 100,000 population per year have been documented in Zimbabwe (Zwi et al., 1993). The large differences between studies may reflect actual differences in rates of injury requiring medical attention in hospitals in the different settings, use of other services (such as private clinics and health centres), and the accuracy of the catchment populations used as denominators. Considerable variations in rates by type of injury, age and sex of casualties are also evident: being greater for assaults (457.9 per 100,000/year) than other types of injuries (228 for traffic, 202.4 for fall, and 47 for burns), and in males (1650) and adults aged 15 years and over (1824). Most traffic victims (92.5%) are adolescents and adults aged 15 years and over, with the group at highest risk being 20-44 years (70.5%). Children under 15 years of age account for only 7.5% (mainly as pedestrians and passengers). Males are at a higher risk across all types of injuries, in particular traffic, where the ratio of males: females is greatest (3.5:1). A previous study by Jacobs et al., (1977) of traffic-affected admissions in two hospitals in Nairobi, shows comparable age distribution, with 11.5% under 15 years and 76% aged 15-44 years, unfortunately the distribution by gender was not presented. Other previous studies in Kenya, based on hospital records, give some limited indication on the characteristics of injury morbidity. Katsivo et al., (1994), for example, in a review of injuries involving adults occurring in the domestic environment in Nairobi, found domestic violence, falls and open fires to be the leading causes of trauma that needed treatment at health facilities; and high risk groups in all types of injuries as being men and those aged 20-39 years. Another study in Nairobi (Muniu et al., 1994) described only fatal non-traffic injuries. Comprehensive data covering all types of injuries and ages of casualties, that would allow for identification of priority types of injury by external causes, groups most affected (age, sex, occupation) as well as the nature of injuries in Kenya is therefore scarce.

Few studies in Africa have documented the importance of road trauma as a cause of hospital attendance. For instance, hospital-based studies in Ghana (Mock et al.,1995) and Nigeria (Asogwa and Ubionu, 1985; Odelowo, 1991)showed road traffic "accidents" to be the most common cause of injury-related admissions followed by burns or falls; and in another hospital study also in Nigeria (Elechi et al., 1990), traffic "accidents" ranked second after assaults as the leading cause of injuries. In Senegal (Hatton et al., 1986), traffic injuries ranked third after falls and burns among trauma attenders; while in South Africa (Van der Spuy, 1991; Butchart et al., 1991; Byarugaba and Kielkowski, 1994), traffic crashes follow violence as the most common cause of trauma requiring medical treatment. Irrespective of variations in ranking, traffic crashes remain as the major mechanism of injuries: and remarkable similarities exist in the age-sex distribution of casualties involved across most developing countries (Taket et al., 1991). (see Chapter 1, section 1.3.2.2).

The fact that the majority of road traffic casualties (56.2%) are passengers is not surprising: nearly 70% of the total number of passengers get injured in crashes involving buses and *matatus* which are often overcrowded. The relatively small proportion of pedestrian casualties (17.7%) is unexpected, as they comprise the largest proportion of road deaths (NRSC, 1992), perhaps this is because most pedestrian collisions are fatal with most deaths occurring on the scene. The proportion of drivers affected (11.4%) is about the same as among fatalities reported in the national accident statistics (12%), while pedal cyclists represent 13.4%, a proportion greater than that reported in fatality statistics (8.1%). A small number of people sitting by the roadside (street traders) also usually get injured (1.3%).

Interpersonal violence or assaults are most common in the age group 20-39 years, with the risk among males being more than double that of females (2.4:1), a pattern that is seen globally (World Bank, 1993; WHO, 1996). Children are more at risk of burn and fall-related injuries, with boys being more likely than girls to be involved (with a gender ratio of 1.7:1), the exception is found in age groups 5-9 years and 10-14 years where girls are at a greater risk of sustaining burn and assault-related injuries, respectively, compared to boys of the same age group. Similar findings have been reported by Mwaura et al. (1994) in a retrospective study involving a review of case files of persons aged under 18 years attending health centres in Nairobi. A hospital-based study of injury-affected children aged 0-19 years in a township in Johannesburg, South Africa (Zwi et al., 1995) also documented a very similar male: female ratio of 1.7, but with violence-related injuries being greater in males aged 15-19 years (male: female ratio =2.5). Overall, the distribution of childhood injuries by gender found in the current study is comparable to the global pattern (Manciaux and Romer, 1986), indicating boys to be at a higher risk than girls across nearly all types of injuries.

The temporal distribution of injury occurrence indicates a greater risk of assaults on weekends and at night. Traffic crashes, on the contrary, are more common during daytime with no significant across the week variation. A study in Saudi Arabia (Ofosu et al., 1988) reported similar findings, but most surveys in a number of developing countries show greater frequency of crashes during weekends (Kaye, 1971; Ferguson, 1974; Wyatt, 1980; Fosseus, 1983; Sinha et al., 1989; Wong et al., 1990). A significant feature of night-time traffic crashes is that nearly 90% happen between 7 pm and midnight, with the highest frequency being on Saturday nights. Literature from other developing countries such as Papua New Guinea (Sinha et al., 1981), Nigeria (Obembe, 1988), South Africa (Ferguson, 1974; Fosseus, 1983), and Trinidad and Tobago (Holder,1989) report similar findings. Given that traffic density is much reduced at night, the increased probability of being involved in a motor vehicle crash (mainly dusk to midnight) suggests the influence of specific risk factors affecting night-time driving.

Evidence from this study suggests that the increased risk of a driver being involved in a motor-vehicle crash at night and during weekends is associated with alcohol consumption. For the first time in Kenya, this study documents that a large proportion of drivers involved in road crashes (60%) had been drinking prior to the crash, of whom two-thirds have BACs in excess of 50 mg%. This proportion is by far greater than in pedestrians (33.3%), passengers (16%) and cyclists (8.3%) who sustained injuries during the same period. The key risk factors associated with alcohol-related crashes identified in this study are being male, over 30 years of age, a motor vehicle driver, and travel by road on a weekend or at night. Alcohol use is a significant factor affecting not only drivers, but also a large proportion of pedestrians. These findings are important for the development of targeted traffic injury control priorities and strategies. In the African continent, South Africa is perhaps the only country that has provided some empirical evidence of levels of alcohol involvement in crashes (Myers et al., 1977; Fosseus, 1983; Peden et al,. 1996). Many other developing countries have yet to recognize alcohol as a major factor in road accidents, and there is a dearth of relevant data that can help elucidate the nature of the problem (see Chapter 1, section 1.3.3).

Alcohol abuse is a well known risk factor for interpersonal violence worldwide, and in some studies alcohol is estimated to account for over half of cases of assaults (WHO, 1996), with considerable variations between countries. For instance, in a recent hospital-based survey in Western Pacific countries, Perkins et al (1995) found a substantial proportion of assaults to be alcohol-related (82% in Fiji, 67% in Australia and 22% in Papua New Guinea), while in South Africa up to 65% of interpersonal violence is estimated to be attributable to alcohol (Parry et al, 1996). The results of this study reveal comparable proportions, with 43% of assaulted patients having a positive blood alcohol and nearly a third being intoxicated (BAC≥50 mg%). Once again, however, these data will refer to both perpetrators and victims, and may thus under-estimate alcohol as a factor contributing to the event occurring. Although alcohol misuse may be recognized as one of the key factors associated with assaults, there is no systematic method of documention, and specific alcohol treatment programmes are currently non-existent in Kenya. There is an urgent need for public health professionals to play a more active role in maintaining proper documentation of alcohol-related events presenting to health care facilities, undertake research to identify the most affected risk groups in the population and be involved in the development of strategies for addressing it both at community and national levels.

9.2.2. Impact of Traffic Injuries on Hospital Services

A striking feature of the current study is the demonstration of the extent to which traffic crashes contribute to increased utilization of both outpatient and inpatient services. In terms of use of diagnostic services, the demand for X-ray services is clearly greater for fall-affected patients, while road traffic crashes is second, with at least 40% of the victims requiring an X-ray. Given the nature of traffic-related trauma and the numbers involved (arriving simultaneously in the event of a bus or *matatu* crashing), the urgency and priority for X-rays create instantenous overload in the department (often at the expense of patients with other conditions). Trauma from RTAs has been reported to be the main reason for an X-ray examination in district hospitals in Kenya (Raja, 1982), and in rural hospitals in Nigeria (Makanjuola, 1982). With regard to the use of surgical services, assaults present the single most frequent cause of injuries that need stitching and dressing in outpatient departments, while fall trauma places significant demands on skeletal reduction procedures (with plaster casts or traction). Injuries from traffic crashes are characterized by the high utilization rate of operating theatres (approximately 50% of all trauma-related major surgeries) which has implications for the costs of medical services in terms of resource inputs and staff requirements. Although this study did not attempt to estimate the cost of injuries on hospital services, these tracer indicators suggest that traffic-related trauma exerts a considerable burden on the already overwhelmed health care services, relative to other causes of injury. Hardly any information is available on the economic costs of injury in Kenya that would allow for an estimation of the proportion attributable to road trauma. An earlier estimate by the Road Safety Unit (MOPW, 1992) indicates that medical costs alone represent 20% of the total unit cost of a non-fatal traffic injury (comprising loss of output, vehicle damage, medical care), based on figures obtained from one private hospital in Nairobi. In the UK, for comparison, the equivalent proportion for a serious or slight injury treated in 1994, estimated from hospital surveys, was just 8% (TRL, 1995). Despite the many differences that exist between Kenya and U.K, these values imply that the cost of treatment for a traffic injury, as a proportion of the total unit cost, is more than twice as great in Kenya as in the UK. However, more empirical costing data are urgently needed to assess the potentially avoidable traffic injury-related costs if effective interventions were implemented. Such cost data may also be extremely valuable in influencing policy-makers to address this issue.

