

**The Epidemiology of Motor Vehicle Collisions involving Pedestrians in eThekweni
Municipality 2001 to 2006**

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ABSTRACT

Introduction

Road traffic collisions in developing countries contribute towards the greatest burden of disabilities and fatalities globally. Concern has arisen about the high proportion of pedestrians involved in collisions in South Africa.

Aim

This study describes the epidemiology of motor vehicle collisions involving pedestrians in eThekweni Municipality from 2001 to 2006, aiming to identify opportunities for prevention and informing policy.

Methods

An analytic cross-sectional study design was used. Data was obtained from the eThekweni Transport Authority database (police accident reports), and the National Injury Mortality Surveillance System (mortuary reports). Exposure variables included pedestrian and drivers' demographics and collision environment. Death and injury were the outcome variables measured. Population data was obtained from Statistics South Africa.

Results

Pedestrians' injuries decreased from 7 445 to 6 288 (incidence risk: 241 to 193 per 100 000) from 2001 to 2006. Annual case fatality rose from 4.9% (366 deaths in 2001) to 6.8% (430 deaths in 2006). Child pedestrians aged 5 to 9 years had a 77% increased risk of injury relative to other children. The fatality risk ratio of male to female pedestrians was 3.8 (95% Confidence Interval: 1.7 to 9.3). Male drivers aged 30 to 34 years had a 68% increased collision risk relative to all other male drivers and eight times (Incidence risk ratio: 8.0; 95% Confidence Interval: 6.2 to 10.3) the risk of female drivers. Only 3.4% of collisions occurred on freeways but accounted for 19.6% of pedestrian fatalities. Few (1.5%) collisions involving pedestrians occurred at night in unlit conditions but constituted more than four times the number of fatalities as number of collisions in these conditions.

Discussion and Recommendations

Interventions involving pedestrians should target economically active pedestrians, particularly those from 25 to 39 years. Programmes that target children, especially boys, in junior primary would be addressing the most vulnerable population. Methods should include improving pedestrian visibility and separation of pedestrians from traffic.

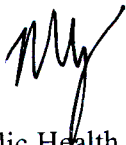
Strategies to reduce driving practises that place pedestrians at risk, should be aimed at male drivers in the younger age groups.

High-risk environmental factors such as the type of road and other environmental conditions should inform the use of engineering measures to protect pedestrians, and plan emergency services.

DECLARATION

I, Michelle Bridget Hobday, declare that

- a. The research reported in this dissertation, except where otherwise indicated, is my original research.
- b. This dissertation has not been submitted for any degree or examination at any other university.
- c. This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
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PRESENTATIONS

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2. Oral presentation in HIV-Community-based and Public Health section, at College of Health Sciences Research Symposium, University of KwaZulu-Natal, 12 and 13 August 2008, Durban, South Africa.

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CHAPTER I: INTRODUCTION

Globally the burden of road traffic injuries measured by disability adjusted life years (DALYs) lost was ranked 9th in of all causes of mortality and morbidity in 1990. The human suffering due to road traffic collisions is expected to rise to 3rd position by 2020. Developing countries, including South Africa, comprise the majority of the disabilities and fatalities caused by road traffic collisions. ^{1 a}

In recent years, increasing disquiet has arisen concerning the high proportion of injuries and fatalities of pedestrians involved in motor vehicle collisions in South Africa. It is a major concern to the national, provincial and local transport authorities, and messages alerting the public to the problem are widely circulated in the media, particularly over holiday periods. The Department of Transport commenced a road safety awareness media campaign aiming to reach 80% of television viewers and 90% of radio listeners in South Africa, and since 2006, road safety has been included as a separate topic in the primary school curriculum. ²

Authorities obtain data on pedestrian injuries and fatalities related to motor vehicle collisions from accident reports completed by police officials. Municipalities are responsible for collecting, collating and processing this data. The reports produced contain useful information and can assist municipal traffic safety managers to motivate for appropriate intervention programmes to reduce pedestrian injuries and fatalities. The collated data is also furnished to the provincial and national traffic authorities to be used at higher levels to establish both policy and the practice of road traffic safety.

eThekweni Municipality has collected data on motor vehicle collisions involving pedestrians since the 1960's, when traffic zoning^b was instituted. Since May 2000, data has been collected and collated from the new Accident Report form ^c(Appendix A) and a computer programme has been developed by the municipality to process and summarise the data electronically. The system has been completely operational since June 2000, and certain data variables from 1998 to 2000 are also available. The eThekweni Traffic Authority uses this information to identify problem areas, such as those intersections with a high number of collisions. It then responds with interventions that combine education engineering and enforcement components (see definitions). The department's managers monitor and evaluate the interventions using the data. It is believed that greater use can be made of the available data.

^a The term road traffic "collision" will be used in this document rather than "accident" as road traffic events causing injury are largely predictable and are usually due to errors of human judgment. Thus the term "accident" is often inaccurate.

^b Traffic zoning was the division of the municipality into the geographic and functional sub-regions such as the central or southern region, residential or commercial areas. Traffic zoning was carried out by the Durban Corporation based on existing residential and land use areas in 1968.

^c The Officer's Accident Report (OAR) form or AR form replaced the old SAP352 form and was developed by the National Department of Transport based on similar data collection tools from other countries. The draft Officers Accident Report received input from all nine provinces and South African Police Service for approval, and was piloted over Easter 1997.

reported to be involved in pedestrian motor vehicle collisions. It would be a useful exercise to analyse the demographics of drivers in collisions involving pedestrians in South Africa with its very different population structure and traffic mix^d *vis-à-vis* developing countries.

Certain vehicle types have been identified to as being more dangerous for pedestrians. However, the study by Roudsari *et al.* looking at vehicle type was situated in the United States¹⁰. Studies in developed countries have identified high risk times and conditions for when pedestrians and particularly child pedestrians are injured.^{7-9, 11} Information specific to a South African municipality would be beneficial in order to compare it with developing countries.

More comprehensively processed data summarised and displayed appropriately, will enable the eThekweni Transport Authority to develop road safety intervention programmes to reduce motor vehicle collisions and protect pedestrians. It would enable evidence-based planning for reduction of motor vehicle collisions and possibly assist in the deployment of emergency personnel such as police, ambulance services and the workload of casualty departments in hospitals. According to a consultant to the Road Traffic Management Corporation, and the head of the KwaZulu-Natal Department of Transport database, the eThekweni Traffic Authority database comprises one of the best and most reliable resources on motor vehicle collisions in the country.^{12, 13} The study could assist other municipalities that have less reliable pedestrian injury databases with appropriate information.

The study processes, summarises, displays and reports data available on pedestrian motor vehicle collisions, using the principles of epidemiological research. It provides relevant, comparable information for evidence based management of road traffic interventions.

1.2 AIMS OF THE RESEARCH

The study aims to investigate the epidemiology of motor vehicle collisions in eThekweni Municipality from 2001 to 2006, and specifically to describe the demographics of pedestrian injuries. It will analyse some of the possible risk factors in collisions involving pedestrians. It proposes to identify priorities for prevention and education, to inform policy decisions and to enable better planning by road traffic engineers, police and emergency medical personnel.

1.3 SPECIFIC OBJECTIVES OF THE RESEARCH

- a. To describe pedestrian injuries and fatalities using standard outcome measures from 2001 to 2006.

^d Traffic mix is the proportion of different motorised vehicles such as trucks and non-motorised vehicles such as bicycles as well as pedestrians making up the traffic. Patterns differ dramatically between developed and developing countries, and within developing countries include country-specific forms of transport.

Table 1: Fatality Risk per 100 000 for Motor Vehicle Collisions in Various Developing Countries.

| Country | Fatality Risk /100 000 | Study | Year of Data |
|--------------------------|------------------------|---------------|--------------|
| Central Africa | 2-6 | ¹ | - |
| Africa (5 to 14 yrs) | 30 | ¹⁷ | 1998 |
| Kenya | 8-11 | ²¹ | 1985-1998 |
| Durban, South Africa | 32-34 | ²³ | 2001-2005 |
| Columbia | 15 | ²⁴ | 2000 |
| Mexico (pedestrian, all) | 7 | ²⁵ | 1994-1997 |
| Men | 11 | | |
| China (provincial range) | 3-15 | ²⁰ | 1999 |
| Iran (all) | 26 | ²⁶ | 1999, 2000 |
| Men | 39 | | |
| Women | 11 | | |

The table is included as an attempt to show differences the burden of road traffic collisions between countries. However, because of lack of research in developing countries and different indicators used between studies, the data included is not in most cases specific to pedestrians.

2.2.2 Factors influencing exposure to risk

2.2.2.1 Increased motorisation

There is a strong correlation between the growth in the number of motor vehicles and the number of collisions. With increasing economic growth, there are greater traffic volumes, which in turn lead to higher numbers of collisions. In low-income countries, the growth in motorisation is not always accompanied by a reduction in the number of people walking, cycling and using public transport. The increased traffic volumes are a risk factor for all road users but particularly for child pedestrians. The different traffic mixes in low and middle-income or developing countries require that technical aspects of planning, design, engineering and traffic management need to be developed locally to manage increased motorisation in the unique local context. Merely transferring solutions from developed countries to developing countries is not effective due to the vastly differing traffic mix, road design and other contextual factors.

The high burden of road traffic injuries in developing countries is partly related to the growth in motor vehicle numbers and the higher number of people killed or injured per collision. Often these injuries occur in multi-passenger vehicles such as minibuses.¹⁷ Poor enforcement of road traffic regulations[§] also contributes to the high burden of

[§] In South Africa the National Road Traffic Act (99 of 1996), regulates the registering and licensing of motor vehicles, issuing learner and driver's licences, roadworthiness certificates and operators permits. It also contains regulations for traffic signs, speed limits and rules of the road

Evidence exists that the risk of injury to vulnerable road users is potentially reduced with the introduction of measures to separate them from motorised traffic by using pavements, implementing traffic calming measures and other aspects of improved road design. However little provision for pedestrian safety exists in developing countries such as Ghana and other less motorised places.¹⁹

2.2.2.3 Socio-economic factors and area of collision

Pedestrian fatalities in Mexico occurring from 1994 to 1997 were studied in order to determine social factors involved in these deaths.^{28,29} The study employed a Geographic Information Systems to analyse four high collision risk areas. Pedestrian fatalities were associated with areas that had a higher proportion of public transport vehicles, increased violation of traffic rules by drivers and pedestrians, low use of pedestrian bridges and poor separation of pedestrians from general vehicular traffic. Qualitative interviews of 12 injured pedestrians in a local hospital revealed that 11 had themselves never driven a motorised vehicle, most were the main breadwinners in their families and had no form of medical insurance. Pedestrian bridges were not used, as they were poorly located or non-existent. While the number of people interviewed was small and not representative of the study population (for example only 4 drivers agreed to be interviewed), the study raised issues about the location of motor vehicle collisions involving pedestrians and the socio-economic status of those affected.

In Memphis, Tennessee in the USA the census tract in which each child pedestrian injury occurred was identified. People living in different census tracts possess various characteristics relating to their socio-economic status. Areas with a higher incidence of injuries had a significantly higher proportion of residents from the non-white population, lower median household income, higher proportion of families below the defined poverty level and more households with more than one person per room. Children living in more crowded areas tend to spend more time outside, with fewer playgrounds than higher income areas and so experience more exposure to traffic. However, a major limitation to the study is that the census tracts where the injuries occurred were not necessarily where the pedestrian resided.

A similar study in Hartford, Connecticut also used census tracts to ascertain the population denominator where pedestrians were injured.³⁰ Analysis revealed an association between the effect of the number of children per acre and motor vehicle collision frequency involving pedestrians. A similar effect was demonstrated for households with more than 1 person per room and for number of housing units per acre. The outcome measure reported was the pedestrian collision incidence risk, which was 310 per 100 000 population. However, it is not reported how many of these collisions resulted in injury or death so cannot be compared to the pedestrian injury incidence risk of 138 per 100 000 population reported in Memphis. The authors recommended geographically focused intervention efforts, to target children and their parents, and mobilisation of community support to complement prevention efforts in high-risk areas.

intoxicated, and that legislation should apply both to the drivers and pedestrians involved in collisions where pedestrians were injured. The National Injury Mortality Surveillance System report blood alcohol concentrations for reported unnatural deaths including pedestrians. This data source is discussed further in 2.2.4.1.

2.2.3.3 Speed and High Traffic Volumes

Pedestrians account for the highest proportion of road fatalities in most African countries and this is most marked in urban areas.^{1, 19, 24} In Ghana between 1994 and 1998, a report on 53 783 casualties showed that pedestrians injured in rural areas were more likely to be fatally injured than in urban areas. The study suggests that this is due to the nature of injuries sustained at the higher speeds travelled by vehicles on rural roads. However, a confounding factor not addressed in the study may be the poorer health care available in rural areas, leading to less favourable outcomes for these injuries.

A case-control study in urban Australia conducted between 1991 and 1993, employed pedestrians admitted to hospital with injuries as cases (n = 100) and matched pupils and other children from their schools as of controls (n = 200), to investigate the link between socio-economic status and pedestrian injuries.³⁵ The increase in number of pavements, and increase in traffic volume and proportion of vehicles travelling over the speed limit led to a raised risk of pedestrian injury. The association between number of pavements and pedestrian injuries was difficult and complex to explain.

