# PILOT STUDY OF THE LONG-TERM EFFECTS OF ROAD CRASHES

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CR 116 February 1993

#### FEDERAL OFFICE OF ROAD SAFETY REPORT DOCUMENT PAGE

Report No.	Date	Pages	ISBN	ISSN
CR116	30.11.91	56	0 642 51236 1	0810-770X
Title and Sub-tit	le:			
Pilot Study of th	e Long-term Effe	cts of Road C	rashes	
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Abstract:

Canberra, ACT, 2601, Australia.

This pilot study was undertaken to identify the types of long-term consequences to people involved in road trauma, comprising physical, psychological and social disabilities, impairments, as well as community and financial hardships. In addition, it aimed to develop the most appropriate methodology for collecting data. A literature review was initially undertaken to highlight previous studies undertaken on outcome measures as well as to provide background information. A mass database was constructed of injury compensation data at the Transport Accident Commission in Victoria for the years 1987 to 1988 to understand the level of data available and to identify target groups of road trauma patients. In addition, a questionnaire format was developed after deliberations with experts in the field of rehabilitation and long-term care of road trauma victims. The questionnaire was administered by telephone to 26 patients who had previously been involved in the MUARC Vehicle Occupant Protection Study and who had given their consent to be interviewed. This report describes the findings of the mass data combined with the findings from the questionnaire and discusses a range of data collection methodologies suitable to conduct a larger scale study on the long-term outcomes of road trauma.

#### Key Words:

#### INJURY, ACCIDENT, LONG-TERM CONSEQUENCES

#### Notes:

- (i) FORS reports are disseminated in the interest of information exchange.
- (ii) The views expressed are those of the author(s) and do not necessarily represent those of the Commonwealth Government.
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    - (c) reports based on analyses of FORS' statistical data bases are published in the SR series.
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### ACKNOWLEDGEMENTS

The authors are indebted to the Federal Office of Road Safety, Commonwealth Department of Transport and Communications, Australia for their sponsorship, interest and assistance with this project.

The study team acknowledge the generous assistance of the study hospitals, their coordinators and their staff providing access to patients and medical records, namely the Alfred Hospital (Dr. Linas Dziukas) and the Spinal Injuries Unit at the Austin Hospital (Dr. Doug Brown and Dr. Gerard Ungar). We are grateful, too, to the patients who kindly agreed to participate in the study.

To the panel of experts and organisations visited we are eternally thankful for their valuable assistance. All committee members were always ready to assist in both contributing background information on the many aspects of rehabilitation, and providing comments and recommendations on the format of the questionnaire. In addition, we wish to thank Dr Bill Foddy, Department of Sociology and Anthropology for his invaluable assistance in the development of the questionnaire.

The Transport Accident Commission kindly agreed to provide their data on relevant details of vehicle crash, injuries and long-term consequences. We are grateful in particular to Mr. David Attwood and his staff for their assistance in making the necessary arrangements.

The valuable assistance of other Accident Research Centre staff is greatly appreciated. In particular, we wish to thank Mr. Terry Mach, Ms. Christina Leong and Mr. Rafael Saldana for their assistance in analysis of the data.

The help of the Biomedical and Main libraries of Monash University is also gratefully acknowledged.

#### PROJECT ADVISORY COMMITTEE

A number of professionals involved in patient rehabilitation from organisations in Victoria were invited to participate in 'brain-storming' exercises aimed at identifying relevant outcomes and patients worthy of follow-up. Background information on the range of rehabilitation services required and supplied to road trauma patients was discussed by committee members and advice was given on questionnaire format.

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The Committee were saddened to learn recently of the death of Dr. Gerard Unger, Deputy Director, Spinal Unit, Austin Hospital. Dr. Ungar made a valuable contribution to the work undertaken in this report and he will be sadly missed.

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#### EXECUTIVE SUMMARY

#### INTRODUCTION

This pilot study set out to identify the types of long-term consequences to those injured in road crashes, to demonstrate groups of road users and injuries especially at risk of severe long-term consequences, and develop and trial an appropriate methodology for conducting a large scale outcome study to provide definitive long term outcome data.

The aim of the study was not necessarily to provide definitive conclusions about long-term consequences to road trauma victims but rather to provide indicative information on what was available and establish a framework by which definitive data could be collected.

Information sources accessed for this study included international road safety and medical literature, two years of Transport Accident Commission [Victorian] claims data, and a small sample of outcome interviews of 26 hospitalised vehicle occupants. An expert panel of 17 medical, rehabilitation, and research professionals was established to help guide this research.

#### LITERATURE REVIEW

A small literature review was conducted to identify previous research that had been undertaken in this area and the range of outcome consequences and data collection methods that had been reported.

This review revealed that there has not been a lot of research conducted in this area to date. Previous outcome studies have tended to address specific issues, injuries, or trauma groups and no research was found that had examined the range and extent of outcome consequences for road trauma victims per se.

Previous findings from this research, however, have showed that those who sustain head injuries in traumas (including both severe and relatively minor injuries) often suffer severe outcomes from their injuries, experiencing major personality and other psychological changes and less likelihood of returning to work. Spinal injuries, too, usually result in long-term (permanent) disability with major reductions in their quality of life. While less life threatening, limb injuries, too, often result in long-term rehabilitation and pain and suffering to the individuals involved.

Past outcome research has relied on collecting outcome data from either follow-up consultations or questionnaires to trauma victims at a suitable time after the event. Two years seemed to be a generally accepted time lapse after the event for outcome follow-up.

#### MASS DATA ANALYSIS

An analysis was undertaken of 2 years state-wide *no-fault* injury compensation data at the Transport Accident Commission (TAC) of Victoria for all road trauma victims injured in excess of the \$317 (July 1989) entry threshold for private medical and para-medical expenses.

This analysis showed that pedestrians and motorcyclists had a higher probability of being hospitalised, requiring on-going medical, para-medical and rehabilitation care, claiming loss of earnings and earning capacity, and being assessed as impaired 18 months after the event than other road users.

While vehicle occupants were generally at lower risk of a severe outcome than other road users, they represented the largest group of claimants on the TAC, accounting for 79% of all injury claims. Bicyclists were generally under-represented in these statistics because of the TAC eligibility requirement to have collided with a motor vehicle.

Injury severity expressed as survival and length of stay in hospital was seen to be well correlated with outcome severity. Moreover, spinal, head and internal injuries were particularly associated with a severe outcome, were costly cases, and usually require on-going rehabilitation and support services.

Even though limb and other fractures and soft tissue [whiplash] injuries were less life threatening, they were of substantial frequency, often requiring long periods of rehabilitation and treatment and represented a major cost to the community.

While the TAC data was the best available for this kind of analysis, it was only possible to obtain summary details on TAC claimants. Thus, it was not possible to conduct a thorough analysis of the long-term consequences of road trauma. In particular, no details were provided on the range of services used or details on the number of visits or time-frame involved in treatment or rehabilitation.

#### **QUESTIONNAIRE DEVELOPMENT & TRIALING**

In an attempt to overcome these deficiencies, a questionnaire was developed seeking outcome information on a number of important factors and trialled on a small sample of prior hospitalised vehicle occupants.

The questionnaire contained information on on-going hospital, medical, rehabilitation, and treatment costs after the patient had been discharged from the initial treating hospital. [Prior information was available for these people on details of their crash, injuries and injury sources, and treatment required to alleviate their injuries from an earlier FORS study].

Items related to the patient's time off work, loss of confidence, family and social implications, and psychological consequences were also collected.

The interview factors were selected in consultation with the views expressed by the expert panel. A specialist in questionnaire design and administration guided this part of the study. Telephone interviews were decided upon to minimise administration cost but ensure personal contact for follow-up and to evaluate the clarity of the questions.

The sample of patients comprised hospitalised vehicle occupants who had agreed earlier to participate in a previous occupant safety study for FORS. For ethical reasons, The Alfred Hospital in Melbourne first contacted these patients and those who agreed to participate again subsequently contacted MUARC.

It was not possible to assess the response bias in the sample in terms of outcome consequences, although the patients who agreed had a representative distribution of injuries.

#### **USEFULNESS OF THE QUESTIONNAIRE**

The main aim of the questionnaire was to develop an appropriate format for detailed data collection and to trial it on a representative sample of road trauma patients.

The results indicated that it elicited appropriate and useful information on the extent of longterm consequences and the range of services and difficulties experienced by these people. There were very few instances of ambiguities with the questions. These data are not currently available in existing data sources and a more comprehensive study would provide valuable insights into the long-term consequences of road trauma not presently documented.

The telephone interview method did provide a practical and relatively inexpensive method for collecting these data. It is acknowledged that the responses were biased in favour of those who agree to be interviewed and probably against those suffering extreme disability and hardship following a crash. However, these biases are difficult to overcome in any survey of this kind, given the patient's absolute right to privacy.

#### **QUESTIONNAIRE FINDINGS**

It is difficult to be too definitive about the findings from the questionnaire because of its methodological objective. However, there were some preliminary indications of the potential worth of mention.

There were a range of services used by these trauma patients including physiotherapy, social work, hydrotherapy, occupational therapy and work trial programs. All respondents reported some loss of earnings. Community services used involved council help, Meals-On-Wheels, Royal District Nursing Service, and public transport assistance.

All respondents reported some form of disability after leaving hospital involving pain. restricted movement, discomfort, loss of memory and concentration, and loss of control or feeling. Many of these disabilities were still apparent two years after the event.

Many respondents reported psychological trauma long after their crash. Loss of confidence with driving was commonly reported and those with more severe injuries commonly noted long-term problems as a result of their crash.

#### CONCLUSIONS

The pilot study into long term trauma outcome provided some useful new data on the longer term consequences of road crash victims. A number of road user groups and injuries were shown to be over-represented in terms of sustaining long term consequences from the original trauma, involving considerable inconvenience, loss of productive capacity, and pain and suffering to the individual and his or her family, and considerable costs in rehabilitation and support services to the community.

Target road user groups include pedestrians and motorcyclists [high risk] and vehicle occupants [high frequency]. While severe spine, head, and chest injuries are most likely to result in long term consequences, disabilities, and impairments, less life threatening limb and other fractures and soft tissue [whiplash] injuries too were seen to have marked long term consequences for those unfortunate enough to sustain these injuries in a road accident.

The telephone administered follow-up questionnaire developed and used in this study was an efficient and effective means for collecting long term outcome data on people injured from road crashes 2 years previously. The literature review and expert panel discussions revealed a general shortage of data on long term road trauma outcomes.

Several options were briefly outlined on how to expand this pilot investigation into a full road trauma outcome study. The advantages and disadvantages of each of these options was duly considered. It would be useful to undertake further research aimed at highlighting the full extent of outcome consequences to road users.