Many studies undertaken in developing countries have attempted to present the mean length of hospital stay as an indicator of hospital utilization attributable to traffic trauma (see Chapter 1, Table 1.5). While this may be a reasonable measure, given the lack of other objective methods, equivalent data for other mechanisms of injury is often not provided for comparison. This study has gone further by illustrating the variability of length of stay by type of injury, age and sex of a casualty, and by hospital of treatment. It is clear that burn and fall injuries, on average, result in a greater period of hospitalization (mean LOS 15.5 and 12.8 days, respectively) than those from traffic (10.6 days). However, when the total trauma-related bed-days are considered, traffic injuries are the most important, especially in adolescents and adults (responsible for 54% of their total in-patient days attributed to injuries). The relative importance of burn and fall injuries in children's wards is also demonstrated (accounting for 35% and 33.3% of the trauma-related bed-days, respectively). Although bed-occupancy rates are greater for males, in both children and adults, a specific feature in childhood is that boys with road trauma (mainly from bicycle accidents) on average spend more days in hospital than girls (14.5 days versus 3.3 days); whereas girls admitted with burns stay longer than boys (15.1 days versus 9.4 days). Data from Zimbabwe, reported by Zwi et al. (1993), show a similar pattern, with traffic, falls and burns utilising most bed-days. Such data, in addition to illustrating patterns of hospital use, provides some indication of the burden placed on the hospital services, and may be valuable in identifying the key determinants of injuries that require inpatient treatment. It also provides additional information that reinforces advocacy for initiation of appropriate injury prevention and control programmes.

Injury severity score provides a valid measure of morbidity status of a casualty and the prognosis of survival or death from multiple injuries (Baker el al., 1974). ISS is currently the most widely used method for determining overall injury severity (Ali and Sherpherd, 1994). Patients with low ISS have less forms of injuries, in general, recover rapidly, whereas those with higher scores are more likely to have a longer period of recuperation. In this study, most patients (76.6%) presenting have injuries of minor character (ISS 0-3), of which approximately 50% are assault-related (sustained in brawls, domestic fights, mugging). More than half are of moderate severity (ISS 4-8) principally arising from falls (fractures and dislocations), whereas nearly three-quarters (73.9%) of all injuries classified as severe or critical (ISS$\geq$16) are due to traffic crashes. This pattern gives some indication of the relative importance of each injury mechanism in terms of the likelihood of hospitalization, survival or death, as well the range and amount of resources likely to be required for treatment. And for those affected by traffic trauma, a greater proportion of pedestrians sustain more severe forms of injuries than other road-users: the fact that vehicle-pedestrian collisions are more likely to be fatal or critical (due to crash impact force) than other types of crashes is biomechanically plausible.

There is a significant positive correlation between injury severity score and the length of hospitalization, indicating that the greater the severity of injury, the longer the period a patient remains in hospital. An earlier study by Bull (1975) and recently by Rosman et al., (1996), further provide consistent evidence of the linear relationship between injury severity and LOS with regard to road traffic casualties. This implies that the length of stay may be used as a proxy measure of injury severity. However, this needs to be cautiously applied for three reasons: firstly, some patients with minor injuries may remain in hospital for more days due to other complications; secondly, other patients may be detained for personal reasons (such as inability to promptly settle hospital bills, or not having bus fare or relatives nearby to help with transportation); and finally, seriously injured patients may stay for only a short period before being transferred to tertiary hospitals, such as those with ICU facilities for specialized care. One also needs to be aware of the potential limitations when comparing hospitalization rates between different hospitals. For instance, data from the current study indicates a tendency for some profit-making private hospitals to retain patients with less severe injuries for disproportionately longer days: this is likely to distort the relationship between ISS and the actual LOS. It is therefore desirable that minimum admission criteria, standardized inpatient management practices and patient discharge procedures are maintained across different hospitals, in order to improve the validity of using the mean length of stay as an indicator of both injury severity and hospital utilization.

9.2.3. Effects of Alcohol on Injury Severity and Length of Hospital Stay

Alcohol is thought to increase severity of injuries, although clinical evidence is conflicting. A large amount of research literature on alcohol comes from industrialised countries. Most studies have not been able to demonstrate any correlation in non-fatal injuries (Huth et al., 1983; Thal et al., 1985; Soderstrom and Eastern, 1987), some have shown a positive correlation among driver (Borkenstein, 1974; Waller, 1986; Warren et al., 1981) and pedestrian injuries (Jehle and Cottington, 1988; Miles-Doan, 1996), while others have even reported a negative correlation in all trauma cases (Ward et al., 1982).

The current study has not demonstrated significant differences in injury severity levels attributable to alcohol in the overall sample of participating subjects, but some cause-specific differences emerged. For instance, sober fall-affected patients have higher ISS scores and, on average, stay in hospital for a longer period than those who have consumed alcohol. This may be intuitively explained by the fact that sober individuals are likely to be involved in high-energy activities such as running, tree-climbing or playing football, and in the process fall and sustain a head injury, multiple or compound fractures, whereas an intoxicated person is likely to sustain low-energy falls just by missing a step or landing in a ditch while walking unsteadily, resulting in less severe forms of injury such as a sprain, dislocation or a simple fracture. Likewise, Hankanen and Smith (1990) in Finland reported a negative correlation of severity of injury and BAC among fall-affected admissions. Sober assaulted patients also tend to sustain more severe injuries, resulting in longer hospital stay than those with detectable amounts of blood alcohol. This may arise where a victim is attacked by someone with a criminal intent (such as violent robbery) or by a drunk partner (common in domestic violence), inflicting serious and sometimes fatal injuries. On the contrary, Sherpherd et al., (1988) in Bristol, found that assaulted patients who had consumed alcohol had more serious injuries, and they postulated that this may have arisen either because aggression and loss of judgement prolongs violence or because intoxicated persons are less able to avoid blows. Whereas the association of alcohol consumption with interpersonal violence is well recognized as an important precipitating factor, the exact links with injury severity seem to be unclear. To establish more direct relationships, one would need to take into account the specific circumstances of the injury event and also to clearly define the groups affected either as perpetrators of violence or as passive victims, then analyse the contribution of alcohol in each group. It is also necessary to recognize the significant cross-cultural and regional variations in the extent of alcohol use.

With regard to traffic injuries, alcohol positive subjects have marginally higher mean ISS score than sober individuals and spend more days in hospital: the small difference found in this study may have arisen because of the exclusion of fatal crash victims dying on the scene or before reaching hospital, most of whom could have been alcohol-involved, and due to difficulties (refusals and delays) in obtaining blood samples from seriously injured subjects. Many studies elsewhere have found more severe injuries among alcohol-affected road traffic casualties (Tulloh and Collopy, 1994), especially among pedestrians (Jehle et al., 1988; Vestrup and Reid, 1989; Peden, 1996; and Miles-Doan, 1996). Only one fatality study (Jurkovich et al., 1993) reported no significant differences in pedestrian mortality rates attributable to alcohol. Possible reasons for increased severity of injury among the alcohol-involved group may be explained by the higher impact of collisions as intoxicated motorists are likely to be driving fast. Another reason advanced by Waller et al., (1986) is that a drinking driver is less likely to use a seat belt than a non-drinking driver, and as a result suffer more severe forms of injuries. Although findings of this study are to some extent consistent with previous research, further studies controlling for elapsed time, and crash characteristics, such as speed of vehicle and seat belt use, are needed.

In summary, the results of this study demonstrate a strong positive correlation of injury severity with the length of hospitalization, and that the net effect of alcohol on all injuries together is negligible. The nature and severity of injury vary by the main external cause; the effect of alcohol similarly varies from one mechanism to another: it is associated with less severe forms of injury in falls and assaults, but apparently potentiates injury in motor vehicle crashes. The results based on one mechanism of injury, therefore, cannot be generalized to other causes. In addition, patients differ by demographical factors such as age and gender, which need to be adjusted for in making comparisons. Performing blood alcohol screening routinely on admitted casualties should be encouraged, not only for clinical assessment and management of patients, but also for the development of effective intervention strategies at both primary and tertiary levels.

9.2.4. The Contribution of Alcohol in Road Traffic Crashes

On the basis of available scientific evidence, the ideal blood alcohol concentration in a driver should be zero, but many countries where a BAC legal limit is in force have variable levels (range from 0.02% in Sweden to 0.10% in the United States). A number of factors influence the choice of a legal limit: these include availability of information defining the nature of the problem, orientation of policy makers, interests of the alcohol industry, public opinion, capacity for implementation, and lessons of drinking and driving countermeasures in other countries.

In countries where no legal limit exists such as Kenya, the first logical step should therefore be to establish the extent to which alcohol contributes to motor vehicle crashes; and evidence from a roadside survey of a sample of drivers is likely to be of help. Firstly, driving in Eldoret (and generally in Kenya) is predominantly a male activity (constituted 98% of motorists in the sample), and 20% of them drive after consuming alcohol, with 8.5% having BAC levels exceeding 50 mg% (0.05%). Those in the age groups 25-34 years are more likely to have been drinking, and very few younger drivers seem to take alcohol. This pattern is quite different from that seen in Western countries, where alcohol prevalence rates are generally lower and younger drivers are more often involved. For instance, roadside night-time surveys in the UK found only between 1.0% and 1.7% of drivers to be over the legal limit of 80 mg% (Sabey et al., 1988; Everest et al., 1990), and in Australia, 4% were over the limit of 50 mg% (McLean and Holubowycz, 1981; McLean et al., 1991), while in Canada, the proportion of night-time drivers with BAC levels exceeding 80 mg% was 6.1% (Lawson et al, 1982). All these studies found the highest impairment rate in young drivers of ages 16-24 years, with males being much more likely than females to have been drinking. In contrast, a recent survey of 891 drivers (97% male) in Papua New Guinea (Johnson, et al., 1995; Hills et al., 1996), shows very high alcohol prevalence levels: 38.5% had been drinking, and 24% had BACs in excess of 80 mg%, with the age group most affected being very similar to that found in the Eldoret study (26-35 years). Series of surveys of drivers stopped at roadblocks between 8 pm and 12 midnight in South Africa since 1990 (Butchart et al., 1996) have consistently found 5.5% drivers to have blood alcohol levels over the legal limit (80 mg%); whereas an earlier roadside survey carried out between midnight and 5 a.m. in Argentina (Fernadez et al., 1985) showed very high alcohol prevalence rates with considerable variations between weekdays, Saturdays and public holidays (respectively, 39.3%, 50.1% and 43.6%), indicating the association of drink-driving with leisure activities.