In Auckland New Zealand, a case-control study conducted between 1992 and 1994, employing pedestrian fatalities or hospital admissions as cases (n = 190) and matched schoolchild controls, indicated that the risk of child pedestrian injury was fourteen times greater in areas with the highest traffic volumes. Curb parking and mean speeds over 40km/h also increased the risk of pedestrian injury.³⁶

2.2.3.4 Age and Gender of Pedestrians

Various studies report that more males are involved in road traffic collisions than females, because of different risk-taking behaviour, exposure to risk, economic opportunities and types of employment. However, this finding is reported to be less marked with pedestrian injuries.¹⁶ A study in Cape Town discovered a higher number of male pedestrians injured in motor vehicle collisions, with a ratio of 2.3:1 (males: females).³⁴ When comparing male and female pedestrians with detectable alcohol levels in the blood, the relative ratio rises to 3.3.

2.2.3.4.1 Child Pedestrians

The study in Ghana showed that one in three pedestrian casualties were less than 16 years of age.¹⁹ A study in Karachi, Pakistan,³⁷ reported that 80% (n = 1 059) of children injured sufficiently to need to be transported by emergency medical services were involved in motor vehicle collisions. Pedestrians accounted for 26% (n = 278) of these

particularly vulnerable to collisions involving certain types of vehicles, because of their smaller stature and resulting lower visibility.

2.2.4 Reporting of Collisions and Use of Data in Developing Countries

Problems arise with maintaining a high quality database for motor vehicle collisions in less developed countries such as South Africa. A case study describing the experience of the Bangalore police department in India illustrates the problems that were encountered with collecting quality data.³⁹ Accident Report forms need to be in a language understood by the average police officer. In India, the problems included understanding the technical terminology around traffic collisions and road geometry. In South Africa, the additional problem existing is that the Accident Report form is often not in the first language of the police officer. Traffic police often lack the resources or training to carry out a thorough and systematic collection of data relating to motor vehicle collisions involving pedestrians. The completion of the form may not be seen purely as a collection of objective facts. The completed Accident Report form may be used in court as a legal document to determine guilt or innocence of the driver or some other third-party. In South Africa, the data collected in the Accident Report form may also be used for insurance purposes or to determine if an application can be made to the Road Accident Fund for compensation by the injured parties.

A study in Ghana used police-reported accident forms, epidemiological and other survey reports as the sources of data.¹⁹ It was concluded that using police records would not indicate the full extent of the motor vehicle collisions and injuries especially due to underreporting of accidents involving slight or no injury. Ghana defines a fatality as occurring up to 30 days after the collision. In South Africa a fatality needs to occur within 6 days of the motor vehicle collision occurring for it to be classified as a collision related fatality. These substantial differences in definitions make comparisons between countries difficult.

A review of records of motor vehicle collisions in Kenya from 1968 to 1998 disclosed that on average 7 fatalities occur from 35 collisions that occur per day during that period.²¹ Data was obtained from police records that was collected using a standard accident reporting form. The system leads to underreporting as not all collisions are reported and only fatalities that occur at the scene of the collisions are reported.

Several sources of data were used for a review of motor vehicle collisions in Mozambique from 1990 to 2001. These sources included police records (no mention was made of a standardised form used by police officers), the National Institute for Road Safety data as well as data from the Central Hospital of Maputo. The study highlights gaps and discrepancies between different data sources, partly due to differing definitions of the severity of injury and because of lack of reporting of motor vehicle collisions to the police.

Odeleye examined the problem of child safety on the roads in Nigeria.⁴⁰ Nigeria is, demographically speaking, a youthful country and 45% of the Nigerian population was

Departments of Transport and, ultimately, to the Road Traffic Management Corporation in Pretoria. Some municipalities such as Cape Town publish an annual road traffic report based on data from the Accident Report form,⁴⁶ which is considerably more detailed than the report published by the eThekweni Transport Authority.^{3,4} However, even this report does not present details about the time of day pedestrian collisions occur (in percentages), day of week and month, location of collision by road name and the area in which they occur. In Cape Town in 2004, 6.8% of motor vehicle collisions (n= 5 334) involved pedestrians, and 412 out of 591 fatalities (70%) were pedestrians.

The Annual Report of the National Injury Mortality Surveillance System, published by the Medical Research Council (MRC)/University of South Africa (UNISA) Crime, Violence and Injury Lead Programme, provides information about deaths from non-natural causes including transport-related deaths.^{6,23,47} It includes sections on motor vehicle collisions in Cape Town, Tshwane, Johannesburg and Durban as well as a national overview of non-natural deaths.⁴⁷ The report primarily includes urban mortuaries where non-natural deaths are examined and does not include any mortuaries in Limpopo, Mpumalanga or Free State provinces. It estimates that it represents about 39% of all non-natural deaths in South Africa. The generalisability of this report is limited because of selection bias resulting in poor external validity of the findings. The report also represents a broad summary of the findings based on the National Injury Mortality Surveillance System and is descriptive rather than analytic. The 2005 Annual National Report indicates that accidental deaths constitute 39% (n = 9 129) of non-natural deaths recorded in 2005, of which 74% (n = 5 675) are transport related.

The reports for individual municipalities follow a similar format reported for eThekweni Municipality in section 2.2.4.2 of the literature review. A published report based on the National Injury Mortality Surveillance System from 2001 and 2004 in the four major cities in South Africa will be discussed in section 5.2.2.⁴⁸

2.2.4.2 Research in eThekweni Municipality

eThekweni Municipality publishes annual motor vehicle collision reports based on the statistics collected by the Road Safety department of the eThekweni Transport Authority.^{3,4} These reports present data relating to the types of motor vehicle collisions, costs of motor vehicle collisions^m, identification of vulnerable road users, location of motor vehicle collisions and their trends from year to year, by month, day and hour that the collision occurred. Vulnerable road users include pedestrians. Data concerning the number of motor vehicle collisions involving pedestrians, the proportion of pedestrian injuries relative to other road users, age distribution of pedestrian injuries and location of pedestrian injuries are included in the publication. However, such data is not related to the overall population or age specific population at risk. Nor are the numbers of accidents compared to changes in number or type of vehicles. The data is not analysed with reference to the greater population of people or vehicles in eThekweni. Data for the reports is sourced only from the eThekweni Road Traffic Database.

^m Estimates of costs include factors such as medical costs, vehicle damage and property damage

were introduced subsequent to this report and the study may have some inaccuracies. Fatality rates (number of fatalities per 10 000 vehicles per annum) rather than fatality risk (number of fatalities per 100 000 per annum) are used to measure the occurrence of motor vehicle collisions involving pedestrians.¹ The most vulnerable group of pedestrians was identified as the 30 to 34 year old age group and the concern was raised that pedestrians of an economically active age accounted for a large proportion of reported injuries and fatalities. Although pedestrian vehicle collisions represented only 10% of the total number of collisions, 65% of all fatalities were the result of collisions involving pedestrians.

2.3 SUMMARY OF CHAPTER

Chapter 2 describes the established patterns occurring in motor vehicle collisions involving pedestrians using a framework described in the World Report on Road Traffic Injury Prevention.¹⁵ It examines road traffic research in the developed and developing world, and discusses the problems of reporting and use of road traffic injury data and indicators used to measure the burden of road traffic injuries.

3.7 DATA SOURCES

Data about each motor vehicle collision is collected by a police officer and recorded on the Accident Report form (Appendix A). The data collected is then collated in the eThekweni Transport Authority database. A computer programmeⁿ has been developed for the Transport Authority from which processed data and information comparing the different data fields captured can be obtained.^o For the purposes of this study, raw data pertaining to motor vehicle collisions involving pedestrians was made available for processing and analysis in Microsoft Excel format.

Additional data regarding pedestrian fatalities in eThekweni municipality was obtained from the National Injury Mortality Surveillance System of the Medical Research Council-University of South Africa Crime, Violence and Injury Lead Programme. The data contributing to this database was obtained from the Gale Street, Phoenix and Pinetown mortuaries where autopsies are performed on all people suspected of having died of unnatural causes in eThekweni municipality. This data was collected from mortuary records using a data collection form (Appendix B).

The two databases were used for the following reasons:

- Some variables occurred in both databases, which allowed validation of data quality.
- Some variables occurred in only one database, so using both databases enabled analysis of a wider variety of risk factors.

Demographic data used the population at risk for the denominator in incidence risk calculations. Population data was obtained from Census data for 2001.⁴⁹ Projected population data for 2002 to 2006 were obtained from the Strategic Transportation Planning Department at eThekweni Transport Authority. However, the annual data were for total populations, divided by race group and not gender, and so were not suitable for some of the population specific incidence risk measures of disease occurrence.⁵⁰

3.8 VARIABLES

The following variables in relation to motor vehicle collisions involving pedestrians were obtained from the eThekweni Transport Authority database for the period 2001 to 2006 in eThekweni municipality:

Number of motor vehicle collisions involving pedestrians.

Population at risk, by age and gender.

Number of pedestrians injured in different age groups.

Number of pedestrian fatalities involved in motor vehicle collisions in different age groups.

ⁿ The computer programme was developed by a programmer who consults for the eThekweni Transport Authority. The raw data is not available using this programme. A system has been developed by the programmer, whereby summary reports can be extracted for different types of collisions, classes of road users, locations etc in a user-friendly manner.

^o According to Mrs Preeta Hirjee of the eThekweni Transport Authority, some fields of the Accident Report form are not well completed by police at accident scenes and so this data is not available, as it is either missing or inaccurate.

The National Injury Mortality Surveillance System collects data from post-mortem reports, police investigative records, forensic pathology laboratory results and criminal justice system reports.⁴⁸ All known fatalities, regardless of the time that has elapsed since the collision, are included in the database. The full database from 2001 to 2005 was made available for the purposes of this research project.

3.9 BIAS AND LIMITATIONS

3.9.1 Selection bias

Motor vehicle collisions involving pedestrians where the pedestrian either suffers from minor or no injuries may often not be reported to the police and therefore not captured on the Accident Report Form and not collated in the eThekweni Transport Authority database. It is difficult to control the quality and completeness of data on motor vehicle collisions as this relies on members of the public reporting collisions to the police, and on accurate completion of the Accident Report form by police personnel. Comparisons were made between fatalities recorded in the eThekweni Transport Authority database and the National Injury Mortality Surveillance Survey records to validate data quality.

3.9.2 Information bias

Accurate completion of the Accident Report form will reduce information bias and improve the internal validity of the data. Inaccurate grading of injuries by the police officials completing the form in particular could contribute to information bias. The police officers may selectively complete certain fields such as suspected alcohol use based on preconceived ideas about who is likely to be intoxicated. A driver or pedestrian suspected of being under the influence of alcohol is required to be taken to a police station for testing, which is a time-consuming procedure and thus a disincentive for police officers to apply the law. Incomplete but useful data fields often could not be processed and utilised in the analysis.

In addition, the study relies on correct capture of data onto the database from the Accident Report form by data capturers employed by the road safety section of the eThekweni Transport Authority. The study involves a secondary analysis of data, so the quality of the data collection could not be influenced. The use of both the National Injury Mortality Surveillance System and eThekweni Transport Authority data for fatalities enabled an assessment of the degree of congruence between the two databases.

3.10 STATISTICAL ANALYSIS

Analysis of the National Injury Mortality Surveillance System database and summary reports of eThekweni Transport Authority database was conducted using Microsoft Excel 2000. Incidence Risks and Incidence Risk Ratios were calculated. Additional analysis was done using Epicalc 2000 (Version 1.02) and EpiInfo 6 (Version 6.04d). These programmes were used to calculate confidence intervals and p-values, and to test for significant trends. Variables with high proportions of missing variables such as age were further analysed to search for differences between the cases with and without missing

CHAPTER IV: RESULTS

4.1 INTRODUCTION

Chapter 4 presents the results of analysis of both databases relating to pedestrians involved in motor vehicle collisions, the drivers involved in these collisions and environmental factors that may have contributed towards the collisions.

4.2 ANALYSIS OF DATA

Two databases were processed and analysed to obtain the results of this study, which aims to describe the epidemiology of motor vehicle collisions involving pedestrians in the eThekweni municipality from 2001 to 2006 and to assess risk factors that could be contributing to the findings. The databases used were the eThekweni Transport Authority database (2001 to 2006) and the National Injury Mortality Surveillance System database (which only records fatalities, from 2001 to 2005) of motor vehicle collisions involving pedestrians in the eThekweni municipality. Incidence risk is the outcome measure used in this study looking at motor vehicle collisions involving pedestrians.

4.3 PEDESTRIANS

4.3.1 Trend in Pedestrian Injuries and Fatalities 2001 to 2006.

Motor vehicle collisions that involve pedestrian injuries and fatalities reported in the eThekweni Transport Authority database were assessed from 2001 to 2006 (Table 2). There has been a gradual but statistically significant decrease in pedestrian injury incidence risk from 2001 (241 per 100 000 population) to 2006 (193 per 100 000 population) (χ^2 for trend = 2.69: $p < 0.001$). The odds ratio for non-fatal injuries dropped from 1 in 2001 (reference year) to 0.80 in 2006 ($p < 0.001$).

The annual case fatality increased from 2001 (4.9%) to 2006 (6.8%), although the fatality incidence risk (12 per 100 000 in 2001 to 13 per 100 000 in 2006) did not change significantly (χ^2 for trend = 1.26: $p = 0.26$). The odds ratio rose from 1 in 2001 (reference year) to 1.12 in 2006, but this also was not statistically significant.

A graphic comparison of the changing patterns of injury incidence risk and fatality incidence risk from 2001 to 2006 is shown in Figure 1.