# 1. INTRODUCTION

Most research on injury by road crash has primarily been based on the study of frequency and severity of crashes or treatment of injuries in the crash. The cost of long-term disability to both the injured person and the community however, has largely been neglected. There is a high rate of morbidity experienced by crash victims and it has only been in recent years that studies have focussed on injury outcome. To determine the full impact of road crashes a wide range of components must be considered, that is pre-crash details, the incidence of the original injury, post-crash events as well as the extent of the long-term disabilities including additional sequelae such as psychological and social factors. It is not until all these factors and their variables are considered that a more realistic and broader estimate of the severity of injuries can be made.

In January 1991 the Federal Office of Road Safety commissioned the Monash University Accident Research Centre to undertake a pilot study into the long-term effects of road crashes. The study was aimed at identifying the types of long-term consequences to people involved in road trauma and pilot the most appropriate methodology for conducting a larger scale study. The study also set out to further increase the understanding of injury and its consequences to determine the full impact of road injuries.

#### **1.1 STUDY OBJECTIVES**

The four major objectives specified by the Federal Office of Road Safety for the long-term effects of road crashes study were:

- . to identify the types of long-term consequences to people involved in road trauma, comprising physical, psychological and social disabilities, impairments or handicaps, as well as community and financial hardships,
- . to indicate the relationship between injury and outcome and the various problems and associated long-term consequences,
- to describe the relationship between road user and outcome nominating high risk target groups and the problems and services involved, and
- . to develop the most appropriate methodology for conducting a larger scale study.

Moreover, the pilot study brief was to examine whether a larger scale project is warranted and/or the need for other pilot research in this area.

#### 1.1.1 Key Issues

The project specification nominated a number of critical items or issues that need to be addressed in the study, namely:

- . to provide an overview of the dimensions of the adverse effects of road crashes to the population,
- . to identify categories of people, crash types and injuries that are at risk of severe outcome, relative to the total crash population, and
- . to provide a detailed description of the nature of crash consequences, including impairment, disability and associated costs.

The aim of this pilot study was not to provide definitive answers to all these issues but rather to provide indicative information. Moreover, the study gave greater priority to the methodology, potential problems and data collection framework necessary for undertaking a larger scale project.

#### **1.2 STUDY TASKS UNDERTAKEN**

There were *three* main project tasks undertaken in an attempt to meet the study objectives. First, information was sought from a number of sources to gain a broad overview of key issues related to the long-term consequences of road trauma on the people involved and risk factors likely to be involved. Second, suitable existing mass data were analysed to provide incidence data on risk factors and target groups and (to the degree possible from these existing databases) the use and extent of services required by these people in their rehabilitation and on-going support. Finally, a pilot study was undertaken involving the development and administration of a suitable data collection instrument on a sample population of road trauma victims. These activities are described further below.

From the outset, it was apparent that there were very few comprehensive sources of data available that would provide a broad national overview of the long-term consequences of road trauma. There was a degree of uncertainty, therefore, how comprehensively the study objectives outlined above could be met. This is discussed further in detail in Chapter 6.

#### **1.2.1 Information Gathering Activities**

The first step in the study was a small review of relevant literature to provide insight into key variables or risk groups, as well as methodologies that may have been used elsewhere for similar studies. This included literature from mainstream medical safety journals such as the Journal of Trauma, Accident Analysis and Prevention, SAE Papers and relevant conference proceedings (eg, AAAM). This review is reported briefly in Chapter 2.

Next, visits were conducted to individual professionals, hospitals, and support centres who are involved in providing long-term services for Victorian road trauma victims. These visits were especially helpful in identifying the range of services provided to these people and locating experts involved in the rehabilitation process.

A Project Advisory Group meeting was then arranged where a number of key people in patient rehabilitation participated in "brain-storming" exercises aimed at identifying a relevant list of items (variables), outcomes and patients worthy of follow-up. (A list of the people who kindly gave of their time and advice throughout the course of this project is provided at the front of this report).

#### 1.2.2 Mass Data Analysis

The Transport Accident Commission of Victoria (TAC) are a statewide *no-fault* government authority responsible for injury compensation to road accident victims in this state. Discussions were held with the TAC to ascertain the types of services they provide to road trauma victims and the availability of their claims data for analysis here.

Subsequently, two years of Victorian road trauma claims from 1987 to 1988 were provided and analysed including such factors as crash circumstances, patient details, injuries sustained, medical and hospital treatment, rehabilitation services used, loss of income, and some details on impairment at 18 months, and total payout. This is described further in Chapter 3.

#### **1.2.3 Developing & Trialling of Suitable Data Collection Methods**

From the information compiled from the literature review, discussions with local professionals, and the brain-storming activity, a questionnaire was subsequently developed (see Appendix 1) which contained questions aimed at eliciting relevant and useful information not readily available from existing sources. This process is described fully in Chapter 4.

A pilot study was then undertaken of 26 severely injured vehicle occupants to test its usefulness and highlight any problems associated with the procedure. The tentative findings from this pilot study are reported in Chapter 5.

### 2. LITERATURE REVIEW

Road trauma studies in general focus on the cause of accidents or on immediate triage or treatment of road trauma victims. Relatively little is known about the long-term disability suffered by individuals, the duration of the disability, the effect on their ability to carry out normal pre-accident daily routine or the cost to the community. Most research to date on social costs of injury has been limited to loss of employment and hospital costs. The result has been a limited analysis of the nature of crash injuries and a limited view of injury severity in terms of long-term disabilities and consequences. Moreover, there is a paucity of information on the relationship, if any, between the severity or type of injury and the duration and severity of disability.

It may be assumed that as the severity of a particular injury increases, the likelihood of permanent disability occurring also increases due to the irreversible nature of correcting that injury. For this reason brain injuries and spinal cord injuries have been of special interest in many outcome studies.

#### 2.1 SEVERE HEAD INJURY

Head injury has been the focus of several studies on outcome due to its relative frequency and the significant morbidity and mortality associated. Research is just beginning to show that severe head injuries have significant costs five to ten years post-injury in aspects of life that have not been studied previously.

Persisting disability after severe head injury usually comprises both mental and physical handicaps. Often, it is found that the mental/cognitive component is the more important facet in contributing to overall social and psychological disability. The recently released Health Department Report on Acquired Brain Damage (Health Department Victoria, 1991) looks at the extent of brain injury in Victoria and gives a good overview of causes, prevalence, recovery, rehabilitation and long-term care and support for people suffering brain damage. This data base study led to a number of observations, some of which are that the community has failed to appreciate the sorts of problems which brain injury poses for individuals and their families; that service providers have not fully understood the needs of people with head injury, nor, as a result, the services required; that the long-term nature of brain injury must be emphasised; and, that medical treatment, assessment and rehabilitation is at present unsatisfactory when it leaves no resources to maintain acceptable quality of life in the long run.

Lyle and associates (Lyle, Quine, Pierce & Thomson, 1990) examined physical and psychosocial changes after injury in a range of trauma patients (ie. severely head injured patients, patients with major trauma and those with minor trauma). They found that severely head injured patients had the greatest degree of difficulty in self care and mobility and in community living skills and reported more frequent behavioural changes than the other two groups. Similarly, personality and other psychological changes were reported more frequently in the severe head injury group and fewer returned to work. Major trauma cases suffer similar, but less severe, psycho-social problems to the severely head injured group.

Oddy and Humphrey (1980) reported upon the social adjustment of fifty-four patients after severe closed head injury. They found marked changes in occupational status, leisure activities, social contacts and family life. Social isolation seemed to be a major problem especially for those who were unable to work; there was limited contact with friends and loneliness was a great burden. Inactive lives led to a lack of goals, loss of status and family role and difficulty in maintaining established friendships as a result of enforced withdrawal and personality disturbances and behavioural changes. Jennett, Snoek, Bond and Brooks (1981) devised the Glasgow Outcome Scale describing overall social outcome which deals with severe head injury and further suggest that improvement in social integration may be partly due to pre-morbid personality, ability of family members to cope, adaptation to a fixed disability and rehabilitation programs.

Prigitano, Fordyce, Zeiner, Roueche, Pepping and Wood (1984) researched emotional dysfunction of the head injured and found that while cognitive dysfunction may improve over time, the degree of improvement is not always adequate to ensure a return to a previous lifestyle. They suggested that cognitive and personality disturbances following severe closed head injury in young adults are associated with poor rehabilitation outcome emphasising that modern rehabilitation programs do not address the emotional and motivational problems often associated with brain injury.

They describe the Neuro-psychological Rehabilitation Program (NRP) in Oklahoma and report less personality disturbances, better learning and memory scores in NRP patients than in control patients. From these results they argue that present rehabilitation programs are not adequate in their attempts to re-integrate road crash victims to their previous lifestyles and that treatment of emotional disturbances may be quite important for rehabilitation success.

#### 2.2 SPINAL CORD AND MINOR HEAD TRAUMA

Spinal cord injuries generally result in some long-term disability, the severity of which is dependent upon (among other factors) where the injury is along the spinal cord. In any event, spinal cord injuries have long lasting effects. The Spinal Injuries Unit at the Austin Hospital developed a data collection system which has been used to analyse some of the results of treatment of admissions to that unit. Burke, Burley and Ungar (1985) gave specific assessment of physical independence and emphasise that treatment and rehabilitation of a patient with a spinal cord injury requires a long period of hospitalisation.

There are other studies that show that minor head injuries and injuries to other body regions have relatively high associated morbidity and additional sequelae such as neuro-psychological and psycho-social consequences do occur.

Rimel and her associate's (1981) research into moderate head injury showed that nearly 70% of patients had difficulty returning to work before three months after injury while Dikmen, McLean and Temkin (1986) found extensive disruptions of everyday activities such as social interactions, ambulation, sleep, rest and leisure in minor head injury patients. The findings of Rimel's study provide evidence of significant problems experienced by people with minor head injuries, stating that patients may become incapacitated by the psychological responses to their injuries such as difficulty in understanding why they continue to have problems long after the initial injury was sustained even though the physical effects of the injury have largely disappeared.

Alves (1986) showed that nearly 30% of minor head injury patients have residual social and work problems caused by the residual disability creating a 'snowball' effect which has repercussions that may affect the social and economic life of individuals and their families for many years after the injury.

#### 2.3 LOWER LIMB INJURY

Injuries to body regions other than the brain or spinal cord (for example, lower limb injuries) are rarely life threatening, yet, because of the possibility of long-term disability, they often require extensive and expensive medical treatment. In addition, psychological and social sequelae are associated due to loss of mobility, loss of employment and life-long discomfort

and pain. A review of the long-term effects of lower limb injuries by Levine (1986) indicated that a significant percentage of these patients were left with permanent impairments and, for some injuries, the impairment developed and/or worsened with increased victim age. Moreover, these injuries are relatively frequent events often requiring substantial treatment periods and are extremely costly to the community.

#### 2.4 CHRONIC PAIN

Chronic pain often develops as a result of injury in road crashes and may be associated with considerable long-term disability. This disability can typically disrupt a person's entire lifestyle and restrict social activity. Dooley (1986) summarised the psychological impact of chronic pain and found that in most chronic pain conditions it is not so much the underlying physical injury that impairs functioning as the associated pain and the consequent emotional disruption that handicaps the individual.