One of the significant findings of this study is that drinking is more common among private motorists than in professional drivers, they are also more likely to be heavy drinkers. This, for one, indicates the need to direct preventive measures to the general public, but also it should be encouraging to the public transport industry to cooperate as they might not lose out if drinking and driving were made illegal and enforced. Local driving over short trips-mostly to or from popular drinking places and non-working leisure trips, being alone or in the company of one passenger, night-time driving between 9 pm and 12 midnight (coinciding with bar-opening hours), and driving along particular streets are the other key factors shown to be strongly associated with drink-driving. Heavy drinking (BAC>50 mg%) is more common on weekends, comparable to the Papua New Guinea study, although distinct across the week variation is not evident. In the absence of any other data on drink-driving, these results can be used as a baseline to guide policy makers in defining a legal limit as well as in designing and planning appropriate strategies for combatting the problem of drinking and driving. For example, ensuring a police presence (preferably associated with random breath testing) along routes known to be used by a high proportion of drinking drivers at certain times (say, between 8 pm and midnight) in itself may be a deterrent measure; making lessons on the effects of alcohol on driving a compulsory course in driver training schools and examinable for licensing would also increase awareness and discourage the inexperienced newly qualified drivers, especially first generation car owners, from combining drinking with driving. For example, in every driving test, questions about how many drinks you can have before the limit being exceeded, and what fines or penalties are for drunk driving could be routinely included.

On the basis of these findings, it is possible to compute an estimate of the relative contribution of alcohol in crashes through comparison with prevalence levels in crash-involved drivers obtained from the hospital study. Even though roadside breath testing was carried out only at night, whereas the crash data was obtained at all times of the day, the percentage of drivers with a positive BAC for the crash-involved drivers is still three times that of the sample breath tested in the roadside survey (Chapter 4, Table 4.23). The differences between the two groups are even more significant when percentages of those with BACs greater than 50 mg% are considered (40% versus 8.4%). When compared to sober drivers, the probability of a drinking driver being involved in a crash is significantly greater and rapidly increases with the rise in level of alcohol concentration in blood (OR=3.5 at BACs of 50 mg% or less, and 9.6 at BACs over 50 mg%). This comparison provides some local evidence of the importance of alcohol as a factor in crashes, and is in agreement with previous research elsewhere (Borkeinstein et al., 1964; McLean and Holubowycz, 1981; Ryan et al, 1992). The practical value of these comparisons is the ability to quantitatively estimate attributable fraction of alcohol and preventable injuries. In this sample, 83% of alcohol-related crashes would not have occurred if the drivers involved were sober, and 90%

of the crashes involving drivers with higher BACs would have been avoided if a legal limit of 50 mg% were in force and complied with. However, if the entire driving population is considered, approximately 75% of the crashes associated with alcohol use would have been avoided if all drivers drove at zero BAC: this is however not practical. A minimum BAC limit of 50 mg% would still have prevented up to 70% of such crashes. This reinforces what has been experienced in countries where drink-driving laws are in force. Lloyd (1992), for instance, has quantitatively estimated that 59% of fatal alcohol-related crashes would have been avoided in New South Wales if drivers kept below the existing legal limit of 50 mg%, and the percentage of lives saved varied by age and sex, with male drivers standing a greater chance of benefitting. Attributable risk fraction estimates may be of particular help to policy-makers, especially if costed in monetary terms as potential savings that can be raised through implementation of alcohol-specific countermeasures.

9.2.5. Knowledge and Attitudes of Policy Makers and the Public to Alcohol and Road Accidents

The foregoing sections of this chapter have discussed epidemiological aspects of associations of alcohol with injuries and traffic crashes in particular, as well as the impact of trauma on hospital utilization, and an argument is presented that a large proportion of alcohol-related injuries could be prevented if efforts to discourage drink-driving were established. This section now describes how the public and policy makers perceive the problem, and their choices of preferred interventions.

Road traffic accidents are recognized as a growing problem in Kenya, and many factors are thought to be responsible. This study has provided some insights into the various causal pathways that people regard as contributory. There is a unanimous agreement among respondents that human error is the commonest cause of road accidents: the poor state of roads, poorly maintained vehicles, weak traffic legislation and law enforcement are also cited. Respondents interviewed feel that of the driver-related factors, speeding, driving under the influence of alcohol, carelessness and disregarding traffic rules are the leading immediate contributory factors (Chapter 7, Table 7.3). However, what is regarded as the primary underlying cause is viewed differently by various informants: some (the police and government officials) attribute it largely to driver error, others (lawyers, *matatu* operators) to poor roads, while a section of the public (insurance industry, lawyers and traffic casualties) feel that wider social and legislative issues constitute significant determinants. These variations reinforce the multifactorial nature of interacting factors that determine whether a crash will occur or not (Chapter 7, Figure 7.1), and emphasize the need for development and application of multiple intervention strategies.

Media reports similarly reflect the diversity of views across different members of the public, experts and government officials, but with elements of human error being more frequently reported (Chapter 7, Table 7.9). Of significant importance is the finding that nearly 80% of the road disasters (fatal crashes resulting in 5 or more deaths) reported in the press over a 6-month period was attributed to driver errors, mostly due to wrongful overtaking of another moving vehicle. Other data from the police also indicate that over 90% of all reported injury-producing crashes occurring in Eldoret are due to road-user's fault (Chapter 7, Tables 7.10 and 7.11), and drivers and pedestrians were judged to be nearly equally responsible (36.7% and 32.9%, respectively).

Overall, the findings from the different information sources are corroborative and emphasize the significance of human behaviour as the single most important factor contributing to road crash deaths and injuries in Kenya. This is consistent with what has epidemiologically been documented worldwide, as discussed in Chapter 1 (Section 1.3.2.3). Many injuries and deaths are potentially avoidable by modifying driver behaviour to adopt more responsible and courteous vehicle control, but this does not underplay the need for improvements in traffic environment (road engineering and vehicle safety), regulatory legislation and law enforcement as well as public education on road safety.

Whereas the hospital-injury study (Chapter 4) provides quantitative measures of alcohol involvement in crashes, this does not necessarily mean that the public also recognize the alcohol factor. However, through interviews, it emerges that most people (67% of respondents) regard alcohol as one of the most important human-related factors. Consistent with the scientific literature (Chapter 1, section 1.2), they plausibly explain that after a drink, a driver's concentration and ability to coordinate the driving tasks are diminished, and their judgment is often impaired, increasing the probability of causing an accident. Many traffic violations such as overspeeding, improper overtaking, failing to stop at a junction and carelessness may have alcohol as the underlying cause, but in most cases is not verified by the investigating police due to lack of technologies and facilities to measure it, and difficulties in getting doctors to take blood samples. Peak periods when drink-driving occurs, such as in the evenings after work, weekends and on month-ends, are well known. Alcohol prevalence data from injury-affected hospital attenders and from the general driving population confirm perceptions of a higher incidence of intoxication at night and on weekends. It is also clear from this study that a cross section of the society recognize the link between driving behaviour and drinking behaviour with regard to causation of traffic crashes, as they perceive alcohol as increasing the likelihood of involvement in a crash. This aspect of the public's perception of risk is important for the development of programmes aimed at changing the society's (and driver's) attitudes towards drinking and driving. As Pidgeon (1992) argues, the recognition of alcohol as a hazard to safe driving in itself may enhance the public's willingness to comply with drink-driving interventions. It thus has the potential to increase the capacity of not only policy makers and service providers, but also that of members of the public, to participate in identifying alcohol as an issue, developing relevant interventions as well as promoting compliance. It would also be important to raise public awareness of the problem of drinking and walking: although the epidemiological data from this study shows that up to a third of adult pedestrians involved in a crash or collision are associated with alcohol consumption, unfortunately, the degree of recognition of this as a problem by the public is currently low (not voluntarily cited by any respondent interviewed).

The most preferred measure for discouraging drinking and driving is random breath tests (RBTs), and the support for it is overwhelming across different sections of the society. However, for this to be successfully implemented, it will be necessary to promulgate drink-driving legislation defining the legal alcohol limit, permitting the use of breath tests as evidence in court and stipulating penalties for drink-driving offenses. In addition, wide publicity, public education and strict law enforcement will need to be initiated and sustained. It was encouraging that such insights were apparent among key informants and participants in the FGDs. Empirical evidence of successful application of media publicity, education, legislation and law enforcement in reducing the number of motorists driving while affected with alcohol is well documented in many industrialised countries (Broughton and Stark, 1986; Trinca, 1987; CDC, 1992 & 1993). The fact that respondents identified potential constraints to implementation of a random breath testing programme is particularly helpful for decision-making purposes. The high cost of Alcolmeters, programme administration costs, staff requirements and scepticism about the capacity and efficiency of the traffic police, are key issues that will need to be incorporated and resolved at the policy formulation phase.

The next section examines how both qualitative and quantitative data from this study can be used to influence the process of defining, formulating and making decisions on a policy for reducing driving under the influence in Kenya.

9.3. POLICY RESPONSE TO ALCOHOL-RELATED CRASHES

9.3.1. Definition of Policy

The meaning of the term policy varies in many different contexts, some analysts use the words policy-making and decision-making interchangeably. Hogwood and Gunn (1984), for instance, suggest a number of possible categories of usage of the term policy: as a label for a field activity; as an expression of general purpose; as a specific proposal; as a decision of government; as a formal authorization of government; as a programme; as an output or what the government actually delivers; as an outcome or what is actually achieved; as a theory or model; and as a process. Others (Anderson, 1975) use the term in a broad sense to mean a purposive course of action undertaken by an actor or set of actors in dealing with a problem or matter of public concern. It can also be used to refer to intentions of politicians, to actions of government or even the impact of government. For a policy to be regarded as a "public policy", formal institutions of the government have to be involved in the process of its development, and it must be authorized or ratified by the government. A public policy therefore embodies a policy generated or processed within the framework of governmental procedures, influences and organizations, and thus focuses on purposive action by or for governments (Walt, 1994).