4.3.2 Occurrence of Pedestrian Injuries in eThekweni Municipality in 2005

There were a total of 5 593 non-fatal injuries in eThekweni in 2005 reported in the eThekweni Transport Authority database. This included 276 (27%) children under 15 years and 1 257 (28%) adults with serious injuries, and 755 (73%) children and 3283 (72%) adults with slight injuries. The age of the balance (n = 22) of the injured pedestrians was not recorded (Table 3).

4.3.3 Occurrence of Pedestrian Fatalities in eThekweni Municipality in 2005

There were a total of 433 fatalities in eThekweni in 2005 according to the eThekweni Transport Authority database. Of these, 53 (12%) were children under the age of 15 years, and 380 (88%) were adults.

4.3.4 Pedestrians Injuries and Fatalities by Age

The age of pedestrians injured in motor vehicle collisions and reported on the eThekweni Transport Authority database in 2005 are presented in Table 3. Fatalities recorded in the National Injury Mortality Surveillance System were included for comparison.

The overall incidence risk of pedestrian injuries in children under 15 years of age in 2005 was 115 per 100 000. The 5 to 9 year old subgroup had the highest pedestrian injury incidence risk of 162 per 100 000 population. The overall fatality risk in children under 15 years of age was 6 per 100 000 population in eThekweni municipality. The highest fatality risk of 11 per 100 000 child population occurred in the 5 to 9 year age group. The incidence risk ratio of 5 to 9 year old pedestrians relative to other child pedestrians was 1.77 (95% Confidence Interval: 1.56 to 2.00; $p < 0.001$).

In adults (15 years and older), the overall incidence risk, including those without a recorded age, was 220 per 100 000 population in 2005. Excluding those of unknown age, the incidence risk was 131 per 100 000 population. The age group of pedestrians aged 30 to 34 year old had an incidence risk of 163 per 100 000. The incidence risk ratio of this group relative to other adult pedestrians (excluding adults of unknown age) was 1.29 (95% Confidence Interval: 0.93 to 1.78; $p = 0.13$). Overall, 35% (2 110) of pedestrian injuries did not have an age recorded. Only 9% (102) of children did not have an age recorded compared to 40% (1 986) of adult injured pedestrians in the eThekweni Transport Authority database.

The incidence risk ratio of injuries in child pedestrians compared to adult pedestrians injured in motor vehicle collisions was 0.96 (95% Confidence Interval: 0.76 to 1.20; $p = 0.10$) overall. There were 66% (Incidence Rate Ratio: 0.34; 95% Confidence Interval: 0.14 to 0.87; $p = 0.02$) less child fatalities compared to adult fatalities.

In 2005 in eThekweni municipality, the overall case fatality of motor vehicle collisions involving pedestrians was 7.5%. The overall case fatality in adults was 7.7% and in children under 15 years of age was 4.9%. In children, the highest case fatality was in the

Table 3: Occurrence of Injury and Fatality of Pedestrians Involved in Motor Vehicle Collisions from January to December 2005 in eThekweni by Age Group (eThekweni Transport Authority Database and National Injury Mortality Surveillance System)

| Age group (years) | eThekweni Transport Authority | | | | | | National Injury Mortality Surveillance System | | | |
|--------------------------|-------------------------------|--------------------|---------------------------------------|----------------------|----------------------------------|---------------|---|---------------------------------|---------------|--|
| | Population at risk | Number of injuries | Total Injury Incidence Risk / 100 000 | Number of Fatalities | Fatality Incidence Risk /100 000 | Case Fatality | Number of Fatalities | Fatality Incidence Risk/100 000 | Case Fatality | |
| < 5 | 273098 | 167 | 61 | 10 | 4 | 6.0% | 12 | 4 | 7.2% | |
| 5 to 9 | 286610 | 463 | 162 | 32 | 11 | 6.9% | 33 | 12 | 7.1% | |
| 10 to 14 | 294818 | 352 | 119 | 13 | 4 | 3.7% | 10 | 3 | 2.8% | |
| Total Child excl unknown | 854526 | 982 | 115 | 55 | 6 | 5.6% | 55 | 6 | 5.6% | |
| Child unknown age | - | 102 | - | 1 | - | 1.0% | - | - | - | |
| Total Child | 854526 | 1084 | 127 | 53 | 6 | 4.9% | 55 | 6 | 5.1% | |
| 15 to 19 | 323343 | 309 | 96 | 15 | 5 | 4.9% | 21 | 6 | 6.8% | |
| 20 to 24 | 331474 | 413 | 125 | 41 | 12 | 9.9% | 30 | 9 | 7.3% | |
| 25 to 29 | 316323 | 467 | 148 | 58 | 18 | 12.4% | 44 | 14 | 9.4% | |
| 30 to 34 | 256429 | 419 | 163 | 40 | 16 | 9.5% | 39 | 15 | 9.3% | |
| 35 to 39 | 236007 | 320 | 136 | 45 | 19 | 14.1% | 44 | 19 | 13.8% | |
| 40 to 44 | 195032 | 303 | 155 | 40 | 21 | 13.2% | 26 | 13 | 8.6% | |
| 45 to 49 | 154641 | 205 | 133 | 19 | 12 | 9.3% | 21 | 14 | 10.2% | |
| 50 to 54 | 129095 | 185 | 143 | 21 | 16 | 11.4% | 14 | 11 | 7.6% | |
| 55 to 59 | 91992 | 131 | 142 | 16 | 17 | 12.2% | 12 | 13 | 9.2% | |
| 60 to 64 | 72329 | 86 | 119 | 12 | 17 | 14.0% | 16 | 22 | 18.6% | |
| 65 to 69 | 50019 | 43 | 86 | 4 | 8 | 9.3% | 2 | 4 | 4.7% | |
| > 70 | 78911 | 53 | 67 | 6 | 8 | 11.3% | 4 | 5 | 7.5% | |
| Total Adult excl unknown | 2235595 | 2934 | 131 | 317 | 14 | 10.8% | - | - | - | |
| Adult unknown age | - | 1986 | - | 63 | - | 3.2% | - | - | - | |
| Total Adult | 2235595 | 4920 | 220 | 380 | 17 | 7.7% | 273 | 12 | 5.5% | |
| Total Child (0-14) | 854526 | 1083 | 127 | 53 | 6 | 4.9% | 55 | 6 | 5.1% | |
| Total Adult (15+) | 2235595 | 4920 | 220 | 380 | 17 | 7.7% | 273 | 12 | 5.5% | |
| Unknown Age | - | 23 | - | 0 | - | 0.0% | 0 | - | 0.0% | |
| Grand Total | 3090121 | 6026 | 195 | 433 | 14 | 7.2% | 328 | 11 | 5.4% | |

4.3.6 Occurrence of Pedestrians Injured and Killed by Age and Gender

Pedestrians who died in motor vehicle collisions and reported on the National Injury Mortality Surveillance System database were analysed according to age and gender for 2005 (Table 5).

The overall incidence risk of pedestrian death in males under 15 years of age in 2005 was 38 per 100 000 population at risk and in female children was 17 per 100 000. The 5 to 9 year old male subgroup retained the highest fatality incidence risk of 23 per 100 000 population. The fatality risk ratio of 5 to 9 year old male pedestrians relative to other child pedestrians was as 3.6 (95% Confidence Interval: 2.1 to 6.1; $p < 0.001$). The fatality risk ratio of male child pedestrians relative to female child pedestrians was 2.3 (95% Confidence Interval: 1.3 to 4.0; $p = 0.004$).

In adult males (15 years and older), the fatality incidence risk was 218 per 100 000 population in 2005. The fatality incidence risk for adult females was 55 per 100 000. The age groups of male pedestrians from 25 to 39 years old possessed an incidence risk of 34 to 38 per 100 000. The incidence risk ratio of this group relative to other adult pedestrians was 1.7 (95% Confidence Interval: 1.3 to 2.3; $p < 0.001$). The fatality risk ratio of male adult pedestrians relative to female adult pedestrians was 4.0 (95% Confidence Interval: 1.7 to 9.3; $p < 0.001$).

4.3.7 Occurrence of Pedestrians Injured and Killed According to Gender and Race

Pedestrians who died in motor vehicle collisions in eThekweni Municipality and whose deaths were reported on the National Injury Mortality Surveillance System database were analysed according to gender and race for 2005 (Table 5).

The incidence risk of motor vehicle collisions involving pedestrian deaths in black males in 2005 was 22 per 100 000 population at risk and in black females was 5 per 100 000. The fatality risk ratio of black males pedestrians relative to black female pedestrians was 3.96 (95% Confidence Interval: 1.6 to 9.76; $p = 0.002$). The fatality risk ratio of black males pedestrians relative to all other pedestrians was 1.45 (95% Confidence Interval: 0.8 to 2.5; $p = 0.18$). The fatality risk ratio of black female pedestrians relative to other female pedestrians was as 2.8 (95% Confidence Interval: 0.3 to 23.2; $p = 0.32$).

Table 6: Occurrence of Pedestrian Fatalities in Motor Vehicle Collisions in eThekweni Municipality by Gender and Race in 2005 (National Injury Mortality Surveillance Database).

| Race | Male | | | Female | | | Incidence Risk Ratio |
|--------------|--------------------|----------------------|----------------------------------|--------------------|----------------------|----------------------------------|----------------------|
| | Population at Risk | Number of Fatalities | Fatality Incidence Risk/ 100 000 | Population at Risk | Number of Fatalities | Fatality Incidence Risk/ 100 000 | |
| Black | 1 015 141 | 221 | 22 | 1 095 442 | 58 | 5 | 3.96 |
| Asian | 295 833 | 27 | 9 | 319 002 | 10 | 3 | 2.91 |
| Coloured | 40 823 | 4 | 10 | 46 452 | 2 | 4 | 2.28 |
| White | 133 239 | 5 | 4 | 144 185 | 2 | 1 | 2.71 |
| Total | 1 485 036 | 257 | 17 | 1 605 081 | 72 | 4 | 3.86 |

4.3.8 Occurrence of Pedestrians Injured and Killed According to Age, Gender and Blood Alcohol Level

Pedestrians who died in motor vehicle collisions in eThekweni Municipality and reported on the National Injury Mortality Surveillance System database were analysed according to age and blood alcohol level for 2005 for males (Table 7) and females (data not shown). These were categorised according to their reported blood alcohol level. The three groups used were 0g/100ml, up to 0.049g/100ml and above 0.05g/100ml.[†]

Only 46% of pedestrian fatalities in the database in 2005 had data on their blood alcohol level. Blood alcohol level data was available for 48% (947) of males and 39% (260) of females.

[†] The legal limit for driving in South Africa is a blood alcohol level of less than 0.05g/100ml

Authority database whereas it was highest in the 60 to 64-year-old age group (22 per 100 000) in the national database.

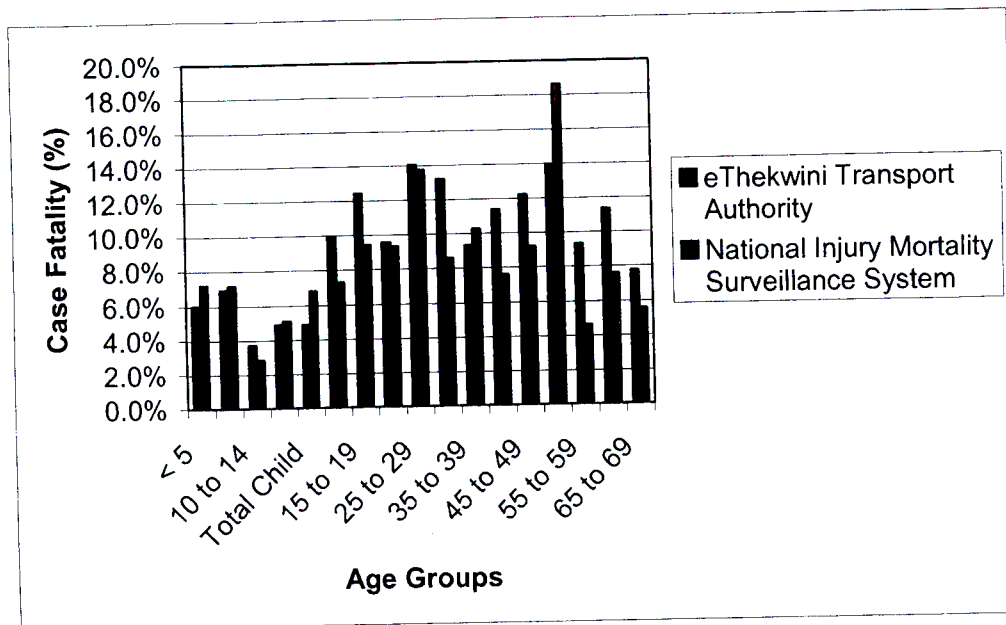


Figure 2: Comparison of Case Fatality (%) for Pedestrians Involved in Motor Vehicle Collisions for the eThekweni Transport Authority and the National Injury Mortality Surveillance System Databases in eThekweni in 2005.