He concluded that as chronicity extends and lifestyle disruption persists, environmental and psychological factors exert increasingly greater influence and that multiple psychological and environmental consequences evolving from long-term pain can maintain a level of disability beyond objective physical considerations.

#### 2.5 **OVERVIEW STUDIES**

Galasko, Murray, Hodson, Tunbridge & Everest (1986) extracted information on age, sex, date of accident, injuries sustained, subsequent referrals and trauma classification from clinical records of all patients admitted to the Hope Hospital in the UK over a two year period. The aim of their study was to determine whether there is any correlation between injury severity and subsequent disability, whether long-term disability is a consequence of particular injuries and whether the effects of long-term disability should be included in evaluating the cost of road traffic crashes.

A questionnaire was sent to each patient six months after the date of the accident and from the information changes in lifestyle, occupation, leisure and daily living activities were established. From the results they found that there were correlations between age and longterm disability and between the length of in-patient stay and the development of disability. Their results also showed that injuries associated with the highest incidence of long-term disability were soft tissue injuries to the cervical spine and closed fractures to the lower limbs.

They concluded that psychological and social variables must be taken into account when assessing whether a particular impairment is likely to give rise to a significant disability in a given individual.

#### 2.6 CONCLUDING COMMENT

The consequences of road trauma are broad and sweeping and involve neuro-behavioural and psychological impairments as well as physical injury and economic hardship. Little is known about duration of disabilities, length and cost of outpatient treatment, time taken to return to pre-accident employment, morbidity and psycho-social and economic consequences of road injury.

In addition, while the consequences of major injuries have been reported previously, there is a paucity of information on the outcomes of relatively minor injuries (that is, limb injuries and soft tissue injuries such as whiplash). Future studies in this area are necessary to emphasise the consequences of these lesser known, yet frequent, injuries.

Previous studies, with their limitations, may have significantly underestimated the consequences and cost of road traffic crashes to the community, the individual, and his or her family. When the long-term outcomes from road crashes are considered, the full extent of road crashes in terms of their drain on scarce community resources becomes abundantly clear, even for those involving relatively minor to moderately severe injuries. Research efforts need to focus on these issues and technologies need to be developed for the assessment of injury risks and minimising the effects of road trauma on its victims and the community at large.

## 3. MASS DATA ANALYSIS

The study objectives called for the identification of the various types of long-term outcomes for those involved in road crashes, use of community services, and the injuries and road users most at risk of sustaining long-term outcomes. It was intended to obtain these details from existing mass data sources, supplemented with other information where necessary.

The most promising source of suitable and available data for use in this project was that maintained by the Transport Accident Commission in Victoria (TAC). This state government authority is unique in Australia: Victoria is the only state which has a single publicly owned authority responsible for all injury compensation resulting from road crashes that occur in this state. The TAC, therefore, has a state-wide *no-fault* database containing details of all road crash claims and payouts. Discussions with the TAC lead to the provision of data from 1st January 1987 to 31st December 1990 of which the first two years (1987 and 1988) was the most complete source of long-term outcome details including impairment assessments undertaken by the TAC 18 months after commencement of a claim.

#### 3.1 DATABASE CONSTRUCTION AND VARIABLES

The Transport Accident Commission (TAC) was legally constituted on the 1st January, 1987 under the new Transport Accident Act 1986. Previously, state-wide injury compensation came under the control of the Motor Accidents Board (MAB) under the previous Motor Accident Act 1973 and Section 5 of the Motor Car Act 1958. The Transport Accident Act 1986 was introduced to reduce the opportunities for litigation against the state resulting in marked reductions in the number of minor injury claims to that previously experienced.

Entry into the TAC system requires certain criteria to be met. First, the claimant must have been injured from a collision involving a vehicle potentially able to be registered for use on Victorian roads. This includes motorcycles, passenger cars, vans, trucks, buses, trains and trams (pedestrian and bicyclists can only claim on the TAC if they have been involved in a crash with a suitable vehicle). Next, the TAC do not pay the first \$317 (July 1989) of private medical and para-medical treatment costs or the first week off work for loss of earnings. In addition, a police report must have been completed about the crash for it to be processed. Finally, while the TAC primarily exists to service Victorians involved in local crashes, road accidents involving Victorian cars in other states and residents of other states involved in Victorian crashes are still covered by the TAC.

Eighteen months after commencement, each claim is assessed by the TAC. In the event that a claimant is still claiming benefits, the case is reviewed to determine the level of disability and circumstances of the claim. If the individual is still legitimately claiming for loss of earnings, they can be assessed to have a "Loss of Earning Capacity" which can extend this loss of earning claim for a further 18 months. If the individual is assessed as being "impaired" beyond 11% of their pre-crash ability, they can be paid a lump sum payment and a weekly annuity payment for up to 3 years. If the individual is impaired beyond 50% of initial ability, then both loss of earnings and impairment annuity can be extended for life. While there is provision for common law claims to be taken out against the TAC in certain circumstances, most of the claim categories are subject to maximum threshold amounts which cannot be challenged legally. There have been very few common law claims at this time because of the relatively short life of the TAC.

Access to TAC data was generously provided to MUARC for the mass data analysis in this project. A computerised database was constructed from magnetic tapes supplied by the TAC which contained relevant details on vehicle crashes, injuries and long-term consequences that occurred in Victoria between the 1st January 1987 and the 31st December 1990. However, only the first 2 years of data were analysed here as the most recent data was less likely to be complete (it can often take up to 2 years before a claim is finalised at the TAC).

Independent variables made available by the TAC included date and time of crash, crash location, age and sex of the claimant, level of outcome severity (fatality, >6 days in hospital, <7 days in hospital, or not admitted), injuries (five International Classification of Disease ICD9 as well as the major injury determined by the TAC), cost of death benefits, hospital, medical, ambulance, rehabilitation and other treatments, loss of earnings, impairment payment at 18 months, loss of earning capacity, and total cost of claim. Other variables were not available or were not sought for a host of reasons.

#### 3.2 **RELIABILITY AND ANALYSIS OF THESE DATA**

The TAC database provided a comprehensive set of outcome details on injury treatments and costs incurred by road accident victims. Previous analyses undertaken by MUARC have shown these data to be reliable and valuable indicators of road trauma state-wide and a unique source of accident and injury statistics. With the introduction of the TAC, there has been a notable reduction in the number of claims, such as whiplash injuries for instance, some of which were thought to be fraudulent.

A series of detailed analyses were performed on the mass database to provide an overview of the range of long-term consequences, target groups of road users and injuries of prime concern. Frequency tables for all variables were generated and crosstabs of selected variables (such as road user, major injury sustained, injury severity level, age and sex, with mean medical, ambulance, rehabilitation and impairment amounts, mean loss of earnings capacity and mean total cost claim). Probability of a claim (where probability equals actual claims over total potential claims) and average amounts, were also generated and analysed.

The distribution of average claim cost can be seen in Table 3.2, Item 1 - Total Cost of Claim. This indicates a *positively skewed* distribution, that is, the majority of claims (83%) were relatively minor (involved amounts of less than \$5,000) but they only accounted for approximately 20% of the total claim cost (\$18.5 million out of \$101.3 million). Thus, the average claim amounts shown in the following analysis need to be treated with some caution. Further information on these distributions may be obtained on request from either the Federal Office of Road Safety or the Monash University Accident Research Centre.

#### 3.3 OVERVIEW OF FREQUENCY DATA

A series of frequency analyses were performed on the mass database to provide an overview of the types of road users involved in collisions between 1987 and 1988, injuries sustained, outcome level, and amounts paid by the TAC for hospital, medical, rehabilitation and other services. In addition, this overview analysis permitted checks for consistency and reliability of these data, essential for understanding the value and limitations of the database. Table 3.1 shows the frequency distributions of several relevant crash and patient details while Table 3.2 shows amounts paid by the TAC for relevant outcomes. The results of the frequency distributions show that most of the TAC claimants were car occupants (79%), the majority of which were not admitted to hospital (70%). The age groups most commonly involved in claims were 26 to 55 years (35%) and 17 to 25 years (33%), and there were roughly equal numbers of males and females involved in TAC road crash claims.

Of the total number of claimants on the TAC, over half (63%) made a claim for less than \$1,000. Twenty percent of claims were between \$1,000 and \$10,000, and only a small number of people (11%) received more than \$10,000. Nine percent of all claimants received no payment because they were subsequently judged to be ineligible, failed to reach the entry threshold (of \$317), or were work related. The majority of people did not receive payment for loss of earnings (83%), impairment at 18 months (98%), nor loss of earnings capacity at 18 months (98%). Less than 1% of all claims involved death benefits payments. [Death benefits are normally paid to the victims spouse and dependent children].

#### TABLE 3.1 PATIENT CHARACTERISTICS OF THE MASS DATABASE FOR TAC CLAIMANTS INJURED IN CRASHES (Average Annual Figures - 1987 and 1988).

	CHARACTERISTIC	No. CASES*	PERCENTAGE
1.	TYPE OF ROAD USER		
	Car Occupant	15,375	79.1%
	Motorcyclist	1,237	6.3%
	Pedestrian	1,763	9.1%
	Bicyclist	836	4.2%
	Other/Unknown	246	1.3%
2.	INJURY SEVERITY LEVEL		
	Killed	681	3.5%
	Hospitalised $> 6$ days	2,513	12.9%
	Hospitalised <= 6 days	2,563	13.2%
	Not hospitalised	13,699	70.4%
3.	PRINCIPAL INJURY SUSTAINED		
	Limb fractures	2.163	11.3%
	Neck injuries	1,548	8.1%
	Head injuries	1,287	6.7%
	Other fractures	1,002	5.2%
	Fatal injuries	681	3.5%
	Other sprains & strains	395	2.0%
	Internal injuries	329	1.7%
	Other severe injuries	156	0.8%
	Spinal cord injuries	44	0.2%
	Minor/unknown injuries	11,581	60.5%
4.	AGE OF CLAIMANTS		
	0 - 16 years	3.074	15.8%
	17 - 25 years	6.353	32.7%
	26 - 55 years	6.882	35.4%
	56 - 75 years	2,488	12.8%
	Over 75 years	657	3.3%
5.	SEX OF CLAIMANTS		
	Male	9,821	50.6%
	Female	9,599	49.4
	Annual Average	19,456**	100.0%

\* Average number of cases annually across the 2 years of TAC data

\*\* Total claims include approximately 9% of cases which were subsequently not processed by the TAC for a host of reasons (found to be incligible, failed to reach payment threshold, work related, etc). It was assumed that non-eligible cases were spread randomly throughout these data when using these figures to calculate probabilities.