9.3.2. Phases and Determinants of Policy Process

Policy-making is a dynamic and interactive process that involves forward and backward movements with opportunities for feedback at various stages, as well as among the different actors and participating organizations. The stages of the policy process are presented differently by policy analysts. Kingdon (1984), for example, talks of a set four key stages that include setting of the agenda, specification of alternative choices, making an authoritative choice among those specified alternatives, and implementing the decision. A more detailed framework of the policy process suggests nine stages (Hogwood and Gunn, 1984): deciding to decide (issue search); deciding how to decide (issue filtration, agenda setting); issue definition; forecasting; setting objectives and priorities; options analysis; policy implementation, monitoring and control; evaluation and review; and policy maintenance, succession or termination. These stages can be summarised in four main phases (Walt, 1994): agenda setting (problem identification and issue definition), policy formulation, policy implementation or intervention, and policy evaluation. This process is inextricably linked with the context in which the policy is being made and the content or nature of the policy being advocated. It therefore does not necessarily follow a linear process, as there are numerous contextual factors that influence both the direction and pace of the decision-making process. Many policy analysts (Hogwood and Gunn, 1984; Grindle and Thomas, 1991; Jenkins, 1993; Walt, 1994) recognize the range of contextual determinants which influence the policy process: these include societal interests (power and resources), historical experiences (national experiences, such as the struggle for independence or post-independence conflicts), international institutions (economic dependency, political and military alliances), political and economic conditions (domestic economic factors, inflation levels, performance of the public sector), administrative capacity of governments (availability of skilled human resources and administrative structures) as well as other existing policies that may affect the viability of new policy. Such factors have the potential to influence the perceptions, actions and effectiveness of policy-makers in defining and formulating a public policy.

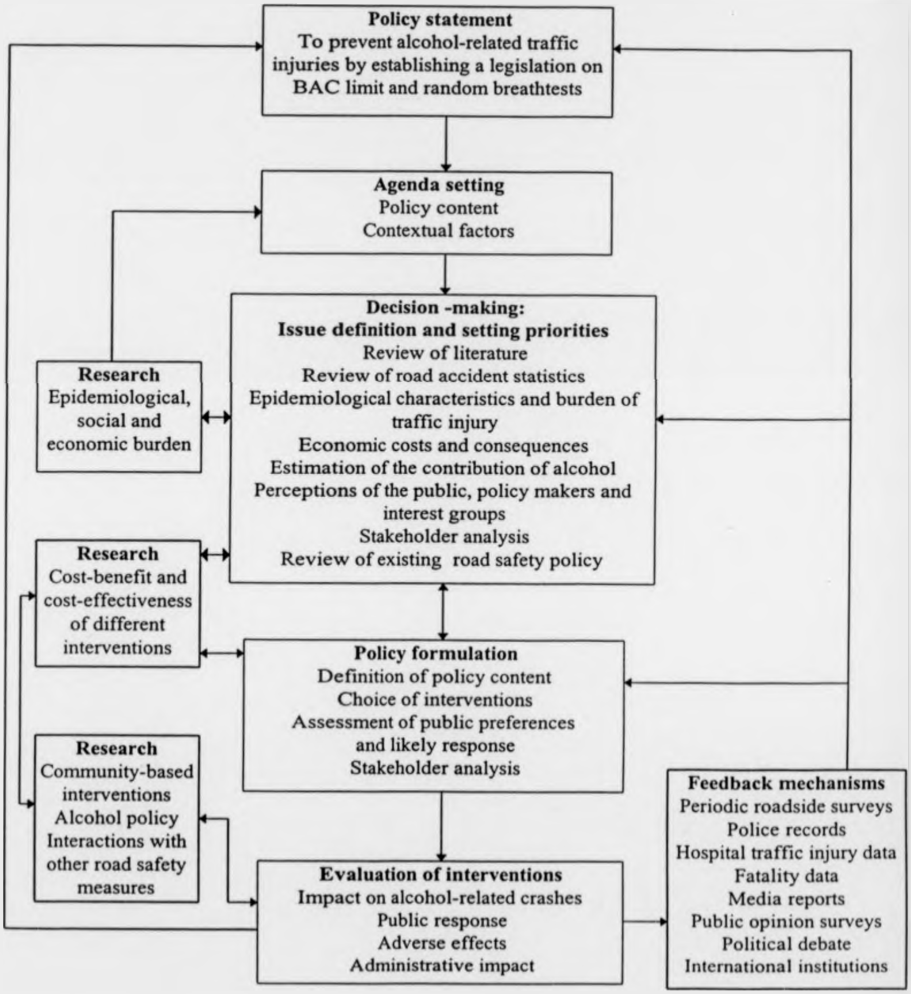
In the context of a developing country, the capacity of making well-informed policy decisions has been shown (Grindle and Thomas, 1991; Reich, 1995) to be dependent on four key factors: economic (economic policies, national resources, commercial interests), political (political will and power, interest groups), demographic (human resources) and informational (availability of sufficient information to base policy-decisions). Furthermore, opportunities for decision-making are created by a range of situations, varying between "crisis" and "non-crisis" (Walt, 1994) which may arise from different circumstances (internal or external), such as uncertainty, perception of risk, routine and unprogrammed processes. "Crisis" is a situation that is usually regarded by decision makers as threatening to their organizational goal, and as such, in their view, demands immediate response. A perception of crisis among high-level officials and politicians often leads to radical changes in public policy. Such changes are characterized by involvement of high-level policy makers (the President or Prime Minister and the Cabinet), and influenced by the political and economic gravity of consequences if no action is taken, as well as pressure from international agencies. Radical economic and health care reforms that have been introduced in many developing countries since the 1980's are illustrative, having been enhanced by high-level perceptions of the existence of financial crises and pressure from the global financial institutions. On the contrary, there is often less impetus for action in non-crisis or "politics-as-usual" situations; mid-level decision makers (usually bureaucrats and experts) therefore get more involved. Consequently, the processes of agenda setting and decision making tend to follow the normal bureaucratic paths and routines. Policy response under such circumstances is influenced to a greater extent by internal perceptions of policy-makers as to what constitutes a problem for government or society, the stakes and power relationships within the bureaucracy and the degree or incremental nature of change required. The time interval that elapses from problem identification to developing relevant policy responses can be altered by circumstances. Under conditions of perceived crisis, decision-makers often are under pressure to act immediately, whereas in "non-crisis" the process of agenda setting and decision making may be long and slow: an issue may be identified and defined but left aside for a considerable time without being acted upon.

Given the different circumstances of issue definition and agenda setting, decision-making is often more complex and tends to be pushed by different actors, sometimes in divergent directions. For a policy proposal to move forward in the policy-making process, some critical impetus at a point in time may be required. Hall, et al., (1975) for instance, identify three key conditions that may facilitate decision-making: when an issue is perceived by the government to be legitimate and state intervention is likely to be accepted by the public; when there is a capacity for successful implementation (availability of financial and technical resources, skilled personnel, adequate information and administrative capacity); and when there is public support, especially of influential interest groups. Other factors that influence choice of policy, especially in developing countries (Grindle and Thomas, 1991), include availability of technical advice and reliable scientific information, bureaucratic and institutional implications of the choices, political stability and support, and the influence of international agencies. These conditions may be applied by the state to assess whether an issue has a high or low priority. Government ministries, high- and mid-level bureaucrats, as well as foreign advisors play a central role at the policy formulation phase (Walt, 1994). This, however, does not downplay the influence of international institutions (such as the World Bank and IMF) and other multilateral or bilateral agencies in determining outcomes of the decision-making process (through economic and technical leverage). The health sector reform process in developing countries, encompassing the introduction of user fees in Kenya (Mwabu, 1995; Mwabu et al., 1995; Collins et al., 1996), for instance, illustrates the significance of the influence of international actors in setting in motion major policy changes.

9.3.3. Formulating a Public Policy for Preventing Alcohol-Related Crashes

Changes in the national public health policy are more likely to be effected through bureaucratic mechanisms of influence, as public health problems are generally perceived as a non-crisis or low politics matter. Heise et al., (1994) for instance, discuss the prospects of greater influence of bureaucrats and the political pressure exerted by women's organizations in initiating policies addressing the problem of violence against women given its perception as a "non-crisis" matter. At the same time, the development of a health-related policy usually occurs in an environment of dynamic change in health status, and in the context of concurrent changes in economic, social and political conditions. In order to facilitate a more comprehensive understanding the nature of the problem and potential ramifications of the policy in addressing a particular health problem, a rational concept in the decision-making process may be adapted for illustrative purposes. The basic concepts of a rational model emphasize four key principles (Steensberg, 1989): setting policy goals at the onset, choosing a preferred strategy from a set of alternatives, evaluating consequences of the chosen strategy, and making appropriate policy choice. Epidemiologic, demographic, economic and effectiveness data are therefore of value in improving the range of policy choices and strategies (Walsh and Simonet, 1995). Lack of data may result in poorly-defined problems with unclear policy goals, and may indicate the need for more information on what works or does not work and better knowledge about the interests of the various groups affected by the policy. Thus, a rational data-based health policy utilizes information at every step of the policy-making process. In addition, each step in the process involves consultations and negotiation among the various actors and groups affected by the new policy. Figure 9.1, adapted from Steensberg (1989), illustrates a framework of the systematic sequence of decision-making process in formulating a health-related policy; it forms the basis of discussion on the potential policy response to drinking and driving in Kenya. It is important to recognize, however, that the linear rational approach is unrealistic given the multitude of other, less rational factors, which have an impact on the policy process. However, using different models and approaches may help elucidate some of the issues which need to be carefully considered within these policy contexts.