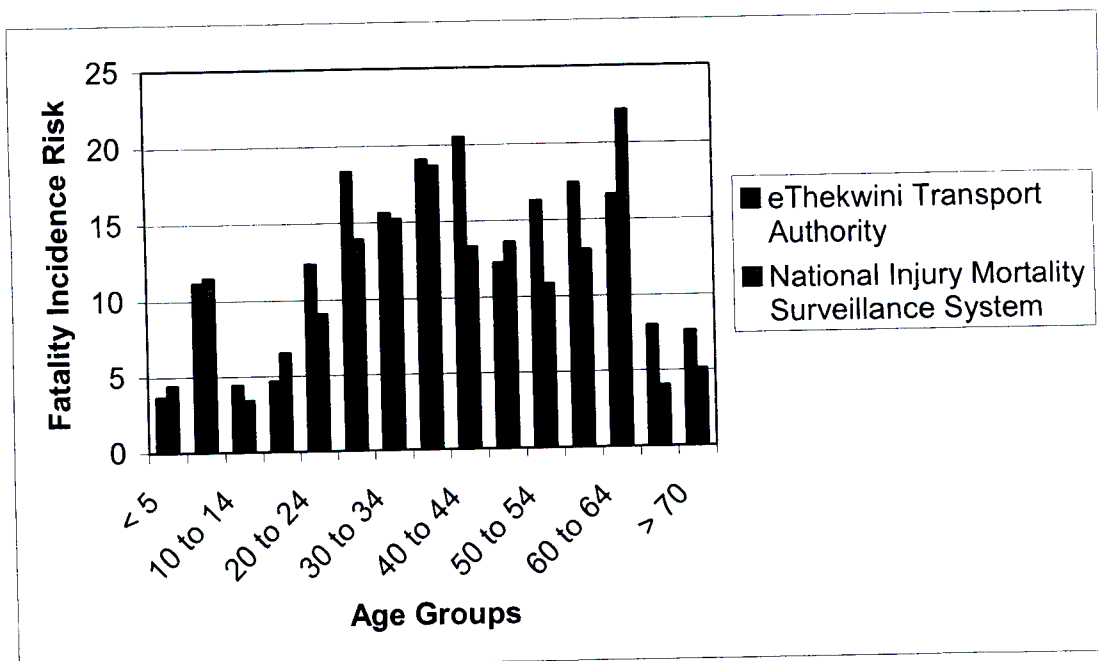


Figure 3: Comparison of Fatality Incidence Risk per 100 000 for Pedestrians Involved in Motor Vehicle Collisions for the eThekweni Transport Authority and National Injury Mortality Surveillance System Databases in eThekweni in 2005.

Table 8: Drivers Involved in Pedestrian/Motor Vehicle Collision in eThekweni from 2001 to 2006 (eThekweni Transport Authority Database)

| Year | Total Drivers | Population at Risk | Incidence Risk /100 000 | Odds Ratio | Male Drivers | Male Population at Risk | Incidence Risk /100 000 | Odds Ratio | Female Drivers | Female Population at Risk | Incidence Risk /100 000 | Odds Ratio | Unknown |
|------|---------------|--------------------|-------------------------|------------|--------------|-------------------------|-------------------------|------------|----------------|---------------------------|-------------------------|------------|---------|
| 2001 | 7 576 | 2 235 595 | 339 | 1.00 | 4 481 | 1 059 181 | 423 | 1.00 | 602 | 1 176 414 | 51 | 1.00 | 2 493 |
| 2002 | 7 303 | 2 235 595 | 327 | 0.96 | 4 629 | 1 059 181 | 437 | 1.03 | 623 | 1 176 414 | 53 | 1.03 | 2 051 |
| 2003 | 6 939 | 2 235 595 | 310 | 0.92 | 4 707 | 1 059 181 | 422 | 1.05 | 654 | 1 176 414 | 56 | 1.09 | 1 578 |
| 2004 | 6 980 | 2 235 595 | 312 | 0.92 | 4 734 | 1 059 181 | 447 | 1.06 | 702 | 1 176 414 | 60 | 1.17 | 1 544 |
| 2005 | 6 485 | 2 235 595 | 261 | 0.86 | 4 392 | 1 059 181 | 426 | 0.98 | 732 | 1 176 414 | 62 | 1.22 | 1 361 |
| 2006 | 6 712 | 2 235 595 | 297 | 0.89 | 4 503 | 1 059 181 | 423 | 1.00 | 731 | 1 176 414 | 62 | 1.22 | 1 478 |

Table 9: Occurrence of Injury in Drivers Involved in Motor Vehicle Collisions Involving Pedestrians from January to December 2006 by Age Group and Gender in eThekweni (eThekweni Transport Authority Database).

| Age Group (Years) | Population At Risk | Total Drivers | Incidence Risk /100 000 | Male Population At Risk | Male Drivers | Incidence Risk /100 000 | Female Population At Risk | Female Drivers | Incidence Risk /100 000 | Unknown |
|--------------------|--------------------|---------------|-------------------------|-------------------------|--------------|-------------------------|---------------------------|----------------|-------------------------|--------------|
| 15 to 19 | 129 337 | 66 | 51 | 63 130 | 52 | 82 | 66 207 | 12 | 18 | 2 |
| 20 to 24 | 331 474 | 607 | 183 | 162 918 | 539 | 331 | 168 556 | 65 | 39 | 3 |
| 25 to 29 | 316 323 | 850 | 269 | 156 719 | 733 | 468 | 159 604 | 115 | 72 | 2 |
| 30 to 34 | 256 429 | 821 | 320 | 123 867 | 698 | 564 | 132 562 | 122 | 92 | 1 |
| 35 to 39 | 236 007 | 653 | 277 | 111 027 | 514 | 463 | 124 980 | 133 | 106 | 6 |
| 40 to 44 | 195 032 | 555 | 285 | 91 639 | 442 | 482 | 103 393 | 109 | 105 | 4 |
| 45 to 49 | 154 641 | 376 | 243 | 72 870 | 311 | 427 | 81 771 | 62 | 76 | 3 |
| 50 to 54 | 129 095 | 252 | 195 | 62 105 | 220 | 354 | 66 990 | 31 | 46 | 1 |
| 55 to 59 | 91 992 | 194 | 211 | 42 363 | 179 | 423 | 49 629 | 14 | 28 | 1 |
| 60 to 64 | 72 329 | 93 | 129 | 30 124 | 83 | 276 | 42 205 | 10 | 24 | 0 |
| 65 to 69 | 50 019 | 46 | 92 | 19 536 | 42 | 215 | 30 483 | 4 | 13 | 0 |
| > 70 | 78 911 | 34 | 43 | 28 187 | 31 | 110 | 50 724 | 2 | 4 | 1 |
| Adult | - | 2 066 | - | - | 625 | - | - | 51 | - | 1 390 |
| Unknown age | - | 99 | - | - | 34 | - | - | 1 | - | 64 |
| Grand Total | 2 041 589 | 6 712 | 329 | 1 059 181 | 4 503 | 425 | 1 176 414 | 731 | 62 | 1 478 |

Table 10: Comparison of Fatality and Injury Incidence Risk for Pedestrians, Drivers and Passengers in eThekweni in 2006 (eThekweni Transport Authority Database).

| Pedestrians | | | | | | |
|--------------------|---------------------------|-------------------------------------|---------------------------------------|-----------------------------|---|----------------------|
| | Population at Risk | Number of Non-Fatal Injuries | Injury Incidence Risk /100 000 | Number of Fatalities | Fatality Incidence Risk /100 000 | Case Fatality |
| Child (0 to 14) | 854 526 | 1 011 | 118 | 74 | 9 | 7.3% |
| Adult (15+) | 2 235 595 | 4 790 | 214 | 355 | 16 | 7.4% |
| Unknown | - | 57 | - | 1 | - | 1.8% |
| Total | 3 090 121 | 5801 | 188 | 430 | 14 | 7.4% |

| Drivers | | | | | | |
|----------------|---------------------------|-------------------------------------|---------------------------------------|-----------------------------|---|----------------------|
| | Population at Risk | Number of Non-Fatal Injuries | Injury Incidence Risk /100 000 | Number of Fatalities | Fatality Incidence Risk /100 000 | Case Fatality |
| Adult (15+) | 2 235 595 | 201 | 9 | 1 | 0 | 0.5% |
| Unknown | - | 5 | - | 0 | - | - |
| Total | 2 235 595 | 206 | 9 | 1 | 0 | 0.5% |

| Passengers | | | | | | |
|-------------------|---------------------------|-------------------------------------|---------------------------------------|-----------------------------|---|----------------------|
| | Population at Risk | Number of Non-Fatal Injuries | Injury Incidence Risk /100 000 | Number of Fatalities | Fatality Incidence Risk /100 000 | Case Fatality |
| Child (0 to 14) | 854 526 | 6 | 1 | 0 | 0 | 0.0% |
| Adult (15+) | 2 235 595 | 46 | 2 | 1 | 0 | 0.1% |
| Unknown | - | 0 | - | 0 | - | - |
| Total | 3 090 121 | 52 | 2 | 1 | 0 | 1.9% |

Table 11: Fatalities and Injuries in Pedestrian/Motor Vehicle Collisions by Road Type in eThekweni in 2006 (eThekweni Transport Authority Database).

| Road Type | Fatal Collisions | % | Collisions with Serious Injuries | % | Collisions with Slight Injuries | % | Collisions with Non Fatal Injuries | % | Total Collisions | % |
|--------------------|-------------------------|---------------|---|---------------|--|---------------|---|---------------|-------------------------|---------------|
| Arterial | 23 | 5.4% | 64 | 3.3% | 122 | 3.0% | 186 | 3.1% | 218 | 3.4% |
| Collector | 46 | 10.8% | 270 | 14.0% | 569 | 14.1% | 839 | 14.1% | 899 | 13.9% |
| Distributor | 243 | 57.3% | 1 307 | 67.9% | 2 774 | 68.9% | 4 081 | 68.6% | 4 397 | 67.9% |
| Freeway | 83 | 19.6% | 53 | 2.8% | 91 | 2.3% | 144 | 2.4% | 223 | 3.4% |
| Local | 29 | 6.8% | 230 | 12.0% | 472 | 11.7% | 702 | 11.8% | 737 | 11.4% |
| Total | 4 241 | 100.0% | 1 924 | 100.0% | 4 028 | 100.0% | 5 952 | 100.0% | 6 474 | 100.0% |

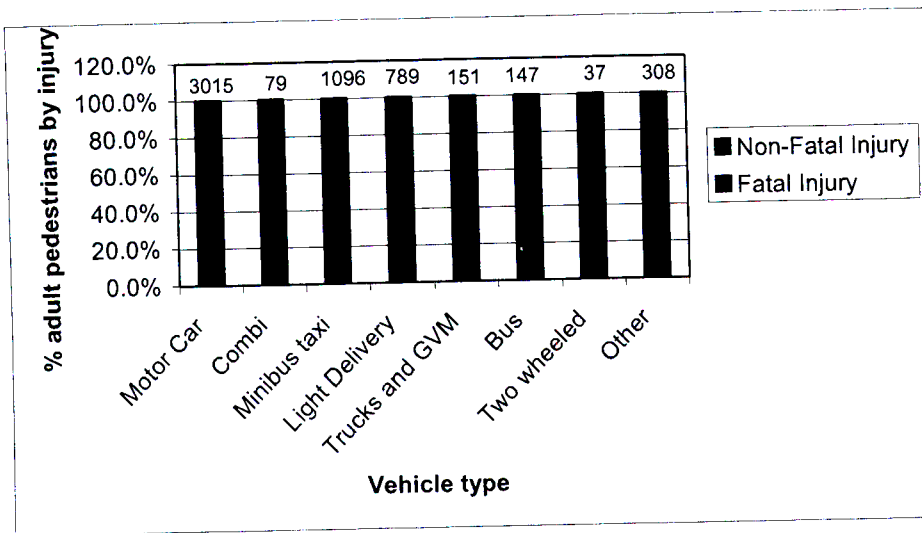


Figure 6: Adult Injuries According to Vehicle Type Motor Vehicle Collisions Involving Pedestrians in eThekweni in 2006 (eThekweni Transport Authority Database).

4.6.3 Road Conditions

Data from pedestrian collisions occurring at different road and light conditions that were reported in the eThekweni Transport Authority database are presented as percentages (Figure 7). More than two thirds (4 527 - 69%) of all motor vehicle collisions involving pedestrians occurred during daylight hours, 18% (1 216) at night, lit by streetlights, 11% (738) at dawn or dusk, and 2% (97) at night on unlit roads in 2006. Although only 18% of collisions occurred at night, lit with streetlights, collisions in these light conditions accounted for nearly double the fatalities (130 - 33%). While only 2% (97) of collision occurred at night in unlit conditions, more than four times the fatalities occurred in these conditions.