# TABLE 3.2 AVERAGE ANNUAL CLAIM COSTS AND FREQUENCY OF CLAIMING

	CLAIM AMOUNT	No. CASES*	PERCENTAGE
	TOTAL COST OF CLAIM	·····	
	\$317 - \$1.000	11.073	62.6%
	\$1,001 - \$5,000	3 612	20.4%
	\$5,001 \$10,000	1.054	6.0%
	\$10,001 - \$10,000	770	0.070 A A01
	\$10,001 - \$20,000 \$20,001 - \$20,000	119	4.470
	\$20,001 - \$50,000	695	3.9%
	\$50,000 - \$100,000	298	1.7%
	\$100,000 plus	168	1.0%
	Total Claims	17,679	<u>\$101.3m</u>
-	IN-PATIENT & OUT-PATIENT HOS	SPITAL AMOUNT	
	\$0 - \$1,000	10,425	73.8%
	\$1,001 - \$5,000	2,198	15.6%
	\$5,001 - \$10,000	670	4.7%
	\$10,001 - \$20,000	467	3.3%
	\$20.001 - \$50.000	289	2.0%
	\$50,000 - \$100,000	50	0.4%
	\$100 000 - \$100,000	22	0.4%
	\$100,000 pius	25	0.270
	Total Claims	14,122	\$26.0m
	MEDICAL & REHABILITATION SE	RVICES	
	\$0 - \$1,000	7,312	69.0%
	\$1,001 - \$5,000	2,391	22.5%
	\$5.001 - \$10.000	505	4.8%
	\$10.001 - \$20.000	256	2.4%
	\$20,001 - \$50,000	114	1.1%
	\$50,000 plus	20	0.2%
	Total Claims	10,598	\$19.8m
	LOSS OF EARNINGS		
	\$0 - \$1,000	1,189	36.4%
	\$1,001 - \$5,000	1 196	36.5%
	\$5,001 - \$10,000	360	11 3%
	\$10,001 - \$10,000 \$10,001 - \$20,000	333	10.2%
	\$20,001 - \$20,000 \$20,001 plus	183	5.6%
	Total Claims	3.270	\$15.7m
	IMPAIKMENI AMUUNI		
	\$0 - \$5,000	170	38.0%
	\$5,001 - \$10,000	105	23.4%
	\$10.001 - \$20.000	96	21.4%
	\$20,001 - \$50,000	62	13.8%
	\$50,001 plus	15	3.4%
	Total Claims	AA9	\$5.4m
			<u></u> 03.4III

#### 3.4 DETAILED DESCRIPTION OF CLAIMS AND AMOUNTS

#### 3.4.1 Road User

Table 3.1 showed that the most common type of road user claim on the TAC was for vehicle occupants (79%). However, when looking at the probability of claiming and the amount paid, it appears that other road user types (especially motor cyclists and pedestrians) are more likely to lodge a claim involving (on average) higher on-going medical, treatment and associated needs. These results are shown in Tables 3.3 to 3.8 and Figures 3.1 and 3.2.

ROAD USER	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Motor Cyclist	1,000	0.81	3,321	13.0%
Pedestrian	1,415	0.80	3,972	22.0%
Bicyclist	662	0.80	1,651	4.3%
Vehicle Occupant	10,864	0.71	1,429	60.7%
Total/Average	13,941	0.72	1,837	\$25.6m

# TABLE 3.3 IN- & OUT-PATIENT HOSPITAL CLAIMS BY TYPE OF ROAD USERS.

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

**IN- & OUT-PATIENT HOSPITAL CLAIMS:** Table 3.3 shows that the probability of making a claim for in-patient and out-patient hospital treatment for motor cyclists, pedestrians and bicyclists is around 0.8 compared with only 0.7 for vehicle occupants. Moreover, the average cost of a claim for hospital treatment for motor cyclists and pedestrians was more than double that of vehicle occupants. It should be noted, though, that vehicle occupants still account for 60% of the total acute hospital costs for road trauma victims in this state.

**MEDICAL, PARA-MEDICAL & REHABILITATION:** Table 3.4 shows that while the vast majority of claimants for medical and out-patient rehabilitation payment were vehicle occupants, the probability of claiming was again much higher for motor cyclists and pedestrians. In addition, the average amounts claimed by pedestrians and motorcyclists was also much higher than that claimed by vehicle occupants.

Interestingly, bicyclists had only a 0.59 probability of making a claim. However, this may be a function of the particular age groups of these road users and the general resilience children and young adults have to injury. In addition, the low frequency of bicyclists seen is probably due to the entry criteria as previously discussed in Section 3.1. Of the total number of bicycle accidents, only those which involve a motorised vehicle (car, car-derivatives, trucks, buses, trains etc) can be classified as traffic crashes and thus claimed on the TAC. [There are many other bicycle accidents not involving motorised vehicles such as bicycles hitting poles, trees, riding off cliffs etc. that would not show up in these data].

ROAD USER	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
				·
Motor Cyclist	876	0.71	2,362	10.7%
Pedestrian	1,165	0.66	2,823	17.2%
Bicyclist	496	0.59	1,344	3.5%
Vehicle Occupant	7,955	0.52	1,661	68.6%
Total/A verage	10,492*	0.55	1,835	\$19.3m

#### TABLE 3.4 MEDICAL, PARA-MEDICAL AND NON-HOSPITAL REHABILITATION PAYMENTS BY TYPE OF ROAD USER

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

#### TABLE 3.5 IN-PATIENT REHABILITATION TREATMENT BY TYPE OF ROAD USER

ROAD USER	NO, OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Pedestrian	127	0.07	21,030	32.7%
Motor Cyclist	59	0.05	14,461	10.4%
Vehicle Occupant	259	0.02	17,418	55.3%
Bicyclist	11	0.01	12,494	1.6%
Total/Average	456*	0.02	17,897	\$8.2m

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

*IN-PATIENT REHABILITATION*: Pedestrians injured in traffic accidents had the highest probability of making a claim on the TAC for rehabilitation hospital stay and the highest average claim amount, confirming the disabling effects of these injuries. Motor cyclists also had a higher probability of claiming hospital rehabilitation than vehicle occupants. The low probability of bicyclist claims may be explained by age effects where most bicyclists are children or young adults and likely to recover faster than older people. They may also need less time in rehabilitation, hence the lower amount of average claim than any other road user category. The average cost of a claim for vehicle occupants is marginally higher than for both motor cyclists and bicyclists suggesting an interaction with age effects.

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ROAD USER	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Motor Cyclist	456	0.37	4,001	12.1%
Vehicle Occupant	2,469	0.16	4,618	75.5%
Pedestrian	251	0.14	6,406	10.6%
Bicyclist	73	0.09	3,801	1.8%
Total/Average	3,249	0.17	4,650	\$15.1m

#### TABLE 3.6 LOSS OF EARNING PAYMENTS BY TYPE OF ROAD USER

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

LOSS OF EARNINGS: Table 3.6 shows the loss of earnings amounts paid by the TAC for each road user type. Motor cyclists had the highest probability of a claim for loss of earnings, yet their average claim amount was lower than that of pedestrians and vehicle occupants. Vehicle occupants and pedestrians had similar claim probabilities, although, pedestrians had a much higher average claim cost, suggesting that injuries received by pedestrians cause longer duration of disability before claimants can return to work.

The relatively low probability of a loss of earning claim for pedestrians and bicyclists could be due to the fact that many of these road users are either children or older persons and less likely to be in the work force.

LOSS OF EARNING CAPACITY & IMPAIRMENT: Impairment and Loss of Earnings Capacity (LOEC) is normally assessed by the TAC 18 months after a claim was first lodged and is indicative of the longer term outcomes sustained by road trauma victims. A claimant is judged to be impaired if after medical examination is shown to have an 11% or greater impairment of function (physical or psychological) as a direct cause of their road crash. The impairment benefit typically includes a lump sum payment (capped to a maximum of \$60,600, July 1992) as well as a weekly payment (from 18 months to 3 years for 11 to 49% impairment or for life if impairment is assessed 50% or greater).

Tables 3.7 shows the breakdown of Loss of Earning Capacity assessed at 18 months by road user type. Motor cyclists and pedestrians, once more, had the highest probability of claiming loss of earnings capacity, although their average amount claimed was less than that of vehicle occupants. This again may be a function of employment differences between these groups and possibly the greater affluence of vehicle occupants generally.

Table 3.8 further shows that pedestrians had the highest probability of being assessed as impaired at 18 months and the highest average claim cost for impairment. Motor cyclists also had a high probability of an impairment claim compared to vehicle occupants, although their average claim amounts were quite similar. The probability and average claim amount for impairment for bicyclists was again low, presumably because of age effects.

ROAD USER	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Motor Cyclist	44	0.04	9,274	10.7%
Pedestrian	41	0.02	10,712	11.5%
Vehicle Occupant	264	0.02	11,053	76.3%
Bicyclist	6	0.01	10,165	1.5%
Total/Average	355	0.20	10,768	\$3.8m

# TABLE 3.7 LOSS OF EARNING CAPACITY PAYMENT (@ 18 MONTHS) BY TYPE OF ROAD USER

• Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

ROAD USER	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Pedestrian	83	0.05	12,709	20.0%
Motor Cyclist	53	0.04	12,083	12.2%
Vehicle Occupant	296	0.02	11,738	66.0%
Bicyclist	12	0.01	9,220	1.8%
Total/Average	444	0.02	11,862	\$5.3m

# TABLE 3.8 IMPAIRMENT PAYMENTS BY TYPE OF ROAD USER

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

#### 3.4.2 Severity of Injury and Outcome

One of the most valuable aspects of these data is the fact that the TAC code up to 5 injuries sustained by each patient using the International Classification of Diseases (ICD-9) codes commonly used by the hospital system. In addition, the TAC code the "principal injury" sustained by each claimant. These data allowed outcome to be assessed by type of injury sustained for each type of road user.

Unfortunately, though, the TAC do not code injuries in terms of any severity scale. A proxy was used previously with these data (Fildes et al 1991) where severity was defined as whether the victim survived or not and the extent of treatment required (fatal, hospitalised for more than 6 days, hospitalised for 6 days or less, or not hospitalised). This injury severity proxy has added additional strength to previous analyses and was judged relevant in this analysis too.









**TYPE OF INJURY SUSTAINED:** The numerous ICD-9 injury codes were grouped into seven discrete body regions and analysed by type of road user. These results are illustrated in Figure 3.1. In this analysis *multiple* injuries were included, that is, all injuries to a maximum of five recorded for each patient (on average, though, only 2.1 injuries were actually listed for each patient).

Head/face, lower limb, and chest body regions were the most common injuries sustained by TAC vehicle occupants, while lower limbs, the chest, and the abdomen were the most frequent injuries experienced by motor cyclists. Pedestrians sustained many lower limb, head/face, and chest injuries and bicyclists, lower limb, chest, and head/face injuries.

**OUTCOME SEVERITY:** As noted above, injury or outcome severity was defined in terms of survival, or the number of hospital admission days, and categorised into 4 groups, comprising those who were killed, hospitalised for more than 6 days, hospitalised for less than 6 days, or not hospitalised. This was a proxy for the severity of the crash (and the injuries sustained) given that these data are not coded for injury severity directly.