Figure 9.1 Potential phases and sequence of the decision-making process in formulating a policy on alcohol and driving



Source: Author (with adaptation from Steensberg , 1989)

The first step in developing a policy addressing alcohol-related traffic injuries is the recognition that there are adverse effects of alcohol on driving. This is apparent in Kenya as a draft road safety policy proposal, prepared in 1980 (Republic of Kenya, 1980), included a recommendation for establishing drink-drive legislation. Surprisingly, the issue, relegated to the back of the national policy agenda for the last 16 years, has not been acted upon. This suggests that some degree of influence need to be exerted on policy-makers to successfully act upon the demonstrable need for such policy. As traffic injury is a "low politics" matter, such influence will need to be directed primarily at bureaucrats in the Ministry of Transport and Communications, the Attorney General's office and the Treasury. The availability of epidemiological data and other information highlighting the nature of the problem (such as, how large is it?; what are the determinants?; what can be done about it?; what evidence is there to show that interventions are likely to be successful? how much will it cost and who bears the cost?), is crucial (Heise at al., 1994). And because traffic crashes affect international travel and tourism industry (a serious concern of the tourism industry often highlighted in the media)[36], the role of the international donor community and diplomatic missions may also be important. Other key policy actors will also need to be drawn in: the private sector transport service operators and the insurers are two good examples of key actors whose views need to be elucidated and taken into account.

As discussed earlier, a range of information including getting insights from a variety of organizations concerned with road transport, policy-makers, the insurance industry and health workers on the ground, is required for decision-making. In Zimbabwe, for instance, Zwi et al. (1993) have shown that availability of reliable casualty information can facilitate the identification of traffic injury as a priority health problem, establishing links with different sectors involved and developing a national injury control policy together with specific implementation strategies. The value of scientific data in giving priority to a

[36] Newsweek, January 16, 1995; Sunday Nation, February 5, 1995.

particular public health problem is further raised by Reich (1995b), who argues that owing to extensive research focused on child health, highlighting the determinants of, and the solutions to child heath problems, child survival programmes have received greater international attention than adult health. These examples reaffirm the need for reliable information upon which to base policy and the corresponding strategies.

As indicated in the earlier discussion, however, these technical and scientific inputs to the policy process are important but are just a set of many influences on the process. In the current study, data on alcohol-related casualties clearly demonstrates an increase of motor vehicle crashes in intoxicated drivers and identifies key related risk factors, supported by other data (demographic and travel characteristics) from the general driving population. Conclusions from this study-design, therefore, offer convincing local evidence of the magnitude of the contribution of alcohol in road traffic crashes, valuable information that can help policy-makers to make informed decisions. Recognition of the dimensions and determinants of the problem by key bureaucrats and interest groups is likely to facilitate both the speed and outcome of policy formulation. At present, little information is available to policy-makers who are expected to deal with the problem and they may know little of the potential for interventions nor of their acceptability to a range of local actors. While it is appreciated that availability of data may at times be a minor contributor to policy decisions, in view of the multifaceted process of decision-making (see, section 9.3.2), it can increase knowledge and levels of awareness of the nature of the problem, which is beneficial for promoting changes in people's behaviour towards combining driving and drinking. Data on alcohol-related traffic injury can therefore be used to shape peoples' perceptions of the problem and to advocate for action, but the existence of data alone may not be helpful as many other factors influence the decision-making process. Qualitative information from a range of informants also shows some evidence of societal consensus regarding awareness of the existence and the magnitude of the problem, and the potential for support for measures addressing it.

The Political Mapping technique (Reich, 1994) is helpful in organizing data for policy-making through generating strategic insights into how best to identify key stakeholders, their interests and position with regard to policy and the development of strategies to influence them. It can also identify opportunities for such influence, such as transitional changes within decision-making institutions (Road Safety Authority, Ministry of Transport and the Attorney General's office) and implementing organizations (enthusiastic new Traffic Police chief, new NGO on road safety); the availability of resources for policy implementation (revenue for road safety allocated by Treasury, World Bank funding for various road development projects[37]); and assessment of the political environment for indications of renewed political interest in the problem. As the window for policy formulation presented by these opportunities may be small and open for only a short time, the necessary local information on alcohol and its effects on driving needs to be readily available to the decision-makers in a usable form to aid in making sound decisions without much delay.

Through identifying the relationships between the major players with an interest in alcohol and road safety, it is possible to initiate focused actions for winning their support. The importance of establishing coalitions with alcohol producers, distributors and retailers, the legal system, insurance industry, medical professionals and motoring organizations in mobilizing support for drink-driving legislation and related interventions, as a strategy for taking the policy forward is highlighted.

From this study it is clear that through stakeholder analysis, it is possible to identify strategies and actions that have the potential to increase the feasibility of adoption of legislation on drink-driving, and the successful introduction of random breath testing of motorists. It is also possible to identify and address issues pertaining to potential cost

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37 The World Bank recently granted Kenya Government a loan of Shs 2.75 billion (US $50 million) for the rehabilitation of the Nairobi-Mombasa Highway (Daily Nation, February 5, 1997), in addition to Kshs 8.5 billion (US$ 155 million) released earlier for the Kenya Urban Transport Infrastructure Project.

implications, benefits and adverse effects of the proposed interventions at the policy formulation stage. In attempting to influence policy formulation, an evaluation of existing interventions on alcohol and driving (range of BAC limits, detection procedures and penalties) successfully implemented in other countries (see Chapter 1, section 1.2.3), especially their effectiveness and costs also need to be highlighted.

In summary, advocacy for policy and interventions to change drinking and driving behaviour needs to address informational issues, bureaucratic institutions, commercial interests, international influence, and public perceptions and response. The process may be complex, but needs to be initiated. Availability of accurate data together with an understanding of policy-making context, and the design of strategies for winning the support of a wide section of the society can enhance the pace and outcome of the policy-making process, and the likelihood of its successful implementation. For this to happen, a multisectoral approach is needed: with public health professionals playing a leading role by accurately and comprehensively documenting and elucidating both the nature and magnitude of the problem, as well as indicating the scope for effective interventions. Research, while not necessarily central to the policy-making process, is a useful adjunct to ensuring that while the policy process is not wholly rational, it is at least more rational than it would otherwise be (Zwi, 1996b).

CHAPTER 10

CONCLUSIONS AND RECOMMENDATIONS

This brief chapter presents a synopsis of the overall conclusions of the research. A summary of recommendations for future direction in alcohol-related traffic injury prevention initiatives, and suggestions for further research are also indicated.

10.1. CONCLUSIONS

Reliable information on the nature and extent of injuries is an essential input into public health policy formulation. This study attempted to document the magnitude of the problem and provide inputs to more science-based policy response. Multiple methods were employed, all showed a common issue of convergence: that alcohol is a major contributory factor in road crashes and that appropriate responses to it are desirable and feasible.

The key findings are listed below:

10.1.1. Significance of Traffic Injury

a) Injuries from road traffic crashes are the leading cause of trauma-related admissions, but are second to assaults among the different types of injuries requiring medical treatment in hospitals.

b) The sections of the population affected most are male, and young adults aged between 20 and 39 years. Pedestrians and passengers are most at risk across all age groups. Children are particularly involved as pedestrians, although boys are prone to bicycle injuries as well.

c) Passengers are largely affected in collisions involving public transport vehicles (mainly *matatus*), a greater proportion of drivers involved are private motorists, while most pedestrians are struck by *matatus* and pick-ups.

c) Although less than a third of all crashes occur during night-time, the probability of a motor-vehicle driver being injured is greater at night than during the day.

d) Traffic crashes result in severe types of injuries (fractures, head injury, internal injuries), demanding greater use of operating theatres, surgical resources and hospital beds than injuries from other external mechanisms.

e) The mechanism of injury significantly affects the duration of hospitalization: falls and burns result in longer periods of stay, but road crashes account for the greatest proportion (44%) of the total injury-related bed-days.

f) The principal determinant of the length of time a patient spends in hospital is the degree of severity of injury (assessed by Injury Severity Score).

g) On the basis of injury severity scores, traffic-affected casualties are significantly more likely to sustain severe-to-critical injuries when compared to assaults; fall trauma are also serious. Among traffic casualties, pedestrians sustain the most severe forms of injuries.

10.1.2. The Role of Alcohol

a) Alcohol affects all casualties: it is commonly associated with assaults and traffic crashes, with drivers being the most affected, and pedestrians to a lesser extent. The potentiating effect of alcohol in injury severity is greater in road crashes, while it seems that inebriated assault and fall victims sustain less severe forms of trauma.

b) There is a preponderance of males and those aged over 30 years among the drinking group, especially among traffic and assault victims.

c) Overall, most alcohol-related trauma occurs on weekends and during night-time. In comparison to passengers, drivers and pedestrians involved in a crash are more likely to have been drinking irrespective of time of the day.

d) Drink-driving is common in the general driving population (16%-24%): drinkers are mostly men aged over 24 years, and more likely to be non-professional drivers operating personal cars on local short trips. Popular drinking joints and routes taken (after having a drink) are predictable, so is the peak drink-drive time (after normal daytime working hours). This leisure-related drinking occurs on a daily basis, with no significant variation across the week, though more heavy alcohol consumption is common during weekends.

e) There is some evidence of the association between alcohol consumption and the probability of a driver's involvement in a crash: this increases rapidly with the amount of alcohol consumed.

f) Based on calculations using alcohol prevalence data from the general driving population, a substantial proportion of crashes could be prevented through promulgation and enforcement of drink-driving legislation.

g) Breathalysers present valid and readily available measures of BAC and are acceptable to most hospital patients and drivers.

10.1.3. Knowledge of, and Perceptions to Road Safety

a) A cross section of the Kenyan society recognize road crashes as a major transport problem: human, road and vehicle-related factors are seen as the main causes. There is a general feeling that weak regulatory laws, inefficient law enforcement, economic pressures and inadequate public transport system play a significant role.

b) Driver error is the most common cause of crashes: and alcohol is suspected to greatly increase the risk, through impairment of a driver's concentration, co-ordination, judgement and reaction time, often leading to risky manoeuvres such as improper overtaking, speeding and disregarding traffic rules.

c) Because of the ineffectiveness of the current road safety interventions, there is overwhelming support for strengthening enforcement of existing regulations as well as introducing additional measures. Establishment of drink-driving legislation and other related countermeasures is the preferred strategy for preventing alcohol-related crashes.