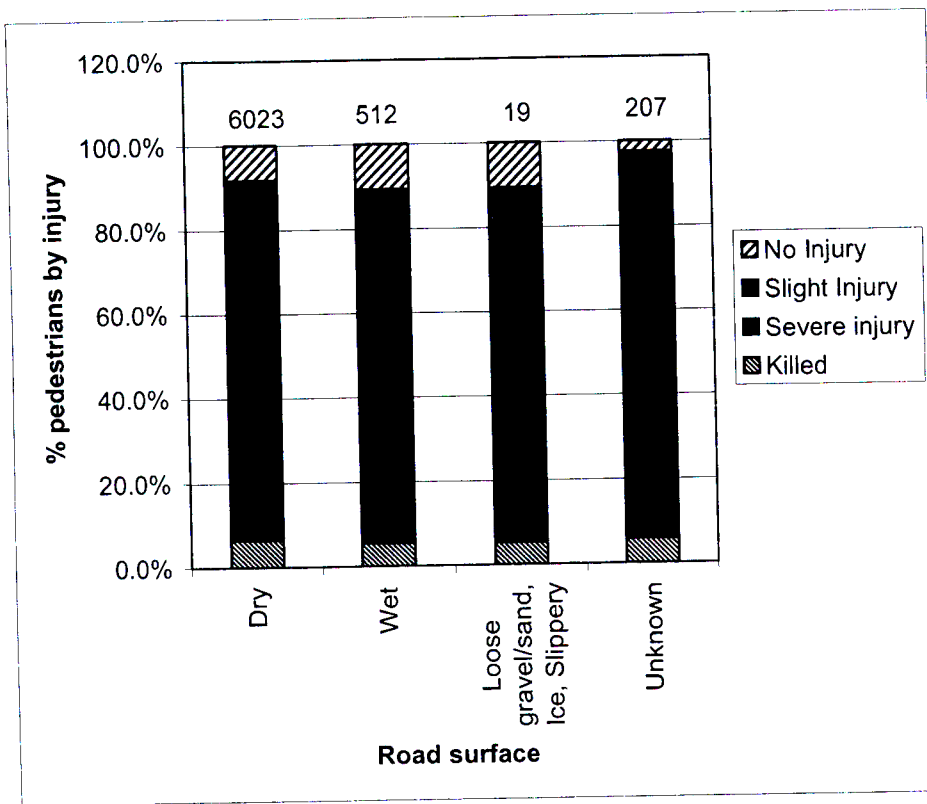


Figure 8: Injury Type According to Road Conditions in eThekweni in 2006 (eThekweni Transport Authority Database).

4.6.4 Time of collision

4.6.4.1 Month of the year

Collisions are recorded according to the month of the year in which the collision occurred (Figure 9). The month with the lowest proportion of collisions was January (6.7%) and with the highest proportion were October and November (9.4% and 9.8% respectively).

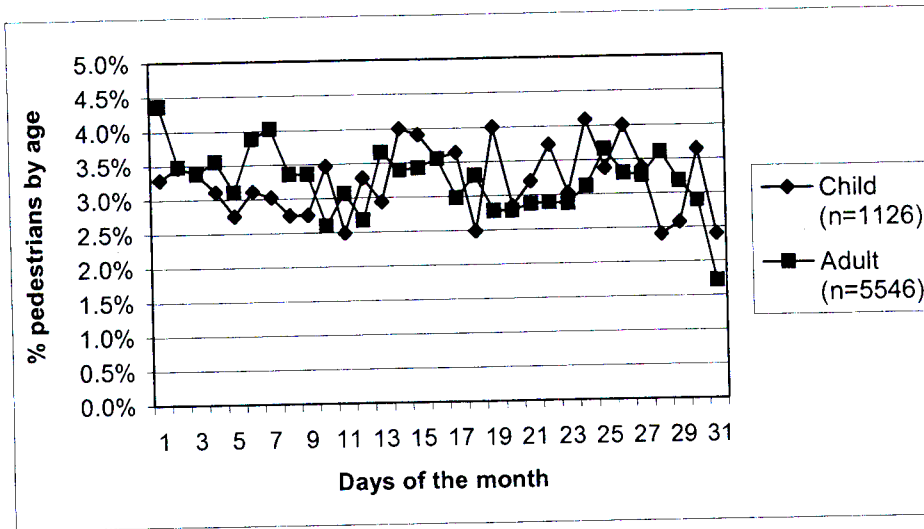


Figure 10: Pedestrians Involved in Motor Vehicle Collisions by Age by Day of the Month in eThekweni in 2006 (eThekweni Transport Authority Database).

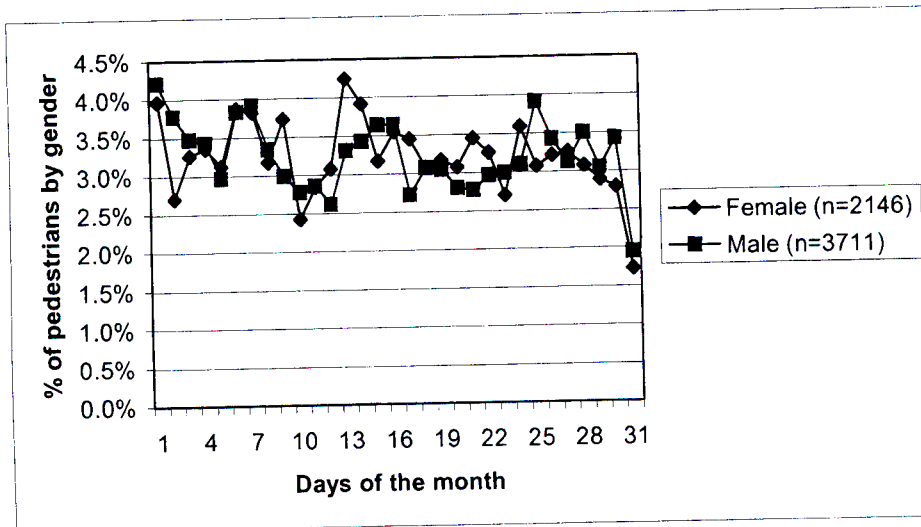


Figure 11: Pedestrians Involved in Motor Vehicle Collisions by Gender by Day of the Month in eThekweni in 2006 (eThekweni Transport Authority Database).

4.6.4.3 Day of the week

Most motor vehicle collisions involving pedestrians occurred on Fridays and Saturdays (18% and 19% respectively in 2006), with Sundays and Wednesdays recording the smallest proportion of collisions (12% each).

Twenty one percent (31) of drivers under 30 years were involved in collisions on Saturdays, dropping to 12% (164) on Sundays (Table 12). In older driver groups, the highest proportion of collisions occurred on Fridays. In the 50 to 59 year old group, 25% (108) of collisions occur on Fridays, and only 8% (27) on Sundays. These differences were statistically significant ($\chi^2 = 41.3$; $p = 0.02$).

Table 12: Comparison of Age Groups of Drivers by Day of the Week in eThekweni in 2006 (eThekweni Transport Authority Database).

| Age Group (Years) | Monday | | Tuesday | | Wednesday | | Thursday | | Friday | | Saturday | | Sunday | | Total |
|----------------------|--------|-------|---------|-------|-----------|-------|----------|-------|--------|-------|----------|-------|--------|-------|-------|
| | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % | |
| <30 | 184 | 12.3% | 193 | 12.9% | 197 | 13.2% | 192 | 12.8% | 258 | 17.2% | 310 | 20.7% | 164 | 10.9% | 1,498 |
| 30 - 39 | 199 | 13.6% | 180 | 12.3% | 169 | 11.6% | 195 | 13.3% | 290 | 19.8% | 265 | 18.1% | 163 | 11.2% | 1,461 |
| 40 - 49 | 143 | 15.6% | 112 | 12.2% | 117 | 12.7% | 123 | 13.4% | 170 | 18.5% | 144 | 15.7% | 109 | 11.9% | 918 |
| 50 - 59 | 55 | 12.5% | 57 | 13.0% | 65 | 14.8% | 48 | 10.9% | 108 | 24.6% | 69 | 15.7% | 37 | 8.4% | 439 |
| >60 | 20 | 11.8% | 32 | 18.9% | 21 | 12.4% | 15 | 8.9% | 32 | 18.9% | 30 | 17.8% | 19 | 11.2% | 169 |
| Total | 601 | 13.4% | 574 | 12.8% | 569 | 12.7% | 573 | 12.8% | 858 | 19.1% | 818 | 18.2% | 492 | 11.0% | 4,485 |

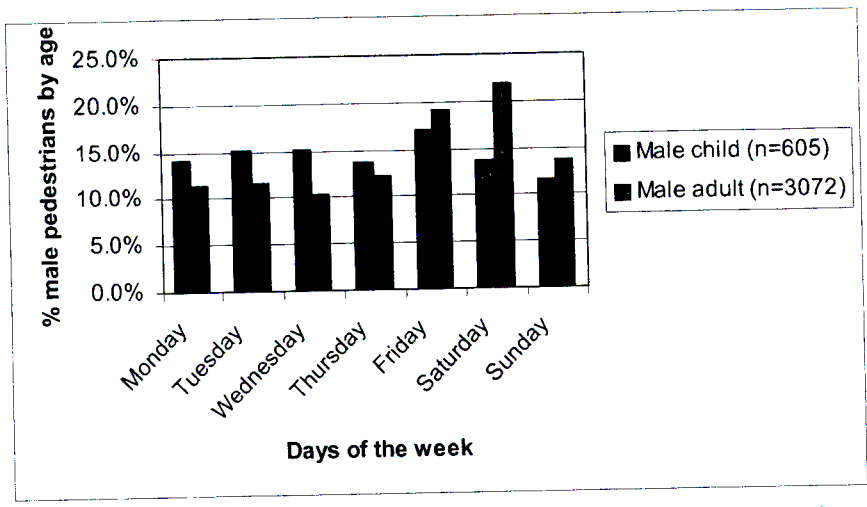


Figure 13: Male Pedestrians Involved in Motor Vehicle Collisions by Age by Day of the Week in eThekweni in 2006 (eThekweni Transport Authority Database).

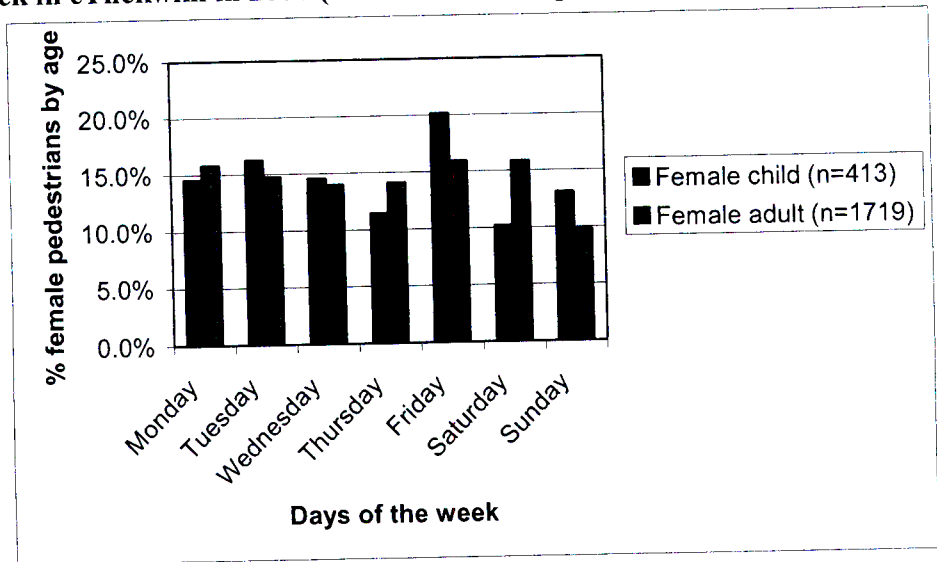


Figure 14 : Female Pedestrians involved in Motor Vehicle Collisions by Age by Day of the Week in eThekweni in 2006 (eThekweni Transport Authority Database).

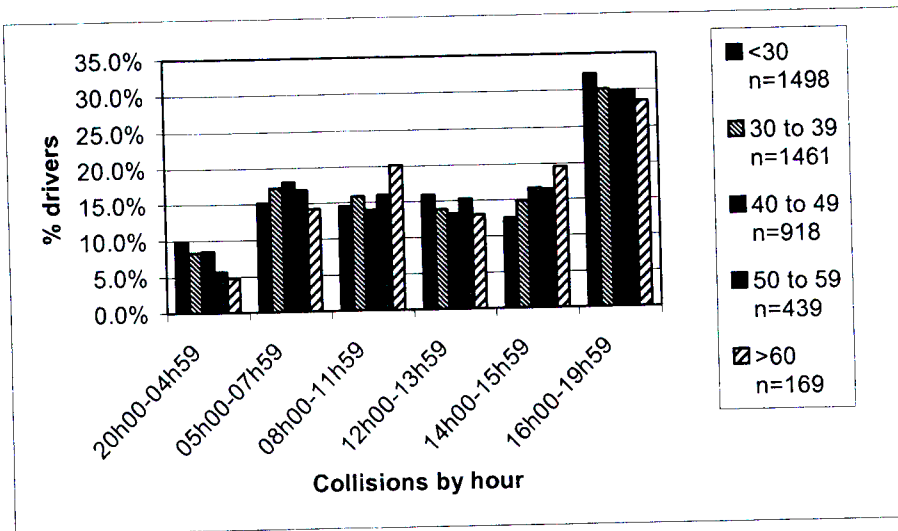


Figure 16: Drivers in Motor Vehicle Collisions Involving Pedestrians by Age by Hour in eThekweni in 2006 (eThekweni Transport Authority Database).

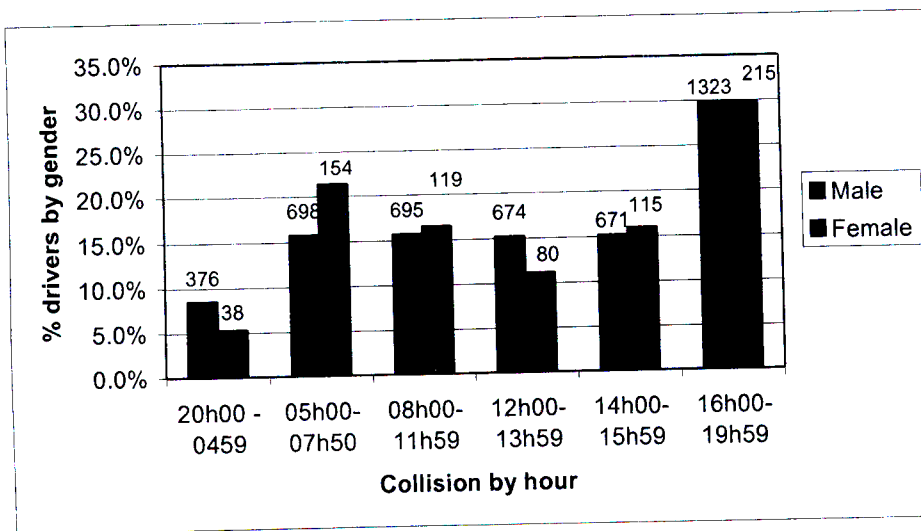


Figure 17: Drivers in Motor Vehicle Collisions Involving Pedestrians by Gender by Hour in eThekweni in 2006 (eThekweni Transport Authority Database).