Figure 3.2 shows the comparison of road user type by injury level, where it is evident that the majority of claimants did not require hospitalisation after their crash (70% overall). This varied considerably across the various road user groups. Pedestrians, for instance, had a higher probability of being hospitalised or killed than vehicle occupants, possibly because of the greater proportion of more severe injuries and/or aged victims among these road users. Motor cyclists, too, had a higher probability of being hospitalised or being hospitalised than vehicle occupants, although their death rates were quite similar. Bicyclists, on the other hand, had a relatively high probability of not being hospitalised or for only short stays in hospital, suggesting either less severe injuries or superior resilience to injury by these predominantly young road users.

Total TAC payment by injury severity level is shown in Table 3.9. Injury from road crashes costs the community a large amount (\$103 million annually in Victoria alone). Those staying in hospital for more than 6 days make up the largest proportion of TAC claim costs (almost 60% of total costs on the TAC during the 4 year study period). While fatalities were much fewer in number, they constituted the most expensive claims on the TAC (\$29,097 on average), although it should be noted that for those hospitalised for more than 6 days, claims were only 20% cheaper than the cost of fatalities. The probability of a claim was lower for those with minor injuries, confirming the higher reject rate among those not severely injured presumably because they fail to meet the financial entrance criterion.

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ROAD USER	NO. OF CLAIMANTS*	AVERAGE CLAIM(\$)	PERCENT TOTAL \$	
Killed	672	29,097	19.3%	-
Hospitalised >6 days	2,508	24,128	59.7%	
Hospitalised <6 days	2,561	3,266	8.3%	
Not Hospitalised	11,959	1,079	12.7%	
Total/Average	17,700	5,725	\$101.3m	

#### TABLE 3.9 TOTAL TAC PAYMENT BY INJURY SEVERITY LEVEL

Payment for a variety of services were broken down by injury severity level (length of hospital stay). As expected, for all variables analysed the probability of making a claim increased as the length of hospital stay increased.

#### 3.4.3 Principal Injuries Sustained

As noted earlier, the TAC codes the principal body injury sustained by each patient using a threat to life logic not too dissimilar to that used by Miller et al (1991) and others. This logic assumes for instance that spinal and major head injuries are more *major* (ie; likely to be life threatening) than are extremity and soft tissue injuries.

Table 3.10 shows the total payments by principal injury sustained by each claimant. The most common types of injuries were limb fractures and head injuries, accounting for almost half the total amount claimed on the TAC. In general, there was a high probability of a claim for all these principal injuries, although whiplash alone or with other less serious injuries was still relatively common compared with other more "minor" injuries.

While the number of principal spinal cord injuries were low, the average amount of a claim for this extremely severe injury was markedly higher than for any other injury (more than three times the cost of a head injury for example). Average claim amounts were similar for head, internal, and other serious injuries, while the average amount claimed for whiplash and other minor injuries was comparatively low.

INJURIES	NO. OF CLAIMANTS*	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Limb fractures	2,135	11,825	25.8%
Internal injuries	327	15,239	5.1%
Head injuries	1,264	16,999	22.0%
Spinal cord injuries	44	58,566	2.6%
Other fractures	983	6,554	6.6%
Other serious injuries	152	16,930	2.6%
Whiplash & other injuries	870	5,408	4.8%
Whiplash only	468	3,323	1.6%
Minor injuries	10,577	2,728	28.9%
Total/Average	16,819**	5,851	\$98.4m

# TABLE 3.10TOTAL PAYMENT BY PRINCIPAL INJURY SUSTAINED

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC

\*\* This total is slightly less than total TAC payments because of missing values in these data.

**IN-AND OUT-PATIENT HOSPITAL CLAIM:** Table 3.11 shows that spinal cord injuries had the highest probability of claiming in-patient and out-patient hospital services (and the highest average amount claimed), indicating the relative seriousness of these injuries. By contrast, whiplash and other injuries, whiplash alone, and minor injuries, had the lowest probabilities of hospitalisation and average claims.

INJURIES	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Internal injuries	316	0.96	5,816	7.5%
Spinal cord injuries	42	0.95	21,933	3.7%
Limb fractures	1,993	0.92	4,736	38.3%
Head injuries	1,183	0.92	4,619	22.2%
Other fractures	909	0.91	2,702	10.0%
Other serious injuries	135	0.87	5,850	3.2%
Whiplash & other injuries	556	0.56	583	1.3%
Whiplash only	281	0.51	379	0.4%
Minor injuries	7,817	0.67	414	13.4%
Total/Average	13,416	0.73	1,838	\$24.7m

TABLE 3.11 IN-& OUT-PATIENT HOSPITAL CLAIM PAYMENT BY PRINCIPAL INJURY

\* Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

**MEDICAL, PARA-MEDICAL & REHABILITATION:** TAC payments for medical, paramedical and rehabilitation (out-patient) by type of principal injury sustained are shown in Table 3.12. The most frequent injuries resulting in a claim for medical, hospital and outpatient rehabilitation services were limb fractures and head injuries, which accounted for more than 55% of the total costs for this service.

The probability of a claim for these services was highest for spinal cord, internal, and limb fractures, where roughly 9 out of every 10 patients claimed for this service. Approximately half of those who sustained whiplash alone or whiplash with other minor injuries also claimed on-going medical, para-medical, or out-patient rehabilitation as a consequence of their injury.

# TABLE 3.12 MEDICAL, PARA-MEDICAL AND REHABILITATION (OUT-PATIENT) PAYMENTS BY PRINCIPAL INJURY SUSTAINED

INJURIES	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Spinal cord Injuries	43	0.97	14,071	3.2%
Internal injuries	312	0.95	4,234	7.0%
Limb fractures	1,925	0.89	2,638	26.9%
Other fractures	855	0.85	1,615	7.3%
Head injuries	1,062	0.83	4,945	28.0%
Other serious injuries	130	0.83	4,429	3.0%
Whiplash & other injuries	628	0.63	1,843	6.1%
Whiplash only	316	0.57	1,282	2.1%
Minor injuries	4,849	0.41	638	16.4%
Total/Average	10,120	0.55	1,864	\$18.9m

• Average number of cases annually for the 2 years between 1987 and 1988 at the TAC.

INJURIES	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Spinal cord injuries	5	0.12	13,143	0 <b>.9</b> %
Head injuries	154	0.12	30,768	59.2%
Other serious injuries	15	0.09	10,941	2.0%
Internal injuries	26	0.08	14,667	4.7%
Limb fractures	177	0.08	12,351	27.2%
Other fractures	30	0.03	8,304	3.1%
Whiplash & other injuries	7	0.007	3,416	0.3%
Whiplash only	2	0.003	3,484	0.1%
Minor injuries	22	0.002	9,961	2.5%
Total/Average	438	0.02	18,365	\$8.0m

#### TABLE 3.13 IN-PATIENT REHABILITATION SERVICES BY PRINCIPAL INJURY

**HOSPITAL REHABILITATION:** Table 3.13 shows that patients suffering head and spinal cord injuries had the highest probability of claiming on-going hospital rehabilitation after acute hospital treatment. Conversely, those with whiplash and other minor injuries had the lowest probability of claiming this service.

Patients with head and limb injuries accounted for most (86%) of the total cost associated with this service. In addition, those with head injuries had the highest average claim costs, compared to all other injury types (spinal cord patients had surprisingly low average claim amounts here, suggesting that some of the rehabilitation hospital charges may be mixed with acute hospital treatment for these patients).

LOSS OF EARNINGS: Table 3.14 shows the claims on the TAC for loss of earnings as a result of not being able to work after road crashes. People with spinal cord injuries had the highest probability of a claim for loss of earnings (5 in every 10 claimants) and also had the highest average amount claimed. The fact that only 17% of all claimants did seek loss of earnings payments suggesting that the majority of claimants are either unable to claim LOE (not employed at the time of their road accident) or that their injuries did not disable them sufficiently to interfere with their employment.

Spinal cord injuries aside, the probability of claiming loss of earnings was remarkably similar across most types of injuries, suggesting that injury type per se is not closely associated with the likelihood of interruption in employment. However, the average amount of loss of earnings claimed is generally higher for those sustaining severe head injuries suggesting longer periods off work for these people. Although whiplash injuries are commonly classed as "minor" injuries, the average amount claimed for loss of earnings was relatively high, confirming the abnormal cost-burden of these injuries on the community.

INJURIES	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Spinal cord injuries	23	0.51	11,926	1.8%
Limb fractures	855	0.40	5,775	32.8%
Other serious injuries	59	0.38	7,600	3.0%
Internal injuries	121	0.37	5,446	4.4%
Whiplash & other injuries	357	0.36	5,922	14.1%
Other fractures	315	0.31	4,090	8.6%
Whiplash only	152	0.28	4,463	4.5%
Head injuries	350	0.27	7,066	16.4%
Other injuries	896	0.08	2,432	14.4%
Total/Average	3,128	0.17	4,812	\$15m

#### TABLE 3.14 LOSS OF EARNINGS PAYMENT DETAILS BY PRINCIPAL INJURY SUSTAINED

LOSS OF EARNING CAPACITY: Loss of earning capacity assessed at 18 months further demonstrates the long-term consequences of severe injury on the capacity of those individuals involved to work. These results are shown in Table 3.15, broken down by the principal injury sustained.

Claimants with spinal cord damage once again had the highest probability of a loss of earning capacity claim at time of assessment and 3 or 4 times higher than any other injury type. Somewhat surprisingly, there was a slightly higher probability of a claim for loss of earning capacity for whiplash and other minor injury cases than for those with head injuries, suggesting that these relatively minor injuries can often result in severe and long-term disability for those who sustain them.

In general, there were relatively high average amounts claimed for loss of earnings capacity for the majority of injuries. The highest average amount claimed, however, was for spinal cord injuries, consistent with earlier findings. Interestingly, the average amount paid for loss of earning capacity for minor whiplash and other injuries were as high or higher than the average amount claimed by people with head, internal and other serious injuries, indicating a relatively high degree of chronic disability associated with these relatively minor injuries. Average amounts claimed for limb and other fractures were slightly lower suggesting that these injuries tend to heal relatively quickly and are less likely to lead to on-going disability.

INJURIES	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Spinal cord injuries	10	0.21	14,047	3.5%
Other serious injuries	11	0.07	11,536	3.3%
Whiplash & other injuries	59	0.06	11,142	17.3%
Head injuries	67	0.05	12,983	23.0%
Internal injuries	17	0.05	10,389	4.5%
Limb fractures	107	0.05	9,604	27.3%
Other fractures	25	0.03	10,024	6.6%
Whiplash only	15	0.03	12,485	4.9%
Minor injuries	39	0.003	9,288	9.6%
Total/Average	351	0.02	10,830	\$3.8m

# TABLE 3.15 LOSS OF EARNINGS CAPACITY PAYMENT BY PRINCIPAL INJURY SUSTAINED

**IMPAIRMENT AT 18 MONTHS:** The final analysis undertaken of the TAC claims data was for the patient's impairment assessment at 18 months, shown in Table 3.16.