10.1.4. Feasibility of Formulating a Policy on Drink-Driving

a) Successful formulation of a policy on alcohol and driving is likely to occur through formal decision-making processes within key government institutions. For the policy proposal to move forward, sufficient data defining the size of the problem and showing evidence of effectiveness of potential interventions are needed; the support and involvement of the commercial sector with interest in the policy (insurance industry, alcohol distillers and sellers, passenger transporters), professionals (lawyers, doctors, road engineers), service providers, non-governmental sector and international institutions are also crucial for influencing both process and outcome of the policy.

b) Some opportunities for change exist: these need to be exploited through a wide range of strategies (such as establishing alliances with supporters, mobilizing public support, and applying techniques for anticipating and countering opposition) likely to shift positions of key players and the public.

c) The most appropriate actions likely to improve the likelihood of successful formulation of policy include, providing convincing local data on association of alcohol with crashes, increasing public awareness about the effects of alcohol on driving through media publicity, building coalitions of wide representation of proponents, encouraging insurance firms to invest funds in road safety, and providing incentives for policy implementors.

10.2. RECOMMENDATIONS AND FUTURE RESEARCH

10.2.1. Recommendations

Due to the multifactorial nature of traffic injuries, tackling the problem of road safety is context-specific and requires development of a range of policy options with the involvement of key stakeholders and access to relevant information. The following recommendations pertain mainly to one aspect: the prevention of alcohol-related crashes.

a) Establish a comprehensive recording system for collecting injury data in out-patient departments, including cause of injury, nature and severity, gender and actual age of casualty. This would help in identifying the burden of traffic-related injuries (and particular types of injuries) on the health service and the community.

b) Enhance routine collection of hospital injury admission and fatality data, using a uniform system such as the E-codes of the International Classification of Diseases, Injuries and Causes of Death (WHO, 1993) or other simplified version, to allow for accurate assessment of trends, regional and international comparisons, the burden of different types of injuries on hospital services as well as their short and long-term outcome.

c) Consideration should be given to introducing objective procedures for blood alcohol evaluation in all adult injury-related out-patient presentations and admissions. This would help document the magnitude of alcohol-related trauma events (traffic and assaults, in particular) and stimulate development of strategies for addressing the problem. Appropriate affordable devices for detecting serum alcohol levels are needed. The potential for wide application of an emergency room alcohol "dipstick" (Kapur and Israel, 1983) in developing countries should be explored.

d) Steps should be taken to establish a National research programme on injury prevention and control to highlight the association of alcohol with different types of injuries, and to quantify the economic costs and burden of health care services. Developed countries should help by committing resources and collaborating with Kenyan researchers.

e) Assessment of perceptions and attitudes of policy-makers, service providers, commercial groups and organizations with interest in road safety need to be done in different parts of the country, to generate views on the importance of alcohol in traffic crashes and determine their preferences in dealing with it.

f) The findings from this study should be disseminated in scientific publications, and submitted to policy-makers and interested parties (including the media) to encourage informed debate, as well as provide some baseline information for making policy-decisions for discouraging drink-driving and preventing alcohol-related road traffic crashes.

10.2.2. Future Research

The main research issues emanating from this study are:

a) An interdisciplinary research involving epidemiologists, surgeons, health workers, economists, road engineers, the police, insurance firms, public transporters, alcohol industry and policy-makers is needed to comprehensively explore the different aspects of the effects of alcohol in road crashes and the various approaches for prevention.

b) Whereas this study is advocating for random breath testing, a pilot study is needed to identify the actual feasibility of implementing such a policy and its effects on the society, including evaluation of its cost-effectiveness and that of alternative interventions, designing appropriate reporting system, assessing public response and possible abuse by implementing individuals. Some of these issues have been identified in this study as potential impediments.

c) Further understanding of the policy process is needed through a more widespread community attitudinal study, in order to identify which aspects of the policy process will work best, including the role of different agencies and interest groups. Such a study may assist in developing mechanisms for establishing a multisectoral working group and designing appropriate strategies for injury prevention and control.

d) Studies on the economic cost of injury, including hospital costs by type of injury are urgently needed to help in identifying priorities for prevention, as well as to enhance advocacy for establishment of appropriate policies and interventions, and the mobilization of resources for implementation.

The central contribution of this research is to improve the current limited knowledge on the association of alcohol with traffic injuries in Kenya. It also adds to the existing little information on the subject in developing countries. The findings are of potential value in advocacy for a public policy on the prevention of road crashes, and provide inputs to the development of a broader national Road Safety Policy. The research process in itself presents an important learning experience, as it provides a significant contribution to the career of the researcher; and presents opportunities for promoting action-oriented injury research in Kenya and for networking with other researchers in traffic injury prevention.

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APPENDICES

APPENDIX 2.1

POLICE ACCIDENT REPORT FORM (P41)

Police 41

THE KENYA POLICE - TRAFFIC DEPARTMENT ACCIDENT REPORT FORM			Acc. Reg. No.
Police Division	Police Station	Cn - Reg. No.	O.B. No.
Day, date and time of accident	Road Authority []MOTC []Municipality []Other	[]Urban []Rural	Speed limit kph
Location of accident (indicate milestone or nearest known place with distance)		Road No.	Total number of participants Total number of victims

Types of vehicles and other participants involved	Register number	Name and address of owner/driver (state which)	Nationality	Brief details of damages
1 []SC []PU []LO []LT []BU []MA []MC []BC []OT []PED				
2 []SC []PU []LO []LT []BU []MA []MC []BC []OT []PED				
3 []SC []PU []LO []LT []BU []MA []MC []BC []OT []PED				

Name and address of injured person	Type of injury Fat.	Ser.	Sli.	Veh/part. ref. No.	Class of person	Age	Sex	Position in vehicle	Safety belt in use

Certificate of competence	Vehicle/Particip. No. 1	Vehicle/Particip. No. 2	Vehicle/Particip. No. 3
Driving licence No. valid/not valid			
Road licence No. valid/not valid			
Insurance company			
Ins. certificate No. valid/not valid			
P.S.V. licence No. valid/not valid			

Pedestrian accidents only

If pedestrian was crossing the road he/she was:
[]on pedestrian crossing
[]1-25m from pedestrian crossing
[]over 25m ____ " ____

If pedestrian was walking along the road he/she was walking:
[]in the direction of traffic
[]towards the traffic

Comments about pedestrian movement:

Road surface	Width of surface	Condition of road at the accident site	Surface was
[]tarmac []murram []earth	___m	[]damaged If damaged, tick below as appropriate []not damaged []potholes []damaged edges []corrugated []loose stones on the surface	[]wet []dry

Accident site was:	Junction accidents only	Traffic signs and signals at junction	Railway level crossing
[]junction []not junction	Junction type was: []T-junction []4-leg junction []roundabout []other junction	[]give way []stop []no signs []no traffic light signals If there were traffic light signals, were they: []operating []not operating	[]uncontrolled []controlled []no railway crossing

Road works at the accident site	Weather conditions	Illumination	Apparent police cause code No.
[]yes []no	[]clear []cloudy []foggy []rainy	[]daylight []night time 6.45p.m.-6.15a.m. []street lights on []no street lights	

State who was primarily responsible for the accident	Alcohol involved
	[]yes []no

"MA" Matatu
"MC" Motor-cycle
"BC" Bicycle
"OT" Other vehicle
"PED" Pedestrian

"SC" Saloon car
"PU" Pickup, van
"LO" Lorry
"LT" Lorry + trailer
"BU" Bus

Position in vehicle
"FS" Front seat
"RS" Rear seat
"ST" Standing (inside)
"OB" On open body

Class of person
"PED" Pedestrian
"CY" Cyclist
"MC" Motor-cycle
"DR" Driver
"PS" Passenger
"PP" Pillion passenger
"OP" Other person

Tick [] where necessary

APPENDIX 2.2
THE KENYA POLICE ACCIDENT CAUSE CODE

CODE		CAUSE
Driver	**Cyclist**	
1	31	Fatigued
2	-	Asleep
3	32	Ill
4	33	Under the influence of drink or drug
5	34	Physically defective
6	35	Inexperienced with type of vehicle in use at the time
7	36	Proceeding at excessive speed having regard to traffic conditions
8	37	Failing to keep to the near side or to the proper traffic lane
9	38	Cutting in
10	39	Overtaking improperly
11	40	Swerving
12	41	Skidding (give cause of skid)
13	42	Forcing way through persons boarding or alighting from omnibus
14	43	Failing to stop to afford passage to pedestrians at pedestrian crossing place
15	44	Turning round in road negligently
16	-	Reversing negligently (other than from parking area)
17	45	Failing to comply with traffic sign or signal
18	46	Failing to signal or giving indistinct or incorrect signal
19	47	Pulling out from near side or from the traffic lane (not from parking are) to another without due care
20	48	Inattentive or attention diverted
21	49	Hampered by passenger, animal or luggage in or on vehicle
22	50	Turning right without due care
23	51	Turning left without due care
24	-	Driver negligently opening door of vehicle
25	52	Crossing without due care at road junction
-	53	Pedal cyclist holding on to anther vehicle
26	54	Losing control (particulars to be specified)
27	55	Dazzled by lights of another vehicle
28	56	Stopping suddenly
29	57	Misjudging clearance, distance or speed (vehicles or objects)
30	58	Other apparent error of judgement or negligence (specify)
30a	-	Reversing from angle parking space negligently
30b	-	Entering parking space (angle or flash) negligently
30c	-	Leaving flash parking space negligently
Pedestrian		
	59	Heedless of traffic- crossing road masked by stationary vehicle
	60	Heedless of traffic- crossing road not masked by stationary vehicle
	61	Heedless of traffic- walking or standing in road
	62	Heedless of traffic- playing in road
	63	Heedless of traffic- stepping, walking or running into road
	64	Slipping or falling
	65	Physical defects or sudden illness
	66	Under the influence of drink or a drug
	67	Holding onto vehicle
	68	Error of judgement or negligence other than above (specify)