Female pedestrians involved in motor vehicle collisions involving were compared across different time-periods throughout a twenty-four hour period in figure 18. The highest proportion of collisions occurred in the afternoon peak period from 16h00 to 19h59. In female pedestrians aged 15 to 44 years, this accounted for 25% (233) of collisions. In the time period from 14h00 to 19h59, 53% (220) of collisions involving female children occurred. In adults aged 45 years and over, 47% (158) of collisions occurred between 05h00 and 11h59. Both adult and child pedestrians were involved in a lower proportion of collisions during the night (20h00 to 04h59). These differences were statistically significant ($\chi^2 = 73.4$; $p < 0.001$).

4.7 SUMMARY OF CHAPTER

The chapter presents the results of the study. It demonstrates the high involvement of male pedestrians and male drivers particularly in the economically active age, and the higher proportion of collisions involving pedestrians occurring in peak traffic times and on Fridays and Saturdays

boys is at least partly attributable to their increased exposure to traffic compared to girls. It seems plausible that, if this increased exposure was controlled, injury incidence risk in boys might decrease. However, earlier studies have shown that the developmental stage of the children most at risk (the 5 to 9 year old age group) makes behavioural modification of very limited effectiveness.⁸

While one study found a ratio of 1.7 to 1 of male to female child fatalities, this study found a fatality risk ratio of 2.25 of males compared to females.⁸ The gender differences are more pronounced in the urban South African context where traffic mix and behaviour is reflective of that of a developing country.

The observed case fatality of pedestrians in eThekweni was different from American reports. In eThekweni 6.8% of injuries were fatal in child pedestrians under 15 years of age. The range was 3.8% to 7.4% in different subgroups. In America, a case fatality of 0.4% to 1.0% was reported.⁷ An explanation could be that collisions involving child pedestrians in eThekweni result in more serious injuries, that are more likely to lead to death. The timing and quality of emergency medical care for injured patients may not be as good. The quality and completeness of injury reporting could also lead to these differences. Pedestrian collisions causing fatalities might be more likely to be reported in eThekweni than non-fatal collisions (a form of ascertainment bias), leading to a misleadingly high case fatality.

In adults (above 15 years of age), the overall injury incidence risk for pedestrians is 220 per 100 000 population and the risk for all ages is 195 per 100 000. Comparisons with other countries are unavailable. Fatality risk is the more usual measure of incidence reported internationally. The Road Traffic Management Corporation does not publish statistics specific to pedestrians, or injury or fatality risk measures.^{22, 44}

The overall pedestrian fatality risk in eThekweni Municipality was 14 per 100 000 in 2005. This is slightly higher than 12 per 100 000 for pedestrians calculated by the National Injury Mortality Surveillance System for Tshwane in 2004 and eThekweni for 2005. It is considerably higher than that reported from Mexico, another developing country, which had an overall fatality risk of 7 per 100 000 in 2000. Notably, the fatality risk for females is the same in eThekweni and Mexico (4 per 100 000), but the fatality risks are 11 and 17 for males in Mexico and eThekweni respectively.²⁵ This difference could be related to a combination of differing quality of emergency medical care and differing patterns of exposure of males and females in the two countries. The fatality risks for Australia, Hungary and the Netherlands were reported to be 2, 4 and 1 per 100 000 population respectively in 1996.⁵² Injury incidence risks in developing countries are generally reported for all road traffic collisions rather than for collisions involving pedestrians only, making comparison with other developing countries impossible.

Pedestrians most at risk of injury, both fatal and non-fatal, were in the 20 to 44 years age groups in eThekweni. The age group represent the young economically active group who probably constitute the largest number of pedestrians, thus increasing their risk of injury due to greater exposure than other age groups. Furthermore, this category of people is

of male pedestrians were more likely to be measured by the forensic laboratory than those of female pedestrians, increasing the selection bias. In addition, in the age group from 20 to 44 years, the proportion of fatal pedestrian collisions with known blood alcohol levels is higher than expected for the percentage of pedestrian fatalities of this age group. The highest proportion of those with blood alcohol levels of 0.05g/100ml and above occurred in this age group.^w An explanation for this finding could be that fatally injured pedestrians in this age group are more likely to have their blood alcohol levels measured because of perceptions by police officers or pathologists regarding groups more likely to use alcohol.

While there is little missing data about age of pedestrians in the National Injury Mortality Surveillance System, the eThekweni Transport Authority database contains a large proportion of fatally and non-fatally injured pedestrians whose age was not recorded. The three “unknown” age categories were “child unknown”, “adult unknown” and “unknown”. The largest proportion of injured pedestrians without age recorded was located in the adult group. Rather than discarding the injuries with unknown ages, they were allocated to age groups proportionally to those with known age groups. By allocating the adult unknown group according to age proportions of adult pedestrians of known age, comparison was possible. The corrected injury incidence risk was higher than that calculated from the uncorrected data but only exhibited a slightly raised fatality risk. The case fatality proportion also dropped noticeably. The “unknown” groups consisted of a higher proportion of non-fatally injured pedestrians resulting in a large misclassification measurement bias. A possible explanation for this is that the Accident Report form is completed more accurately when there is a fatality, or that data from the Accident Report form is supplemented by mortuary data (which has more complete data about age) in pedestrian fatalities that do not occur at the scene of the collision.

The number of fatalities recorded in the eThekweni Transport Authority and National Injury Mortality Surveillance System databases differs, particularly among the adult age groups. The eThekweni Transport Authority database records considerably more pedestrian fatalities in 2005 than the National Injury Mortality Surveillance System database. Despite the fact that the latter database reports all deaths due to pedestrian collisions, regardless of the time that has elapsed since the collisions^x, this situation occurs while the eThekweni Transport Authority database only records fatalities that transpired up to 6 days after the collision. The eThekweni Transport Authority follow up cases, using the Accident Report form details, by checking cases in the mortuary.

The probable reason for this is the “Transport unspecified” category found in the summary report by the National Injury Surveillance System. The summary report classifies transport-related deaths as Driver, Passenger, Pedestrian, Railway case, Cyclist

^w The legal limit for driving in South Africa is a blood alcohol level of less than 0.05g/100ml

^x The inclusion of deaths occurring any time after the road traffic collisions makes it possible that some deaths may be due to co-existing medical conditions such as cardiac disease or HIV. This would cause a misclassification bias.

incidence risk, rather than expressing the incidence using licensed drivers (as discussed below). In the United Kingdom, 43% of drivers registered nationally were females, although female drivers in the study were involved in only 35% of the collisions.⁹ In a more patriarchal society such as South Africa, the percentage of female drivers may be even lower. Unfortunately, the Road Traffic Management Corporation only report the number of drivers' licenses aggregated by province and not by age or gender.^{22, 44, 45}

It has been reported in the United States that while male drivers are over-represented in road traffic collisions, female drivers are at higher risk of serious injury, particularly women from 45 to 54 years old.⁵⁵ Female drivers are more likely to be involved in collisions involving injuries rather than vehicle damage only. The measure of incidence reported in these studies is collisions per million miles driven. Women and men have 2.3 and 1.8 injury involving collisions per million miles driven respectively (n = 80 000).⁵³

A further factor to consider is whether when a man and woman travel in a car together, the man is more or less likely to be the driver than the woman. This could only be measured by calculating average distances travelled per year by males and females, and using these as the denominator. Incidence rate or incidence density would be the measure of outcome occurrence calculated, using distance travelled in kilometres as the denominator, rather than person-time. More detailed denominator data is not available so calculating an incidence rate is impossible.

A major limitation of the analysis of the driver data is the use of the general population data as the denominator population at risk. Ideally, when calculating a population-based measure, the population at risk should only include licensed drivers. The number of licensed drivers is available from Tasima, the organisation that has developed the electronic National Traffic Information System, for the National Department of Transport. A request for this data was made in early November 2007, following extensive attempts to obtain the data from local and provincial traffic authority sources. Due to a backlog and the prioritising of other requests, the data was still not available after a nine month wait, despite repeated following this up of this request^z.

5.2.3 Comparison of pedestrians, drivers and passengers

Comparison of non-fatal and fatal injuries of pedestrians, drivers and passengers in pedestrian motor vehicle collisions showed that most injuries occurred to pedestrians (Incidence Risk = 186 per 100 000 population), the most vulnerable group. Drivers (Incidence Risk = 7 per 100 000) and passengers (Incidence Risk = 2 per 100 000) receive protection through seat belts, airbags or other vehicle protective equipment^{aa}.

^z In addition, the cost of extracting any data would be a minimum of R3000, a potential difficulty as this study was not funded.

^{aa} Protective features include safety glass, ABS and traction control brakes, side, chassis and front reinforcements, headrests, steering wheel retraction, internal bumpers and use of foam substrate material.

426 779) of the vehicles are classified as light passenger vehicles, carrying under 12 persons.⁵⁶ Therefore, proportionally fewer (54%) collisions involved motor cars than other vehicle types. The classification of other vehicle classes by the KwaZulu-Natal Department of Transport was very different to the classification used by the Accident Report form, so no further comparison was possible.

Most literature in the developed world has focused on the increased risk to pedestrians by light trucks and vans, including sports utility vehicles which cause more severe injuries to pedestrians because of the nature of the vehicle frontage.^{10, 57} However in eThekweni these vehicles are classified as motor cars, which renders comparison difficult. In eThekweni, mini- and midi bus taxis and light delivery vehicles, which would appear to be in the high-risk group for pedestrians, surprisingly have only slightly higher proportions of fatally injured pedestrians than motor cars. Because of their smaller stature, child pedestrians are more likely to suffer head trauma and have been shown to be more likely to be fatally injured by bus and motorcycles in the US.³⁸ Fatal injuries by the former can be explained by increased exposure and the latter by difficulties in seeing child pedestrians.

Most pedestrian collisions occur during daylight hours (69%). The most plausible explanation lies in the higher volumes of pedestrian and motor vehicle traffic during the day, leading to increased risk. However, those collisions occurring at night tended to be more serious, resulting in a much higher proportion of fatalities than with collisions occurring during the day. The explanation of this finding is probably due to reduced reaction time because of reduced visibility of pedestrians and higher driving speeds, leading to more severe injuries.¹⁵

The vast majority of pedestrian incidents occur in dry road conditions (89%). The proportion of fatal and non-fatal collisions remains the same across dry, wet and other (slippery, icy, loose gravel) road conditions. While it is expected that this would affect single vehicle or multiple vehicle collisions, the condition of roads is likely to have less effect on pedestrian collisions. The main effect of adverse weather conditions would be decreased visibility of pedestrians. The low proportion of incidents in wet conditions could partly be explained by the reduction in pedestrian numbers in adverse weather conditions. Collisions with unknown road surface conditions recorded a higher proportion of severe injuries and a lower proportion of no injuries than collisions with known road surfaces. This may arise because, due to the serious nature of the injuries, the police officers did not spend as long completing the accident report form accurately.

A comparison was made of data relating to day of the week and time of day in eThekweni and Cape Town.⁴⁶ In both South African municipalities, most pedestrian collisions occurred on Friday and Saturday, with Wednesday having the lowest proportion of the collisions. The higher volumes of pedestrian traffic on Friday and Saturday, particularly during afternoon peak hours, would appear to account for this. The twilight and early evening, when people are out socialising, may also coincide with higher alcohol use than other times of the week. Both male and female drivers and pedestrians are more involved on Fridays, but a peak occurs among male drivers and pedestrians on Saturdays. A

Evidence-based engineering methods to increase visibility of pedestrians include increasing the intensity of roadway lighting and altering the position and angle of parking of motor vehicles. The former method significantly reduced night-time collisions with pedestrians.⁵⁸

Use of roundabouts rather than conventional intersections was the most effective form of speed reduction identified in a review of evidence-based traffic engineering methods to reduce pedestrian collisions.⁵⁸ Traffic calming is another method of speed reduction. A Cochrane review concluded that traffic calming was protective against fatalities (pooled rate ratio = 0.63) and fatal and non-fatal injuries (pooled rate ratio = 0.89) in all road traffic collisions. However the pooled rate ratio for number of pedestrian collisions was 1.00.⁶¹

A method of separation of pedestrians that showed significant reduction in pedestrian conflicts is the use of exclusive traffic signal phasing where all traffic stops for part of pedestrian crossing signal.⁵⁸

A further engineering intervention to decrease road traffic collisions is through the design of safer vehicles. The use of automatic daytime headlights has shown a reduction in daytime collisions demonstrated a reduction of 15% in pedestrian collisions. The construction of safer car fronts can reduce the impact on pedestrians and other vulnerable road users.¹⁶ In less developed countries, with high numbers of pedestrians, buses and trucks, changes which could impact on the number and severity of pedestrian collisions include: making the front of the vehicles “softer”, lowering bumper heights, removing any hard objects below adult height and provide space behind the grill for impact attenuation.¹⁸

5.4 LIMITATIONS

The study used an observational cross-sectional study design, involving a secondary data analysis of two sets, namely the eThekweni Transport Authority and National Injury Surveillance Survey databases. The data is routinely collected and recorded by police officers and mortuary practitioners and collated by data capture by the traffic authorities. An assumption is made that the quality of the collection of data collected and collated and available for analysis on the databases is good.