Once again, the probability of a claim for impairment was highest for those with spinal cord injuries (3 in 10), and these claims were relatively high compared with all other injuries. However, the greatest proportion by far of the \$5.0 million paid by the TAC to claimants for long-term impairment and disability annually was to those sustaining head injuries and limb fractures (62.5% or \$3.15million annually). Very few whiplash or other minor injuries resulted in a claim for long-term impairment.

It should be stressed that these figures do not include any additional costs awarded to claimants through subsequent common law judgements in the courts. The TAC has only been operating for the last 5 years or so and these longer term claims on the TAC can take several years to process. It would be expected, however, that the most severe injuries would again be over-represented amongst common law cases taken out against the TAC.

INJURIES	NO. OF CLAIMANTS*	PROB. OF CLAIMING	AVERAGE CLAIM(\$)	PERCENT TOTAL \$
Spinal cord injuries	14	0.32	33,043	5.8%
Other serious injuries	26	0.17	14,369	7.3%
Internal injuries	29	0.09	13,045	7.5%
Head injuries	104	0.08	17,377	35.8%
Limb fractures	157	0.07	8,577	26.7%
Other fractures	26	0.05	10,494	9.4%
Whiplash & other injuries	23	0.02	5,275	2.4%
Whiplash only	8	0.01	6,859	1.1%
Other injuries	37	0.003	5,467	4.0%
Total/Average	443	0.02	11,827	\$5.2m

TABLE 3.16 IMPAIRMENT PAYMENT AT 18 MONTHS BY PRINCIPAL INJURY

#### 3.5 SUMMARY OF FINDINGS

The frequency analyses showed that the majority of claims at the TAC were from vehicle occupants (79%) followed by pedestrians, motor cyclists, and bicyclists. Almost three-quarters of claims involved injuries not requiring hospital treatment for payments not exceeding \$5000. However, the major cost of road trauma involved relatively small numbers of claimants who were either killed or sustained severe injuries that required extensive treatment, rehabilitation, loss of earnings, and high likelihood of an assessment of loss of earning capacity and impairment 18 months after the initial claim.

Pedestrians and motor cyclists were seen to have a higher probability of claiming acute hospital care, rehabilitation hospital care, medical, para-medical and out-patient rehabilitation, loss of earnings and loss of earning capacity at 18 months and impairment payment than any other type of road user. Furthermore, the average cost of a claim was higher for these road users than for vehicle occupants or bicyclists.

The injuries sustained by these road users were generally more severe requiring extensive medical, rehabilitation and acute hospital care, resulting in high loss of income for the individual and high costs to the community. This indicates the need to emphasise these road users in any program aimed at reducing disabilities or outcomes from road trauma.

Injury severity level (as defined by being killed, time in hospital, and not hospitalised), was correlated with medical, para-medical and out-patient rehabilitation, loss of earnings, loss of earnings capacity, and impairment payments. While road crash fatalities are a large cost to the community, serious injuries however represent an even larger cost burden to the community (a large amount of compensation paid by the TAC was for people injured but not killed in road crashes). As injury severity level (represented by length of hospital stay) increased, so too did payments for all variables.

Accident victims hospitalised for more than 6 days had a higher probability of a claim and higher average claim costs for all services than those hospitalised for less than 7 days or not hospitalised. The more severe injuries (eg; head, spinal, internal) required longer hospital stays, more medical and rehabilitation services, and resulted in higher loss of income, higher loss of earning capacity and higher long-term impairment.

Moreover, these data showed that spinal cord injuries were the most costly in terms of acute hospital stay, medical, para-medical and out-patient rehabilitation services. The majority of road users sustaining these injuries were motor cyclists and pedestrians. The long-term disabling effect of spinal injuries was apparent from the high probability of claiming and from high average payments for loss of earnings, loss of earnings capacity and impairment.

Head injuries were most commonly sustained by vehicle occupants, pedestrians, and bicyclists and resulted in substantial costs for rehabilitation (in-patient) and loss of earnings capacity. Limb injuries, most often sustained by motor cyclists, were also costly in terms of in-patient rehabilitation. In addition, these injuries were shown to have lower payments for loss of earnings, loss of earning capacity and impairment, probably due to the more rapid healing of fractures than other serious injuries.

For the less serious injuries, such as whiplash and other injuries and whiplash only, probability of a claim and the average amounts paid were lower for acute hospital stay, medical, para-medical, out-patient and in-patient rehabilitation costs and impairment than other injuries. However, both the probability of a claim and the average claim amount was relatively high for loss of earnings, and loss of earnings capacity. This reflects the gross under-estimation previous studies have placed on the long-term effects of minor injuries and the need for more research into long-term consequences of these injuries.

## 4. PILOT STUDY OF TRAUMA PATIENTS

Given the lack of specific detail in the mass database, it was necessary to consider alternative means of collecting information on road trauma victims, more detailed than that currently available, if the objectives nominated here were to be achieved (eventually). The specification therefore called for a pilot follow-up study involving the development of a questionnaire format for collecting these data and trialing this instrument on a representative sample of road trauma patients.

#### 4.1 EXPERT DISCUSSIONS

In developing the questionnaire, a number of visits were made to organizations and centres involved in the long-term care of road trauma victims. This was to initiate discussions with experts in the field in order to identify the range of relevant outcome consequences and services provided. Places visited by project officers included:

- . Mont Park Psychiatric Hospital (Road Trauma Ward)
- . Bethesda Rehabilitation Hospital
- . Transport Accident Commission Assessment Branch
- . Transport Accident Commission Rehabilitation (Glen Waverley)
- . Austin Hospital Spinal Injuries Unit
- . Royal Talbot Rehabilitation Hospital
- . Private Rheumatologist Dandenong
- . Royal Melbourne (Essendon) Hospitals

These visits provided valuable background information on the range of rehabilitation services required and supplied to road trauma patients. In addition, details on previous studies undertaken, current trends overseas and in Australia on assessments and measures made on outcomes, and details on many of the relevant issues for the long-term effects of road crashes were also collected.

These organisations were extremely helpful in extending their knowledge and expertise of these issues and made available various forms used to assess disability and impairment, questionnaires used in database studies and methods for collecting rehabilitation and other outcome data related to vehicle crashes. The study team is most appreciative of the assistance readily provided by these organisations.

#### 4.2 EXISTING DATA COLLECTION INSTRUMENTS

During the course of these discussions, a number of existing questionnaires and other data collection formats, both locally and from overseas, were generously provided to the study team from a number of different sources (the authors are extremely grateful to the people and organisations who provided these forms). Details on some of these instruments follows.

#### 4.2.1 Functional Independence Measurement

One method of collecting data is the Uniform Data System (UDS) for Medical Rehabilitation already in widespread use in the United States. There have been recent developments in Australia towards the installation of the "*Functional Independence Measurement*" (FIM) in a number of rehabilitation hospitals aimed at both data collection and hospital audit and it is hoped that it will be installed in more rehabilitation hospitals in Australia within twelve months. This system is primarily an outcome monitoring system and allows individual rehabilitation units to measure their performance against the pooled data from other rehabilitation centres, both nationally and regionally.
The system runs on the principle that each centre subscribes to a uniform data set (FIM), demographic and follow-up information on clients is recorded four times a year, the information is processed in the US and a quarterly report is sent back on outcomes relative to other states and countries. FIM is essentially an 18 point measure of disability and is the basic system for rehabilitation assessment. It is, however, weakest with the disability resulting from brain injury.

Another variation of this rehabilitation data system is the Functional Assessment Measure (FAM) which incorporates FIM and adds another 12 items assessing psycho-social disabilities. While these are especially useful for auditing rehabilitation service, they were only of limited value for outcome research.

#### 4.2.2 Other Rehabilitation & Disability Instruments

The Transport Accident Commission Rehabilitation Centre also provided the study team with a draft of a proposed research data collection form they were compiling on rehabilitation patients at their Centre. This form comprised details on the client's personal details, rehabilitation program undertaken, education and occupation, living arrangements, leisure activities, ICD9 disease and injury codes, and treatment charges.

The one year post-injury questionnaire used by Lyle et al (1991) was also made available containing data items on daily living activities, social and recreational activities, and marital and work status. Presumably, these data were subsequently appended to injury and event details obtained on these patients. The data collection form used in the study reported by the Transport and Road Research Laboratory (Galasko et al 1986) was also sent by the authors containing items from their road traffic survey similar to those described above.

#### 4.2.3 Spinal Injury Measurement

The Spinal Injuries Unit at the Austin Hospital developed a data collection system which has been used to analyse some of the results of treatment of admissions to the Spinal Injuries Unit. They have developed a databank of all spinal cord injured patients since 1976 (983 records to date) incorporating comprehensive details on a number of treatment, impairment, rehabilitation and psychological factors.

Reports by Burke, Burley & Ungar, (1985a, 1985b) gave specific assessment of physical independence and emphasised that treatment and rehabilitation of a patient with a spinal cord injury requires a long period of hospitalisation.

## 4.2.4 Head Injury Measurement

Bethesda Hospital also follows up all of its head injury patients six monthly for the first two years after injury, then at three year and five year intervals. In their survey, they examine medical, physical, psychological and social sequelae and gather some behavioural information on these patients.

The *Report on Acquired Brain Damage* (Health Department Victoria, 1991) examined the extent of brain injury in Victoria and reviewed the causes, prevalence, recovery, rehabilitation and long-term care and support for people suffering head injuries. The study gathered data from consultative meetings with interested individuals and organisations in addition to follow up questionnaires of individuals who had been admitted to hospital with a principal diagnosis of head injury during 1987 and 1988.

The findings of the study led to the identification of a number of specific issues relevant to the care of these patients, such as the need for more community awareness, recognition that brain injury can be a lifelong event, the need for networking services, and raised questions about access to rehabilitation.

## 4.3 EXPERT GROUP WORKSHOP

The next phase of developing the questionnaire involved organising a seminar comprising many of the health service professionals contacted earlier to help identify critical issues and variables of prime interest for this follow-up study. Information gathered from discussions and other sources was compiled into a list of potential variables and an afternoon workshop organised involving these experts in road trauma treatment and rehabilitation. A detailed listing of this group of specialists is provided in the front of this report.

The issues and suggestions that arose the workshop were especially helpful in clarifying thoughts on priorities for the project and independent variables likely to yield useful information. From these discussions a preliminary questionnaire was established and circulated to all workshop participants for comment.

Dr Bill Foddy of the Department of Sociology and Anthropology at Monash University was enlisted to help structure the final questionnaire. Dr. Foddy is experienced in developing these data collection instruments and his efforts helped ensure that the questionnaire was comprehensive, had as few ambiguities as possible, and was likely to achieve the project objectives.

#### 4.3.1 Independent Variables

From all these efforts, a comprehensive questionnaire consisting of 56 follow-up questions was developed containing information on the following:

- . history of road trauma event,
- . accident and injury details,
- . hospital treatment details,
- . rehabilitation services required in-hospital,
- . rehabilitation after hospital,
- . implications on employment,
- . costs associated with the crash,
- . subjective assessments of pain and suffering,
- . consequences on quality of life,
- . consequences on social life and well being, and
- . personal and psychological consequences.