Passenger, etc.		
	69	Boarding or alighting from vehicle without due care
	70	Falling when inside or from vehicle
	71	Other negligence on part of passenger
	72	Stealing ride
	73	Negligence on part of conductor or goods vehicle attendant
Animal		
	74	Dog in carriageway
	75	Other animal in carriageway, including bolting horse
Obstruction		
	76	Stationary vehicle dangerously placed
	77	Other obstruction (specify)
Vehicle defect		
	78	Mechanical defects or failure- brakes
	79	Mechanical defects or failure- tyres or wheels
	80	Mechanical defects or failure- steering
	81	Mechanical defects or failure- other cause
	82	No front light
	83	Inadequate front light
	84	No rear light
	85	Inadequate rear light
	86	Unattended vehicle running away
	87	Driver's view obstructed, e.g, equipment, load, or obscured windscreen
	88	Vehicle overloaded, shifted or defective load
	89	Any other feature of a vehicle which contributed to the accident (specify below)
Road defect		
	90	Road surface slippery
	91	Excessive dust obscuring driver view
	92	Road surface in need of repair (state defects)
	93	Other road condition, view obscured, etc. (specify)
Weather		
	94	Fog or mist
	95	Torrential rain
	96	Glaring sun
Other cause		
	97	Other cause (specify)
	98	Cause not traced

APPENDIX 3.1

INJURY REGISTRATION QUESTIONNAIRE

Part 1- Personal Data

1. Serial Number |_|_|_|_|_| Case Number |_|_|_|_|
2. Day (Mon=1, Tue=2, Wed=3, Thur=4, Fri=5, Sat=6, Sun=7) |_|
3. Date of arrival |_|_|_|_|_|_|
4. Time of arrival (24-hour time scale) |_|_|_|_|
5. Name |______|______|
6. Residence Town __________ Other (specify) _________
7. Age in years (or Date of Birth |_|_|_|_|) |_|_|
8. Sex (Male = 1, Female = 2) |_|
9. Occupation (Pre-school child = 1, Student = 2, Employed (specify)________=3, |_|_|
Self-employed (specify)______4, Not employed=5, Other (specify)_______ =6, Unknown = 98)

Part 2- Injury Data

10. Date injury occurred |_|_|_|_|_|_|
11. Day injury occurred (Mon=1, Tue= 2, Wed= 3,Thur= 4,Fri = 5, Sat = 6, Sun = 7) |_|
12. Time injury occurred (24-hour time scale) |_|_|_|_|
13. Type of injury (RTA = 1, Assault domestic = 2,Assault non-domestic = 3, |_|_|
Fall = 4, Burns = 5, Poisoning =6, Drowning = 7, Firearm = 8, Strangulation = 9,
Sports = 10, Other (specify)___________= 11, Unknown = 98)
14. Breathalysed (yes = 1, no = 2) <u>If no. GO to Q 18.</u> |_|
15. Breath test reading |_|_|_|
16. Time breathalysed (24-hour scale) |_|_|_|_|
17. Time interval since injury (to nearest 1/2 hr) |_|_|_|_|
18. Reason(s) for not breathalysing ________
19. Blood sample for alcohol (taken=1, not taken=2) <u>If no. GO to Q 25.</u> |_|
20. Time blood sample taken (24-hour scale) |_|_|_|_|
21. Time interval since injury (to nearest 1/2 hr) |_|_|_|
22. Date blood sample sent for analysis (day, month, year) |_|_|_|_|_|_|
23. Date results received |_|_|_|_|_|_|
24. Blood alcohol analysis (BAC) results |_|_|_|
25. Reason for not taking a blood sample ____________
26. Patient disposition on presentation (Not admitted= 1, Admitted= 2, |_|
Dead on arrival= 3, Transferred to another hospital=4 (specify_________)

Part 3- Traffic Accident Data ***(This section is to be filled for RTAs only)***

27. Accident reported to the police (yes = 1, no = 2) |_|
28. Police Accident Registration No.| **(researcher to record)** |_|_|_|_|
29. Place accident occurred: Road/Street _______
30. Day of occurrence (Mon = 1, Tue = 2, Wed = 3,Thur = 4, Fri = 5, Sat = 6, Sun = 7) |_|
31. Date accident occurred (day/month/year) |_|_|_|_|_|_|
32. Time accident occurred (24-hour time scale) |_|_|_|_|
33. Category of road user (pedestrian = 1, driver PSV[38]= 2, driver non-PSV=3, passenger PSV=4, passenger non-PSV=5, bicyclist=6, bicycle passenger=7, motorcyclist=8, motorcycle passenger (pillion)=9, tractor driver=10, tractor passenger=11, Other (specify) _________=12, Unknown=98) |_|_|
34. Vehicle involved (car=1, bus=2, matatu=3,'Peugeot' taxi[39] = 4, pick-up= 5, lorry = 6, trailer=7, motorcycle=8, bicycle=9, tractor= 0, other (specify) ____=1, unknown=98) |_|_|
35. Date completed |_|_|_|_|_|_|
36. Interviewer name _________

Part 4: Clinical Data

(Qs 37 to 41 to be filled by the examining clinician)

37. Sign(s) of intoxication observed (smell of alcohol = 1, slurred speech = 2, droopy or bloodshot eyes = 3, none = 4) |_|
38. Impression of intoxication status (intoxicated = 1, not intoxicated = 2) |_|
39. Time examined (24-hour scale) |_|_|_|_|
40. Time interval since accident (to the nearest 1/2 hr) |_|_|_|_|
41. Clinical diagnosis: i) Nature of injury _________________

    ii) Anatomical part(s) of body ________

(Q 42-43 to be filled by the researcher using a standard schedule attached)

42. Injury severity by Abbreviated Injury Scale |_|
43. Injury Severity Score |_|_|

Part 5: Hospital Indicators

---

[38] Public Service Vehicle

[39] inter-city taxis only

(Information for Q44-57 to be obtained from inpatient's notes/OP card

44. X-rays required (yes = 1, no = 2) |_|

45. X-rays actually done (yes =1, no = 2) |_|

46. Placement after initial treatment (Not admitted = 1, Admitted = 2, Dead = 3, |_|

Transferred to other hospital = 4 (specify________)

47. Surgical intervention/operation undertaken (yes = 1, no = 2 |_|

(If Yes, proceed to Q 50)

48. If No, give reason(s) ________________________

49. Type of surgical intervention _______________

50. Use of main operating theatre (yes = 1, no = 2) |_|

51. If Yes, duration of the operation (hours and minutes) |_|_|_|_|

(Questions 52-57 to be filled for admissions only)

52. Date of admission |_|_| |_|_|_|

53. Date of discharge |_|_|_|_|_|_|

54. Length of stay (days) |_|_|_|

55. Treatment outcome (discharged = 1, dead = 2, transferred=3) |_|

If discharged, Go to Q.58 & 59.

56. Date death occurred or date transferred |_|_|_|_|_|_|

57. Duration of hospital stay (for deaths and transfers) |_|_|

58. Interviewer name _______

59. Date completed |_|_|_|_|_|_|

APPENDIX 3.2

THE ABBREVIATED INJURY SCALE

BODY REGION	SEVERITY SCORE CODE					
	1= Minor	2= Moderate	3= Severe (Not life-Threatening)	4= Severe (Life-Threatening)	5= Critical	Highest score
Head and Face	Cerebral injury, headache with no loss of consciousness. Abrasions and contusions of the eye. Fracture and/or dislocation of teeth.	Cerebral injury with or without skull fracture with unconsciousness for less than 15 minutes. Undisplaced skull fracture. Undisplaced fracture of facial bone. Compound fracture of the nose. Eye lacerations. Disfiguring lacerations.	Cerebral injury with or without skull fracture with unconsciousness for > 15 minutes. Displaced skull fracture. Signs of intracranial injury. Loss of eye or avulsion of optic nerve. Displaced facial bone fracture.	Cerebral injury with or without skull fracture with unconsciousness for > 15 minutes. Definite neurological signs. Compound skull fracture.	Cerebral injury with or without skull fracture with unconsciousness for > 24 hrs. Intracranial haemorrhage. Signs of increased intracranial pressure. Major airway obstruction.	
Neck	Whiplash injury without anatomical or radiological evidence.	Severe whiplash with anatomical or radiological evidence.	Cervical spine fractures without cord damage. Thoracic or lumbar spine fractures without neurological involvement.	Thoracic and/or lumbar spine fractures with paraplegia.	Cervical spine injury with quadriplegia.	
Chest	Muscle ache or chest wall stiffness.	Simple rib or sternal fracture. Major chest wall contusions without haemothorax or pneumothorax.	Multiple rib fractures without respiratory embarrassment. Haemothorax or pneumothorax. Rupture of diaphragm. Lung contusion.	Open chest wounds. Flail chest. Pericardial injuries. Myocardial contusion.	Chest injuries with major respiratory embarrassment. Aortic laceration. Myocardial rupture or contusion with circulatory embarrassment.	
Abdomen	Muscle ache. Superficial abrasions.	Major contusion of abdominal wall.	Contusion of abdominal organs. Extraperitoneal bladder rupture. Retroperitoneal haemorrhage. Avulsion of ureter. Laceration of urethra.	Minor lacerations of intra-abdominal organs. Intraperitoneal bladder rupture. Avulsion of the genitals.	Rupture, avulsion or severe lacerations of intra-abdominal organs or vessels.	
Extremities and/or pelvis	Minor sprains and fractures and/or dislocation of digits.	Compound fracture of digits. Undisplaced long bone or pelvic fractures. Major sprains of major joints.	Displaced simple long bone fractures. Multiple hand and foot fractures. Single open long bone fractures. Dislocation of major joints. Multiple amputations of digits. Lacerations of major nerves and/or vessels of extremities.	Multiple closed long bone fractures. Amputation of limbs.	Multiple open limb fractures.	
SCORES OF THE THREE MOST SEVERELY INJURED REGIONS: 1) ___ 2) ___ 3) ___			ISS (SUM OF THE SQUARES) = ___			

Source: Committee on medical aspects of Automotive Safety. American Medical Association. JAMA, 1971