The eThekweni Transport Authority database that obtains raw data from Accident Report forms was collected by the police officer on duty at a collision. It is primarily collected and used for police records and not for research purposes. A selection bias is very likely as more serious collisions, occurring in more accessible areas, have a higher likelihood of being reported.

The difficulties of using data collected by others became particularly relevant when the differences in the two databases became apparent.

The large proportion of missing data about age, gender and alcohol both in pedestrians and drivers could have resulted in information/reporting bias

CHAPTER VI: CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

Chapter VI presents conclusions and recommendations for the study of the epidemiology of motor vehicle collisions involving pedestrians in eThekweni. The conclusions are based on the results of the data analysed from the eThekweni Transport Authority and National Injury Mortality Surveillance System databases. The recommendations include ways to improve the collection and use of data but also indicate areas that need further study.

6.2 CONCLUSIONS

6.2.1 Pedestrian injuries

The period of 2001 to 2006 demonstrated a gradual statistically significant drop of injury incidence risk. Fatality incidence risk remained similar over the time period. However case fatality increased from 4.9% to 6.8%.

The results for 2005 using the eThekweni Transport Authority and National Injury Mortality Surveillance Survey databases indicated a similar non-fatal injury incidence risk to a developed country, but much higher fatality risk and case fatality in eThekweni. Overall, 5 to 9 year old child pedestrians were the highest risk group for fatal and non-fatal injury. When comparing by gender, 5 to 9 year old boys were in the highest risk group of death, and among adult pedestrians, 30 to 39 year males were at the highest risk of death. Black male pedestrians were at considerably higher risk than other subgroups. Male pedestrians with blood alcohol levels above 0.05g/100ml were over-represented, especially the 15 to 19 year old age group.

Analysis was hampered by high proportions of missing age data in the eThekweni Transport Authority database, and lack of blood alcohol level data in over 50% of the cases in 2005 in the National Injury Mortality Surveillance System. There were inconsistencies when comparing the two databases explained by differences in reporting times and transport-related deaths that were not specified in the National Injury Mortality Surveillance System database.

6.2.2 Drivers

During the period 2001 to 2006, the incidence risk of male drivers has remained similar. However, the incidence risk in female drivers has risen from 51 to 62 per 100 000 population. This rise was statistically significant.

The highest risk group is male drivers, especially in the 30 to 34 year old age group. Male drivers are nearly eight times more likely to be involved in pedestrian collisions than females. However, the results need to be interpreted with care because of limitations with denominator data.

The use of reflexive strips worn by pedestrians would improve night visibility and has been encouraged by the eThekweni Transport Authority. A Cochrane review has shown that the following clothing enhances driver detection of pedestrians and cyclists:
Day-time: fluorescent materials in yellow, orange and red, non-fluorescent yellow
Night-time: retro-reflective materials in yellow and red.⁶²

6.3.1.2 Data Collection

Over 50% of fatally injured cases in 2005 in the National Injury Mortality Surveillance System included no data about blood alcohol levels. Such information would be collected either when the patient is seen in casualty at the hospital, or, with fatalities that occur on the scene of the collision, when the autopsy is done. Alcohol is a recognised contributory factor in both pedestrian and driver involvement in road traffic collisions.¹⁵ Mandatory blood alcohol testing of all severely or fatally injured pedestrians and drivers involved in pedestrian collisions should be undertaken to determine the extent of the problem and more satisfactorily assess the highest risk groups. However problems in the accuracy of blood alcohol testing may arise depending on whether the blood alcohol level is tested immediately after the collision or if this occurs after attempts at resuscitation. Large fluid infusions could cause falsely low blood alcohol levels.

36% of cases in the eThekweni Transport Authority database were of unknown age. This is a basic data field but appears on the third page of the Accident Report form. It was impossible to use other fields in the Accident Report form because of the proportion of missing data. The Accident Report form is a four-page form that has to be completed by the attending police officer, who is often very busy. In view of the seriousness of the problems of road traffic collisions in this country, it is vital that accurate, complete data is collected. All police officers should be trained in the completion of the form, and it should be shortened to ensure more consistent completion in the remaining fields.

There are differences in the number of cases in the two databases, with the eThekweni Transport Authority recording more fatalities, even though the post-collision recording period is only 6 days. These databases are potentially complementary, as they cover a range of different variables. This appears to be because of lack of accurate data about the type of road user available at autopsy. Better recording on admission is important to decrease this problem.

6.3.2 Drivers

6.3.2.1 Interventions

Currently, activities to improve the safety of drivers include mass media education to increase driver awareness of the implications of injuring pedestrians, the use of speed limits and enforcement of these and other traffic laws.

More targeted education at men, especially younger men, may be more effective. Because of the massive cost in terms of lives lost in this country to road collisions, increasing

6.3.3.2 Data Availability

Interpretation of environment data is limited by lack of data on traffic volumes in different conditions. If this were collected, it would enable more targeted enforcement at high-risk times and conditions.

6.3.4 Research Methods

The full pedestrian section of National Injury Mortality Surveillance System database was made available for use in this project. Summarised data from the eThekwini Transport Authority database was made available early in the study. Access to aspects of the full database was only granted near the end of the project, which hampered analysis. Further studies would benefit from early access to raw data from this database.

It would be helpful for the researcher to observe a sample of data collection and collation. A better understanding of the process for both databases would facilitate understanding problems with data such as missing data, and differences between databases. Alternatively a sample could be used, and the data extracted directly from the data collection sheet by the researcher.

There were difficulties with obtaining denominator data, despite much time spent trying to trace more accurate population data. It proved a struggle to obtain assistance and co-operation from the various actuarial units and Tasima, the agency developing eNaTIS. Requests for data to Tasima were not processed after several months. This limited the accuracy of analysis, and limited the use of other helpful indicators such as incidence rates, using distance travelled by vehicles as the denominator. If road research was undertaken in conjunction with local or provincial government, this might help improve access to such data.

6.4 PUBLICATION OF FINDINGS

The findings of this study will be presented to the eThekwini Transport Authority and discussion about the findings and possible action. The study will be written up and submitted for publication.

6.5 SUMMARY OF CHAPTER

This chapter presented conclusions about the demographics of pedestrians and drivers in motor vehicle collisions involving pedestrians, and well as summarising the environmental factors relating to the collisions. Recommendations were discussed about interventions to prevent pedestrian collisions and protect pedestrians. Limitations of the study and areas of possible study were described.

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(* COMPLETE IF APPLICABLE)

Accident Report (AR) Form

Official use only

Accident date (DD/MM/YYYY): / /

Accident Register Number

Day of week: Su M Tu W Th F Sa

Issuing Authority Number

Number of vehicles involved

Time of accident (24h) : : km/h

LOCATION

Built-up area: Y N
1. EC 2. FS 3. GP 4. KZN 5. MP 6. NW 7. NC 8. LM 9. WC

SPEED LIMIT ON ROAD:

ROAD TYPE:

- 1. Freeway
- 2. On/off ramp
- 3. Dual carriageway
- 4. Single carriageway (two way)
- 5. One way
- 6. Other (Specify)

Road name/road number

At intersection with (Street/road name/road no.)

Or between (Street/road name/road no.)

and (Street/road name/road no.)

Suburb (if in City/Town)

City/Town name

JUNCTION TYPE:

- 1. Cross roads
- 2. T-junction
- 3. Staggered junction
- 4. Y-junction
- 5. Circle
- 6. Level crossing
- 7. Not a junction
- 8. On ramp/ slipway
- 9. Off ramp/ slipway
- 10. Other (Specify)

At intersection with (Road number/ name)

Or approximately km measured in compass direction N S E W from

(Describe fixed point eg. town, river, bridge, culvert, intersecting street or road, on/off ramp of interchange, name of building/house, pole number, etc.)

Information on kilometre marker: Road no/section

Between (City/town)

And (Next city/town)

Reading: X co-ordinate

Y co-ordinate

PARTICULARS OF DRIVER A OR

DRIVERS

PARTICULARS OF DRIVER B OR

ID type/ ID number /
Country of origin of ID
Surname

Sex: 1. Male 2. Female 3. Unknown

Age

Initials

Age

Residential/home address

Telephone number ()
Work/contact address

Cellphone/other number ()

- 1. Asian
- 2. Black
- 3. Coloured
- 4. White
- 5. Other
- 6. Unknown
- 7. Male
- 8. Female
- 9. Unknown

How would you describe the driver?

- 1. Asian
- 2. Black
- 3. Coloured
- 4. White
- 5. Other
- 6. Unknown
- 7. Male
- 8. Female
- 9. Unknown

Gender

Driving licence number

- A
- B
- C1
- C
- EB
- EC
- Other (Specify)

Driving licence code

- A1
- A
- B
- C1
- C
- EB
- EC1
- EC
- Other (Specify)

Date of issue (DD/MM/YYYY) / /

- 1. Killed
- 2. Serious
- 3. Slight
- 4. No injury

Severity of injury

- 1. Killed
- 2. Serious
- 3. Slight
- 4. No injury

Ambulance service, driver, case reference number & hospital

Yes 2. No 3. Unknown

Seatbelt fitted/helmet present

- 1. Yes
- 2. No
- 3. Unknown

Yes 2. No 3. Unknown

Seatbelt/helmet definitely used

- 1. Yes
- 2. No
- 3. Unknown

Yes 2. No

Liquor/drug use suspected

- 1. Yes
- 2. No

Yes 2. No

Liquor/drug use: evidentiary tested

- 1. Yes
- 2. No

No Yes (Write particulars on page 3)

Any passengers/pedestrians/cyclists?

No Yes (Write particulars on page 3)

DETAILS OF VEHICLE A OR

VEHICLES

DETAILS OF VEHICLE B OR

N S E W

Travel towards direction

N S E W

if front and back number correspond with licence and expiry date

Number plate number

Check if front and back number plate correspond with licence disc and expiry date

Licence disc number

Colour

Make

Model (e.g. 280SE, ASTRA)

&

*Trailer number plate number

&

Yes 2. No 3. Unknown

Carried passengers for reward? (e.g. bus or taxi)

- 1. Yes
- 2. No
- 3. Unknown

Breakdown company, telephone number & driver name

WITNESSES A police/traffic officer/other authorised person must make an attempt to obtain witnesses to an accident. This is particularly important in respect of independent eyewitnesses.

Witnesses at a scene of an accident must not be chased away before a good attempt is made by an officer to find out whether anyone witnessed the accident, and/or can give valuable information about circumstances relating to the accident. and/or can assist with the identification of witnesses who have ceased or seriously injured persons involved in the accident.

In the event of a reliable witness (passenger or independent eyewitness) residing or working in another city/town, an affidavit must, as soon as possible, be taken from him/her either at the scene or at the police station/traffic police department. (This is in the event of a CR/CAS case docket being registered.)

| | | | |
|------------------------|----------------------|---------------------------------------|----------------------|
| Independent eyewitness | Passenger of vehicle | Independent eyewitness | Passenger of vehicle |
| Surname & initials | | | |
| Work/contact address | | | |
| Code | | Code | |
| () | | Cellphone number/ Telephone number | () |

PEDESTRIANS AND CYCLISTS ONLY: Person Reference

Location
 1. Roadway 2. Sidewalk/verge 3. Shoulder of road 4. Median

Location
 1. Within marked crossing 2. Within 50m of crossing 3. Not at crossing

Manoeuvre
 1. Facing traffic 2. Back to traffic 3. Crossing road

Pedestrian Action (for pedestrians only)
 1. Walking 2. Running 3. Standing 4. Playing
 5. Sitting 6. Lying down 7. Working 8. Other

Colour of clothing
 1. Light 2. Dark 3. Light & Dark 4. Reflective
 5. Other (Specify)

DANGEROUS GOODS ONLY: Vehicle Reference

Dangerous goods carried in/on vehicle Y N
 1. Dangerous goods carried
 2. Spillage occurred
 3. Vapour/gas emission occurred

If dangerous goods were carried Y N
 Dangerous goods placard displayed on vehicle:

Draw placard and write the Code/SIN on the diagram

Code/SIN _____
Substance Identification Number

SPECIAL OBSERVATIONS: Vehicle reference

Does it appear to have burst 1. No 2. Yes 0. Unknown

Length of skidmarks: Tape measure _____ metres

Condition of skidmarks
 1. Good 2. Faulty/not visible
 0. Unknown (Comment)

Condition of reflective tape
 1. Good 2. Faulty/not visible
 0. Unknown (Comment)

Condition of tyre quality
 1. Good 2. Faulty/not visible
 0. Unknown (Comment)

SPECIAL OBSERVATIONS: Person number in vehicle

Trapped/fallen out? 1. Trapped 2. Fallen out 7. N/A

Use of cellphone or other hand-held instrument suspected 1. Yes 2. No

Other relevant information (e.g. disabled person, etc)

SPECIAL OBSERVATIONS: Person number in vehicle

Trapped/fallen out? 1. Trapped 2. Fallen out 7. N/A

Use of cellphone or other hand-held instrument suspected 1. Yes 2. No

Other relevant information (e.g. disabled person, etc)

SPECIAL OBSERVATIONS: Vehicle reference

Does it appear to have burst 1. No 2. Yes 0. Unknown

Length of skidmarks: Tape measure _____ metres

Condition of skidmarks
 1. Good 2. Faulty/not visible
 0. Unknown (Comment)

Condition of reflective tape
 1. Good 2. Faulty/not visible
 0. Unknown (Comment)

Particulars of summons/written notice to **appear in court** issued by officer

Particulars of notice to **discontinue use of vehicle** issued by officer

Official use only (applicable to office in which area the accident occurred) Date Stamp

OS Occurrence Book no.