Through these questions it was hoped that specific issues would be addressed such as the range and incidence of the various outcomes of road crashes, specific types of injuries that give rise to long-term disabilities and their consequences, risk of particular road users, and age effects on whether a particular injury will give rise to a disability. A copy of the final questionnaire is provided in Appendix A.

## 4.4 QUESTIONNAIRE ADMINISTRATION

There were a number of issues raised about the administration of the questionnaire from discussions and previous literature that needed to be addressed.

#### 4.4.1 Advantages & Disadvantages of Questionnaires

Questionnaires have several advantages in these studies. First, they can yield a great deal of reliable, valid information for relatively low financial expenditure. Second, they can be given to a large number of people in a short period of time, often involving self-administration, thereby yielding large amounts of data. Third, well designed questionnaires or interview schedules can elicit information not normally available by other means. Finally, well-designed and tested questionnaires have been shown to be reliable and robust measures of behaviour (both current and future).

There are, however, disadvantages too with questionnaire data, predominantly, from poor design and administration. One major disadvantage is that with insufficient thought and preparation, they can be highly misleading and confusing. Unclear aims, poor wording, inappropriate or threatening questions and careless administration can produce worthless data. Another disadvantage is that questionnaires may be subject to various measurement artifacts which may affect the interpretation placed on the results.

Three methods of administering the questionnaire were considered, namely, personal interviews, telephone interviews, and mail questionnaires. The strengths and weaknesses of each of these needs to be discussed fully.

#### 4.4.2 Personal Interviews

Face to face interviews allow for the greatest information flow between the interviewer and the respondent. The interviewer can explain the project and the questions and prompt or follow leads picked up during the interview, similarly, the respondent is able to explain or clarify or explain answers and clarify points he or she does not understand. There are several disadvantages, however. First, interviews tend to be time-consuming and thus expensive to administer. Second, it is possible that the interviewer may 'lead' the respondent by unintentionally reinforcing the respondents answers in some way, that is, to bias their results. When more than one interviewer administers a questionnaire, differences between the individual's interviewing styles and their personalities may influence the respondent's answers in subtle but real ways.

#### 4.4.3 **Telephone Interviews**

The telephone interview, commonly used in surveys, has similar advantages and disadvantages as the personal interview. There are a number of major differences, however. First, telephone interviews are much less costly and less time consuming. Second, there can be poorer communication with the subject than in face to face interviews, although this can also be an advantage in ensuring fewer avenues of biasing the respondent. However, it is true that telephone interviews generally cannot pick up vital non-verbal cues for further follow-up using this technique.

#### 4.4.4 Administration by Mail

Mail questionnaires are a relatively inexpensive and effective means of collecting data (especially in large volumes) and are often less threatening to the respondent. Again there are both advantages and disadvantages to this method of data collection. First, mail questionnaires are a very efficient way of surveying people's views and behaviour. Second, as most survey respondents are volunteers, they are able to complete the questionnaire in their own time, are much less likely to be influenced by professional status of an interviewer, therefore affording less opportunity for the investigator to "bias" the responses.

However, mail questionnaires do allow respondents to seek advice from others in the household or outside about how particular questions should be answered, thereby introducing possible contamination in their responses. Additionally, poor response rates are commonly reported using this method (sometimes as low as 30 to 40% depending on the material being sought), which raises questions about the likely bias introduced by this sampling method (responses are often only those who have the time to fill them out and/or are sufficiently motivated to want to participate).

#### 4.4.5 Conclusion

The telephone interview was eventually selected for use in this study after much discussion with experts in the field and with due consideration to the objectives of the study and its constraints. Telephone interviews have been used in similar surveys to this one which require immediate results and have been shown to be effective procedures for eliciting this type of quantitative information. However, it must be recognised that this technique is less able to pick up subtle differences in the subjects' responses and suffers inaccuracy and minor bias from those who are unable to communicate effectively over the telephone. Those suffering severe speech or memory deficits are most likely to be under- or mis-represented using this technique.

## 4.5 **PROCEDURE**

A suitable sample of road trauma patients was required to trial the administration procedure and adequacy of the questionnaire. An existing data source with relatively easy patient access was available in the "Crashed Vehicle File" maintained by MUARC from previous research in vehicle occupant protection for the Federal Office of Road Safety. This database has comprehensive details on a number of vehicle trauma patients, including information on seating position, all injuries sustained (coded for severity using the Abbreviated Injury Severity, AIS, score), impact direction, etc. These data constituted a suitable subset of road trauma patients for trialing the questionnaire developed here. In addition, the results would allow a more extensive account of the consequences of road crashes to an important and sizable road trauma problem.

At the time of this pilot study, details were available on 392 patients from 324 crashes that occurred after the 1st April 1989. Focussing on the earlier cases which accumulated in the first 6 months of the study (from 1st April to 30th September 1989) provided a number of patients who had been injured from road crashes sufficient to require hospital treatment some 2 years previous. Although restricted to vehicle occupants, these data nevertheless were quite suitable for pilot study analysis of long-term outcome, keeping in mind this study was primarily a pilot project aimed at developing the most appropriate methodology for conducting a larger scale study.

Approval was sought and granted from the Ethics Committee at the Alfred Hospital to contact these patients who had previously agreed to be included in the Crashed Vehicle File and to seek their assistance to co-operate further in this follow-up study. Because of prior promises of confidentiality, the Alfred Hospital made the initial contact and referred willing participants to MUARC. In addition, to supplement the existing sample of hospitalised vehicle occupants with quadriplegic and paraplegic patients (not included in the original Crashed Vehicle Study) approval was sought and granted from the Spinal Injuries Unit at the Austin Hospital to contact a small number of patients who had sustained a spinal cord injury from a road crash.

Each patient was sent a letter approximately 18 months to 2 years after their initial crash from their respective hospital. Those who agreed returned a letter of consent to the Monash University Accident Research Centre consenting to be interviewed on the long-term consequences of their trauma (Appendix B). A consent form stating name, address and telephone number was enclosed along with a stamped self-addressed envelope to MUARC.

## 4.5.1 Response Rates

In previous follow-up studies, Bethesda Hospital estimated their return rate to be around 40% maintaining that the other 60% may not want to be reminded of their problems, may still be denying them, or they still cannot cope with everyday life. Likewise, the Menzies Foundation data collection study reported a response rate of around 40%. Galasko, Murray, Hodson, Tunbridge & Everest (1986) mailed out questionnaires and covering letters to individual patients six months after the date of their injury which were designed to extract information about changes in the patient's lifestyle as a consequence of the crash. Of the 1,593 patients initially contacted, a surprising 940 of them (60% response rate) eventually completed the six month questionnaire (this study did, however, include additional follow-up to maximise the number of returns).

Patients who had crashes between April and September 1989 and who had sustained injuries likely to result in long-term rehabilitation and/or disability were selected. Sixty patients from the Alfred Hospital and four patients from the Austin Hospital were initially contacted by their respective hospitals to participate in this follow-up study. From the previous studies noted above and from discussions with professionals, it was estimated that 40 to 50% of these patients would ultimately respond.

Of the total 64 patients contacted, 31 Alfred Hospital patients and one Austin Hospital patient (50%) agreed to be interviewed. Of these 32 positive responses, six (9%) were ultimately not interviewed because they could not subsequently be contacted, were too ill when telephoned, were rejected because of subsequent crashes, or were too late. Twenty six patients (41%) finally participated in the questionnaire study.

Of the 32 (50%) patients who could not be contacted, eight (12%) of the patients' letters were returned address unknown, while 24 (38%) patients failed to respond to the request.

#### 4.5.2 Sample Details

The predominant trauma of the 26 patients who were interviewed comprised major head and face injuries (AIS 2 to 4), chest injuries (AIS 2 to 5), abdomen and pelvic injuries (AIS 1 to 3), neck injuries (AIS 2), spine injuries (AIS 3 & 4), thigh injuries (AIS 3) and injuries to the leg and foot (AIS 3). These were judged to be fairly representative of the range of severe trauma to vehicle occupants from prior studies (Fildes et al 1991).

Patients ranged in age from sixteen to eighty five years where 18% were under 25 years, 53% were between 25 and 55 years, 20% between 55 and 75 years, and 9% over 75 years. Almost two-thirds of these patients were females. This sample was biased towards older females compared with those who refused to participate and injured occupants in general. This was not considered to be a major difficulty here though given the nature of this study. All patients were car occupants and had spent at least one day as an in-patient in hospital.

The interview questionnaire sought to obtain information on the use of hospital facilities, rehabilitation and outpatient services, changes in work routine or loss time off work. It also sought information on compensation claims, costs of the crash and changes in income as well as changes in lifestyle and activities of daily living and personal consequences. Coded responses were then analysed and frequency and crosstab tables were generated for all relevant variables.

#### 4.6. **RESULTS**

This study sought to examine the physical and psychosocial changes after injury in a range of road crash victims. The ultimate objective of the follow-up study was to describe more fully the long term consequences of road trauma, in particular, the types of services used, the amount of support required, and the social and psychological consequences suffered by these people several years after the event. It was important to be able to describe these outcomes by patient age, sex, type of road user, and injuries sustained. The study was necessary because existing databases do not provide details on these factors and, hence, the real longterm consequences of road crashes are relatively unknown.

It must be emphasised, though, that this was a pilot study to test the adequacy of the questionnaire and the telephone sampling technique. Hence, it was not possible to provide definitive data on these aspects from such a limited sample of patients. Nevertheless, there were some indicative findings that came from this study that can be reported. Care should be taken, though, not to place too much emphasis on the robustness of these findings.

## 4.6.1 Injury by Age

The results of this pilot study failed to show any strong correlation between age and a number of outcome measures, such as length of hospital stay, need for outpatient medical care, number of work days missed or adverse social or personal consequences. It has been shown in previous studies that some correlation existed between age and long-term disability (Galasko et al. 1986; Gustaffsson et al. (1986). Gustaffsson, for instance, reported that elderly people had a far greater risk of a serious outcome for a given severity trauma. Car occupants aged 51 years or older were found to have a more than double risk of poor outcome, compared with younger occupants. It would be useful to examine this relationship further using a much larger all-trauma sample of road trauma victims than that available.

#### 4.6.2 Injury by Acute Hospital Stay.

Roughly 40% of the patients stayed in hospital for more than 7 days, but less than 21 days. There appeared to be a link between the type of injury and the duration of hospitalisation, as noted earlier from the mass data, although it is difficult to establish the degree of correlation. For those patients with head and face injuries, roughly half of them spent between 7 and 21 days in hospital. Forty-two percent of patients with lower limb injuries stayed in hospital for similar periods, although a substantial number stayed for more than 21 days (33%). More than two-thirds of those with neck injuries stayed more than 21 days in hospital.

The severity of all injuries sustained by these patients was scored using the Abbreviated Injury Severity (AIS) score of the Association for the Advancement of Automotive Medicine (AAAM 1985). The overall *Injury Severity Score* (the sum of the square of the three most severe AIS injuries) was also computed for each respondent. Because of the small number of patients, it was only possible to look at the relationship between injury and hospital stay overall (that is, not by the individual body region injured or severity score). In general, as the ISS increased, so too did the length of stay in hospital.