APPENDIX 3.3

ROADSIDE ALCOHOL PREVALENCE SURVEY QUESTIONNAIRE

1. Serial Number |_|_|_|_|
2. Day (Mon=1, Tue=2, Wed=3, Thur=4, Fri=5, Sat=6, Sun=7) |_|
3. Date (day/month/year) |_|_|_|_|_|_|
4. Sampling site (Mitaa/Kidiwa road=1, Huruma road=2, Nakuru road = 3, Kisumu road = 4, Iten road = 5, Oloo street/ Sirikwa Hotel= 6, Kapsoya road= 7) |_|
5. Time started (24-hour scale) |_|_|_|_|
6. Direction (to town=1, from town=2) |_|
7. Vehicle type (car=1, bus=2, matatu=3, 'Peugeot' taxi=4, pick-up=5, lorry=6, trailer=7, motorcycle=8, tractor=9, other (specify)_________=10) |_|_|
8. (Vehicle Reg.No.|_|_|_|_|_|_|_|) Estimated age of vehicle |_|_|
9. Number of passengers (including driver) |_|_|_|
10. Consent for a breath test (Yes=1, No=2) |_|

<u>If No GO TO Q 12</u>

---

11. **Breathalyse the driver and record BAC reading (mg %)** |_|_|_|

---

12. Sex of driver (Male = 1, Female = 2) |_|
13. What is your age? (or year of birth |_|_|_|_|) |_|_|
14. What is your occupation? ___________
15. Where do you live? (Eldoret = 1, UG District (specify)_____ = 2, Other place (specify______ = 3) |_|
16. Where are you coming from? Location within Eldoret_________ or Other (specify)_________
17. What is your destination? ___________
18. Estimated distance to destination ___________ kms
19. Do you drink alcohol? (Yes=1, No=2)

<u>If No Go to 22</u> |_|

20. Have you taken any alcohol today? (Yes = 1, No = 2) |_|
21. At what time did you have your last drink? (24-hour time scale) |_|_|_|_|
22. Time interval since last drink (hrs/minutes -to the nearest 1/2 h) |_|_|_|_|
23. Signs of having been drinking, by observation (smell of alcohol = 1, slurred speech = 2, droopy or bloodshot eyes = 3, none = 4) |_|
24. Interviewer's impression of whether a driver had consumed alcohol (had been drinking = 1, had not been drinking = 2) |_|
25. Time completed |_|_|_|_|
26. Interviewer name _____

APPENDIX 3.4

SAMPLE SIZE FOR THE ROADSIDE SURVEY

The sample size required for providing alcohol prevalence data of drivers on the road was calculated using the EPI-INFO computer programme for estimating sample sizes for population-based cross-sectional surveys. The following assumptions were made:

p- estimated proportion of drunk drivers = 18% (with 14% as the lowest acceptable scenario, on the basis of the best guess of 10%-20% by the traffic police)

d- precision of the study = 5% (95% Confidence Interval)

A minimum sample size of 354 was generated. To improve the precision and reliability of the data in estimating the true alcohol prevalence in the driving population in Eldoret, however, the study aimed to exceed the number and if possible double the computed figure.

For comparison, a formula by Lemeshow et al. (1990) for a simple random sample of a population-based survey, which allows for the estimate to fall within 10 *percentage points* of the true alcohol prevalence with 95% confidence, was applied. The figure obtained was multiplied by 2 in order to compensate for the design effect resulting from the two-stage sampling process (for road location and vehicle selection as shown below:

$N = z^2 \times p(1-p)/d^2$

Thus, $N = 2 [z^2 \times p (1-p)/d^2]$

where:

N = sample size

z = 1.96 (the normal deviate at 95% Confidence Limit)

p = 0.18 (the estimated proportion of nighttime drunk drivers)

d = 5% (precision)

$N = 2 * (1.96)^2 * 0.18 * (1-0.18)/0.05^2$

$= 2 * 3.8416 * 0.18 * 0.82/0.0025$

$= 2 * 227$

= 454 drivers

APPENDIX 3.5

INTERVIEW GUIDE FOR IN-DEPTH INTERVIEWS AND FOCUS GROUP DISCUSSIONS

Part 1. Road Transport Problems

1. What problems do you associate with road transport in this country?

2. Of these problems, which one would you say is of a major public concern and for what reasons?

3. What do you consider as the main factors that contribute to these problems?

4. In your opinion, what do you consider as factors contributing to occurrence of road accidents in this country?

5. Have you at any time been involved in a road accident? If yes, How many times? Can you describe one of the most memorable?

(Probe)-Has any member of your family been injured in a road accident?, if so what were the circumstances and with what results?

6. What road safety measures in this country are you aware of? What do you think of them? Why do you say so?

7. In your view, are there any road safety interventions that you would wish to be introduced?

Which of these would you, personally, prefer?, and why?

8. What do you see as possible problems associated with implementation of such measures? In your view, how would these constraints be overcome?

10. Suppose a person is injured in a road accident, how does he or she initiate and process claims for compensation?

11. From your of point of view, what problems are often encountered while processing road accident compensation claims? and how can these be overcome?

12. In what ways can you or your organization be involved in developing a policy addressing road the problem of road accidents, and in implementing road safety interventions?

Part 2. Alcohol and Road Accidents

13. Have you at any time seen or been driven by a driver under the influence of alcohol? If yes, when was it? (time, day, occasion) What did you think of the experience?

14. What are your views regarding the role of alcohol in road accidents? Why do you say so?

15. In your view, when is driving under the influence of alcohol common?

16 In your view, is it of any use to know whether a person was under the influence of alcohol at the time of

an accident ? If so what are the likely implications? What actions are normally taken?

17. How would you establish whether a driver involved in an accident had been drinking?

18. Could you please tell me what methods you would personally prefer to be used in determining whether a driver is under the influence of alcohol and why?

19. What measures for preventing driving under the influence of alcohol are you aware of in Kenya? (If aware), What do you think of these measure(s)?

20. Which measures for discouraging people from drinking and driving would you personally prefer to be introduced in Kenya? and why?

21. Personally, what would be your reaction if tests for alcohol were made compulsory for all adults involved in a traffic accident?

What do you think would be the reaction of members of the public?, and Why?

22. In what ways would these procedures be made acceptable to you and to the public?

23. In your opinion, what would be the effect on motorists and the public if the government introduced a strict legislation against drinking and driving? Why do you think so?

24. What do you think would be obstacles to implementing such a legislation in this country?

25. In your opinion, in what ways can these constraints be overcome?

APPENDIX 7.1

NEWSPAPER REPORTS ON ROAD ACCIDENTS

Kenya's accidents 'highest'

By MARK AGUTU

Kenya has the highest number of road accidents among developing countries, with more than 2,000 lives lost annually, the chairman of the Automobile Association (AA) of Kenya said yesterday.

Unsafe at Any Speed

Kenya: The world's most dangerous roads?

FOR THE KENYAN TOURISM INDUSTRY, IT was a double black eye at the worst possible time of year. On Nov. 28, at the onset of the Christmas tourist season, a van filled with German holiday-makers was traveling to a game reserve down the decrepit Nairobi-Mombasa highway, Kenya's busiest route, when it collided head-on with a bus. Four Germans died and five were gravely injured. One week later an-

Kato boss: We're losing business

Question: *Newsweek* recently named Kenya as the most dangerous place to drive. Is that true in your experience?

Col.(RTD) Nguru: No. We cannot say Kenya is the superlative in road accidents rate.

Q: How many foreign tourists were killed/maimed in Kenya's road accidents last year, 1993 and in 1992.

A: Road accidents involving tourists in the past one year resulted in nine tourists dead and 50 injured. We do not have the figures for 1993 and 1992.

The curse of bad roads

IT is the view of experts that no amount of road safety campaigns w... yield fruits until the pertinent issue of Kenya's pathetic roads is ... first. The experts also warn that until such a time as the Traffic Act ... Traffic Laws are effectively enforced, the cliché about "safe roads" w... bear little meaning.

Kimutai: Police are not to blame

Question: *Newsweek* magazine recently named Kenya as the most dangerous African country to drive in. Is this a fact?

Mr Kimutai: That is somebody's biased opinion.

Q: The Kenya Association of Tour Operators says nine tourists have been killed and 50 others injured in road accidents in the past year. Is that not too high a toll for just one category of road users?

Traffic police 'ill-equipped'

By NATION Correspondents

The traffic police division does not have a single ambulance, its patrol motocycles are very few and its mobile bases equipment became obsolete 14 years ago, the Traffic Police Commandant, Mr Geoffrey Mwathe, said yesterday.

The road carnage was likely to remain high until the division is equipped with modern facilities.

Mr Mwathe was addressing experts and executives of the motor industry at Motor Show '96 at the Kenyatta International Conference Centre.

Drivers who do not think beyond end of car bonnet

IN a recent *Standard on Sunday* article, your writer Jonathan Singa Mutunga, suggested that speed is the killer. While speed can and does kill, the problem lies much deeper than the simple explanaion he offers.

Driving recklessly, driving without experience, showing off at speed all indicate that speed is the killer.

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A panoramic view of just a part of the incredible traffic jam caused by the accident in which 35 people were killed on Thika Road yesterday morning. The jam stretched all way from the Outer Ring Road Thika roundabout to the Muthaiga roundabout and took a better part of the morning to disentangle. (Picture by KURGAT MARINDANY)

Death at dawn

34 warders killed in horror smash

An army officer (lying down) tries to strap a hook onto the wrecked Prisons lorry as two others direct him in order to get the accident vehicle off the road. It took them, together with other Armed Forces personnel, more than five hours to clear the road of the lorries, the dead and the injured Prisons officers. (Picture by NICHOLAS RUKENYA)

By ERIC SHIMOLI and KURGAT MARINDANY

Thirty-five people died and 31 others seriously injured in a fatal road accident on Thika Road in Nairobi yesterday morning.

Thirty-four of the dead were Prisons' warders. The other casualty was a passenger in a truck into which the lorry carrying the warders smashed. Only one person escaped unhurt.

In a statement issued in Parliament in the afternoon the Minister for Home Affairs, Mr Francis Lotodo, said the accident occurred when the front wheel of the lorry carrying 61 people burst as it descended an incline towards the Broadways bridge near the Kenya Breweries factory plant.

The lorry, which was headed for Nairobi, hurtled across the ditch between the two carriageways to collide with a trailer

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