AS Accident Register no.

CAS no.

OS Occurrence Book no.

Met/Mun Pol/Traffic Dept

COMPLETED BY: Initials Rank

Name

Service number

Signature

For official use only (office where accident was reported/ form is completed)

Name of Department (Met/Mun Pol/ Traffic/ SAPS)

Occurrence Book no.

COMPLETED BY: Driver, official, etc.

Initials Rank

Surname

Service number

Date / / Time :

Signature

8.2 APPENDIX B: NIMSS Data Collection Form

NIMSS DATA COLLECTION FORM

Mortuary _____ Police No. _____ Officer collecting body (Surname) _____

PM no. _____ PM Date

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

 Pathologist (Surname) _____

Date & Time of Injury

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

 :

| | |
|--|--|
| | |
|--|--|

 Race

| | | | | |
|---|---|---|---|---|
| A | B | C | W | U |
|---|---|---|---|---|

 Sex

| | | |
|---|---|---|
| M | F | U |
|---|---|---|

Date & Time of Death

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

 :

| | |
|--|--|
| | |
|--|--|

 Age

| | |
|--|--|
| | |
|--|--|

| | |
|--|--|
| | |
|--|--|

 Years Months

Medical treatment of injury prior to death (check only ONE) 1 None 2 Emergency care at scene 3 Hospital care

Province of Injury (may differ to province of death) _____ Scene of Injury (may differ to scene of death) _____

| | | | |
|--------------|--------------------------|-------------------------------------|---|
| 1 Gauteng | 7 Mpumalanga | 1 Private house & yard (inc. pool) | 9 Medical service area |
| 2 W. Cape | 8 Northern Province | 2 Residential institute | 10 Industrial & construction area, mine |
| 3 K.Z. Natal | 9 North West | 18 Informal settlements/quater camp | 11 Farm, primary production area |
| 4 E. Cape | 10 Unknown | 3 Bar, shebeen, N.Club, disco | 12 Sea, lake, river, dam |
| 5 N. Cape | 11 Other (specify) _____ | 4 Amusement park, sports area | 13 Open land, beach |
| 6 Free State | | 5 Road/steep/highway | 14 Countryside |
| | | 6 Railway track, station | 15 In custody, prison |
| | | 7 Shop, bank, retail area | 16 Place unknown |
| | | 8 School, educational area | 17 Other (specify) _____ |

Town of Injury _____
Suburb or district _____
Closest police station to injury scene _____

External Cause or Circumstance of Injury

| | | | |
|--|------------------------------|------------------------------|-------------------------|
| 1 Firearm Discharge | 9 Fall/push/jump from height | 17 Motor vehicle Driver | 24 Abandoned baby |
| 2 Sharp Object | 10 Other fall/push/jump | 18 Motor vehicle Unspecified | 25 Electrocution |
| 3 Blunt Object | 11 Crushing | 19 Railway casualty | 26 Explosive blast |
| 4 Strangulation, suffocation, asphyxia | 12 Choking, aspiration | 20 Bicycle, motor cycle | 27 Natural cause |
| 5 Hanging | 13 Drowning, immersion | 30 Aviation casualty | 28 Unknown |
| 6 Poisoning, ingestion | 14 Lightning | 21 Medical Procedure | 29 Other Specific Cause |
| 7 Poisoning, gassing | 15 Motor vehicle Pedestrian | 22 Sudden Infant Death | |
| 8 Burn | 16 Motor vehicle Passenger | 23 Abortion, still birth | |

Apparent Manner of Death

1 Homicide 2 Suicide 3 Accident 4 Natural 5 Undetermined

Samples Taken (check all)

1 None 2 Blood 3 Tissue 4 Other fluid

Alcohol and Other Substances (for completion by surveillance consortium staff)

Blood Alcohol Level

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

 Eye Fluid Alcohol

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

 Other Substances (Specify) _____

Type of Intentional Violence _____ Perpetrator - Victim Relationship _____

| | | | | |
|---------------------------|-------------------------|-----------------------|----------------------------|------------------------------|
| 1 Interpersonal | 6 Rape, Sexual | 1 Spouse, Partner | 5 Friend | 9 Unknown |
| 2 Self Directed | 7 Child Abuse | 2 Parent | 6 Official/Legal Authority | 10 Other Specified Person(s) |
| 3 Legal Intervention | 9 Unknown | 3 Other relative | 7 Stranger | |
| 4 Gang, Syndicate | 8 Other (specify) _____ | 4 Unrelated Caregiver | 8 Acquaintance | |
| 5 War/ civil Insurrection | | | | |

Context of Violent Attack (Code from court record) _____

8.4 APPENDIX D: Permission from eThekweni Transport Authority (per email)

Hi

Sorry for the delay in replying.

We have considered this request and unfortunately have to decline it. However, we will provide you with standard outcomes reports viz:

1. pedestrian injuries and fatalities according to age-group (0-4 years, 5-9 years etc)
2. pedestrian injuries and fatalities according to gender
3. pedestrian injuries and fatalities by driver age group
4. pedestrian injuries and fatalities by driver gender
5. pedestrian injuries and fatalities by vehicle type
6. pedestrian injuries and fatalities by road type on which collision occurred
7. pedestrian injuries and fatalities by light condition and time of day of collision
8. number of driver injuries and fatalities in pedestrian accidents
9. number of passenger injuries and fatalities in pedestrian injuries

but will not accede to any request for access to the unaggregated data from the actual data base to be made available.

All the best

Ashok Nansook

>>> "Michelle Hobday" <mbhobday@absamail.co.za> 07/05/07 8:55 AM >>>

----- Original Message -----

From: Michelle Hobday

To: nansookp@durban.gov.za

Cc: Preeti Hirjee

Sent: Sunday, May 27, 2007 6:55 AM

Subject: Pedestrian research project for Masters in Public Health

Dear Mr Nansook

Thank you for meeting with Dr Stephen Knight and myself on Friday to discuss my proposed research project "The epidemiology of Motor Vehicle Collisions involving Pedestrians in eThekweni Municipality from 2001 to 2006."

As we discussed, this is a research project for a Masters in Public Health and I require your permission to proceed. The research, when

8.5 APPENDIX E: Permission from the Crime, Injury and Violence Lead Programme



CRIME, VIOLENCE & INJURY LEAD PROGRAMME

Co-directed by
MRC and UNISA Institute for Social and Health Sciences
PO Box 19070, Tygerberg, 7505, Cape Town, South Africa
Tel: +27 (0)21 938 0216; Fax: +27 (0)21 938 0381
<http://www.mrc.ac.za>



mbhobday@absamail.co.za

Dear Mrs Hobday

Re: Request for raw National Injury Mortality Surveillance System (NIMSS) data

This letter serves to confirm that your request for raw NIMSS data on pedestrian motor vehicle mortality in Ethekwini municipality from 2001 to 2005 for a Master of Public Health (MPH) Degree has been approved based on the following conditions:

- The MRC-Unisa Crime, Violence and Injury Lead Programme (CVLIP) should be acknowledged in all instances;
- A copy of the final research output should be submitted to the CVLIP; and
- All customised reports will remain the intellectual property of the CVLIP.

Please note that several research projects relating to pedestrians have been or are currently being conducted using the NIMSS data. Examples include the work by A. Sukhai and an article by Mabunda, Swart, & Seedat published in *Accident and Analysis*.

Given the number of pedestrian and transport-related studies being undertaken with the NIMSS data, to avoid overlap we request that you present your Masters proposal as well as your final results at the MRC-Unisa Crime, Violence and Injury Lead Programme annual strategy planning meeting or seminar series. We will inform you of the relevant dates.

8.6 APPENDIX F: Copy of slides for presentations at PHASA conference

Table 1 Pedestrian Fatalities and Injuries in eThekweni from 2001 to 2006 -
eThekweni Transport Authority database

| Year | Population at risk | Number of injuries | Total Injury Incidence Risk /100 000 | Number of Fatalities | Fatality Risk /100 000 | Case Fatality |
|------|--------------------|--------------------|--------------------------------------|----------------------|------------------------|---------------|
| 2001 | 3090219 | 7445 | 241 | 366 | 12 | 4.92% |
| 2002 | 3128801 | 7018 | 224 | 427 | 14 | 6.08% |
| 2003 | 3171483 | 6533 | 206 | 451 | 14 | 6.90% |
| 2004 | 3206338 | 6537 | 204 | 462 | 14 | 7.07% |
| 2005 | 3233103 | 6026 | 186 | 433 | 13 | 7.19% |
| 2006 | 3251258 | 6288 | 193 | 430 | 13 | 6.84% |

Table 2 Pedestrians involved in pedestrian/motor vehicle collisions from January to December 2005 in eThekweni by age group.
eThekweni Transport Authority database & National Injury Mortality Surveillance System

| Age group (years) | Population at risk | Number of injuries | Total Injury Incidence Risk / 100 000 | Number of Fatalities | Fatality Incidence Risk /100 000 | Case Fatality |
|-------------------|--------------------|--------------------|---------------------------------------|----------------------|----------------------------------|---------------|
| 5 to 9 | 286610 | 463 | 162 | 32 | 11 | 6.9% |
| 10 to 14 | 294818 | 352 | 119 | 13 | 4 | 3.7% |
| Total Child | 854626 | 917 | 107 | 63 | 6 | 6.8% |
| 15 to 19 | 323343 | 309 | 96 | 15 | 5 | 4.9% |
| 30 to 34 | 256429 | 419 | 163 | 40 | 16 | 9.5% |
| 35 to 39 | 236007 | 320 | 136 | 45 | 19 | 14.1% |
| 40 to 44 | 195032 | 303 | 155 | 40 | 21 | 13.2% |
| 60 to 64 | 72329 | 86 | 119 | 12 | 17 | 14.0% |
| > 70 | 78911 | 53 | 67 | 6 | 8 | 11.3% |
| Total Adult | 2236896 | 4920 | 220 | 380 | 17 | 7.7% |
| Grand Total | 3090121 | 6026 | 185 | 433 | 14 | 7.2% |

Pedestrian age

- Injury IRR (child:adult) – 0.96 (95% CI: 0.8 to 1.2; p=0.10)
- Fatality IRR (child:adult) – 0.3 (95% CI: 0.1 to 0.9; p=0.02)
- Similar child injury incidence risk to US studies
- Higher child case fatalities (3.7% to 6.9% vs 0.4% to 1%)

Rivara and Barber, 1985, Tight, 1996, DiMaggio and Durkin, 2002

- Higher injury and fatality in economically active group
 - Greater exposure: peak hours → higher traffic volumes

Databases: differences

- Lower number of fatalities reported by NIMSS
 - Fatalities recorded any time after collision
- Unexpected higher number of fatalities reported by ETA
 - 33% more fatalities reported
 - Fatalities recorded up to 6 days after collision
- Possible explanations:
 - Misclassification - cause of fatality in mortuary reports
 - Mortuary and collision in different municipalities
 - Counting twice by ETA

Table 3 Pedestrian Fatalities by age and gender in eThekweni Municipality in 2005
National Injury Mortality Surveillance database

| Age group (Years) | Male | | | Female | | | Fatality Risk Ratio |
|-------------------|--------------------|----------------------|---------------------------------|--------------------|----------------------|---------------------------------|---------------------|
| | Population at Risk | Number of fatalities | Fatality Incidence Risk/100 000 | Population at Risk | Number of fatalities | Fatality Incidence Risk/100 000 | |
| 5 to 9 | 142581 | 23 | 16 | 144029 | 10 | 7 | 2.32 |
| 10 to 14 | 146567 | 9 | 6 | 148251 | 1 | 1 | 3.10 |
| Total child | 428857 | 38 | 9 | 428669 | 17 | 4 | 2.25 |
| 30 to 34 | 123867 | 34 | 27 | 132582 | 5 | 4 | 7.28 |
| 35 to 39 | 111027 | 38 | 34 | 124980 | 6 | 5 | 7.13 |
| 40 to 44 | 91639 | 22 | 24 | 103383 | 4 | 4 | 6.21 |
| 60 to 64 | 30124 | 10 | 33 | 42205 | 6 | 14 | 2.34 |
| Total adult | 1059181 | 218 | 21 | 1176414 | 55 | 5 | 4.40 |
| Grand Total | 1488038 | 256 | 17 | 1605083 | 72 | 4 | 3.84 |

Pedestrians by age and gender

- Incidence risk ratio (5 to 9 year old males: other child pedestrians)
 - 3.6 (95% CI: 2.1 to 6.1; p < 0.001)
- IRR (25 to 39 year old males: other adult pedestrians)
 - 1.7 (95% CI: 1.3 to 2.3; p < 0.001).
- Higher child fatality RR (males: females) (2.3 vs 1.7)

Rivara and Barber, 1985, Tight, 1996, DiMaggio and Durkin, 2002

Recommendations

- Collision environment – including:
 - Decreased speed
 - Traffic calming
 - Traffic circles, sleeping policemen
 - Improved lighting
 - Pedestrian friendly traffic signals
 - Separation of pedestrians

Retting, Ferguson and McCart (2003)

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