This is shown further in Figure 4.1 where ISS levels were grouped into three major categories; *Minor* (ISS scores 1-9; 11 cases), *Moderate* (ISS scores 10-15; 9 cases), and *Severe* (ISS scores 16 and above; 6 cases). Of those respondents with relatively minor injuries, the majority (57%) stayed less than 7 days in hospital and only a small number (14%) stayed more than 21 days. However, for severe injuries, no cases stayed for less than 7 days and most respondents (67%) stayed in hospital for more than 21 days.

The majority of patients were discharged home either alone or with their family (62%), two went to another hospital for extended rest closer to their home, four patients required inpatient rehabilitation hospital stay and another four patients went home with assistance. Again, the small number of patients precluded any more detailed analysis here.

#### 4.6.3 Rehabilitation Duration and Services Used.

Only four (15%) of the respondents required rehabilitation hospital stay after acute treatment which ranged from 14 to 42 days. Of these, one respondent who sustained severe head/face and neck injuries went to Bethesda hospital, another with moderate pelvic, hip and thigh injuries stayed in Bethesda hospital, one more who sustained minor pelvic and upper extremities injuries went to Hampton Rehabilitation Centre, and a further one with severe spinal cord injuries stayed at the TAC Rehabilitation Centre.

The range of services used by those requiring in-patient rehabilitation was varied. The respondent with head/face and neck injuries required speech therapy, neuropsychology, counselling, and occupational therapy, while the respondents with abdomen/pelvic and limb injuries required different services, such as physiotherapy, occupational therapy, work trial programs, and hydrotherapy. The spinal cord injured respondent required physiotherapy, social worker, recreation therapy, and hydrotherapy. All patients went home after rehabilitation, two with their families and two with other assistance.







Figure 4.2 Respondent's rating of level of disability at discharge from hospital.

#### 4.6.4 Disability

All respondents noted some degree of disability when they left the hospital, ranging from continuing pain, restricted movement, severe headaches, weakness, difficulty in breathing, discomfort when sleeping, and loss of concentration, memory, control and feeling. Restricted movement was the most common disability for all body regions injured (22%). Particular disabilities were also reported for specific body regions injured. Respondents with head/face injuries reported more instances of loss of memory, difficulty in reading and writing, slurred speech, and loss of sense of smell. A number of these disabilities were noted to still persist at the time of interview (2 years after the event). Of those with chest injuries, restricted movement and difficulty in breathing were common disabilities, and of the respondents with abdomen/pelvic injuries, pain was the most common response. For people with upper and lower limb injuries pain and loss of control were noteworthy.

Patients were also asked to rate the degree of disability they had when they left their acute treatment hospital or their rehabilitation hospital. Most patients rated their level of disability as *severe* (39%) when they left hospital. Of those who required rehabilitation hospital stay, two respondents rated their disability as *modest* and another two as *severe* after discharge. The majority of respondents with minor injuries rated their disability as *moderate* to severe while those with severe injuries rated their disability as severe to *very severe*. The respondents' ratings of disability are plotted against injury severity scores in Figure 4.2.

#### 4.6.5 Services & Out-Patient Help Required.

Most respondents required some services or help after leaving hospital (73%). Twenty patients required at least one visit to outpatients after leaving hospital, 10 required services of a specialist and 13 required consultation from their general practitioner as a result of injuries sustained from the crash. Table 4.1 shows the range and types of outpatient services required by the sample of patients surveyed. Physiotherapy and orthodontics were the most widely used services among these people and of reasonable frequency (58% and 23%). The latter finding is probably higher amongst vehicle occupants than other road trauma patients, given the predominance of driver contacts with the steering wheel from this crash type (Fildes et al 1991). Length of services ranged from 1 to 180 weeks. Two respondents were still having physiotherapy at the time of interviewing (both had sustained severe chest injuries) and one respondent (who had sustained spinal cord injuries), hydrotherapy .

SERVICE REQUIRED	FREQUENCY	PERCENTAGE
Physiotherapy	15	58%
Orthodontics	6	23%
Occupational therapist	3	12%
Neurologist	2	8%
Psychologist	2	8%
Psychiatrist	2	8%
Social worker	2	8%
Vocational counsellor	2	8%
Work trial program	1	4%
Other	8	31%

#### TABLE 4.1 SERVICES REQUIRED BY RESPONDENTS AS OUTPATIENTS.

NB: The frequency of use refers to the number of respondents who reported having used these services at least once (ie; it is not the number of total consultations used for each service.

## 4.6.6 Outpatient Service Correlates

Length of stay in acute hospital, used to measure injury severity level in the TAC data, was compared with the length of services used as outpatients. Of those patients who required less than 7 days initial hospitalisation, a large percentage required no outpatient services at all and only a small number required services for more than 10 weeks. Conversely, of those staying in hospital for longer than 21 days a small number required no services at all, while the majority required services of over five weeks duration. This needs to be tested more thoroughly with a larger group of patients.

The type of injuries sustained by respondents was compared with the length of physiotherapy treatment at outpatients. The majority of respondents with head/face and lower extremity injuries required over 20 weeks service. By contrast, patients with abdomen/pelvic and other injuries required less than six weeks outpatient physiotherapy service.

#### 4.6.7 Community Services Used

Requirements for some form of community assistance were noted by a number of respondents. Services commonly used included council (home) help (11 respondents), public transport (4 respondents), and meals on wheels (3 respondents). Length of requirement for services ranged from 1 to 104 weeks. Two respondents had previously required council help before the crash. Comparing the need for council help services by injury severity showed that respondents with minor injuries in general only required council help for one to six weeks. However, for those with moderate and severe injuries, the length of services required increased beyond seven weeks with one respondent noting the need for help over 100 weeks. Council help included a variety of services such as cleaning, washing, house tidying, home maintenance, etc.

#### 4.6.8 Financial Costs

Most respondents indicated that the TAC had contributed substantially to payments associated with their crash (one respondent claimed that the TAC had not contributed at all because their claim was paid solely by Workcare). Six respondents reported some contribution from Medicare, while three reported that their private health insurance had paid for some of the costs of their crash. Because of the elaborate process involved in obtaining details of TAC payments for individual road trauma victims and issues of confidentiality, it was not possible to obtain these details for this pilot study. However, it would be important to do so in any further follow-up of road trauma victims.

In addition to these *external* expenses, most respondents indicated that they had incurred some personal cost from their accident above that provided by government and employer services. However, most estimated this personal cost to be less than \$500. The majority of these costs were associated with TAC excess for hospital/medical bills and transport costs such as taxi fares. For those respondents who indicated costs of more than \$1000, frequently these expenses included replacement of vehicle, loss of wages (for those self-employed) and court payments.

#### 4.6.9 Time off work

Social costs of injury are often expressed as lost work estimates and the time taken to return to work is used as an indicator of long-term disability following road crashes. Work is a major determinant of quality of life and social re-integration and thus is an important tool for measuring long-term outcomes. At the time of the accident, more than half the respondents (58%) were employed in full-time work, others were part-time or casual workers (12%), selfemployed (8%), or full time house duties (8%). There was one student and three respondents were retired (14%). None of the respondents was unemployed when they crashed. At the time of administration of the questionnaire, most of those who had suffered minor or moderate trauma had returned to their normal employment, studies, or their previous home duties. All but five of the 26 respondents were able to return to their previous employment activity within 12 months. Of those who did not return to work, two believed they would never return, and three were unsure (each of these cases had sustained moderate to severe injuries of the head, neck and chest, spine and chest, and spinal cord. Figure 4.3 shows the relationship between injury severity level (ISS scores) and the time taken to return to work.



Figure 4.3 Time taken to return to work by injury severity level

For those returning to work, the majority (69%) returned within 3 months. For the others, two respondents with minor neck, and minor chest and upper extremities injuries took 16 weeks to return to work, another two with severe head and neck injuries and moderate abdomen and pelvic injuries took 24 weeks to return to work, and one respondent with multiple injuries took 44 weeks to return to work.

Most respondents were working in the same job with no change of duties (69%). Of the remainder, four respondents (who had sustained injuries of abdomen/pelvis, upper and lower extremities, and chest) were put on lighter duties up to six months after the crash. Three respondents with moderate and severe head, neck, face and pelvic injuries were unable to return to their previous job. Reasons why these respondents were unable to return to work essentially showed that they had great difficulty working under stress and became very frustrated after their accidents. One patient who had sustained severe head injuries had worked at four different jobs since the accident and at the time of interview was unemployed.

#### 4.6.10 Behavioural Changes

The extent to which personality change persisted was not assessed directly, however the incidence of various behavioural characteristics reported by many respondents suggested that long-term changes had indeed taken place. A number of respondents noted changes in their memory and concentration since the accident. The majority of these respondents sustained injuries of the head, chest, neck, spine and pelvis and indicated reductions of memory ability particularly for detailed memory, and memory for numbers and names. In addition they noted low concentration spans where difficulty in reading novels, difficulty in long-term concentration through films and lack of concentration when driving was also noted.

Greater anxiety and loss of confidence was reported in many cases. The majority of respondents experienced some anxiety and loss of confidence particularly in activities such as driving or travelling in a car (see Figure 4.4). Reports of phobia, avoidance of the site of the accident and recurrent feelings that a similar accident might happen again were noted, although only one of the sample approached (but not interviewed) had actually been involved in another crash. Those with severe injuries such as head, neck, spine and chest injuries, reported loss of confidence in mixing and coping with people, anxiety about their future, and an inability to remember things.



Figure 4.4 Reports of loss of confidence as a result of the accident by injury severity.

Irritability, frustration, depression and short tempers were reported by a number of respondents. This type of complaint was not confined to the more severe injuries, respondents in each category of severity of injury reported such behavioural changes. In addition, some respondents indicated extreme anger at the driver who caused the crash. Approximately one third of respondents reported a change in their goals and ambitions as a result of the accident. In particular, respondents with severe injuries noted major post-crash changes in their career or work ambitions and had subsequently set themselves lower goals than before the accident. Many of these respondents sustained injuries to the head, neck, spine and chest, and reported that they were less interested in most things, could not do as many things as they could before and thus had changed their life ambitions.

Many respondents also noted that they had taken steps to improve their health since their accident (58%). Examples of improvement health strategies were increased walking, regular exercises set by physiotherapists, increased swimming, and keeping a healthy diet. However, few reported changed patterns of smoking and or drinking following the accident.

#### 4.6.11 Family & Social Contacts

The majority of patients reported receiving some level of support from their family and friends after their crash. However, as noted previously, a number of respondents reported anxiety and loss of confidence in mixing with people and often declined invitations to go out. In addition, 15 (58%) of the respondents acknowledged an impact of the accident on their personal or family life. The majority of these cases were patients with severe injuries, although half of those with minor and moderate injuries still reported that their accident had had some impact on their personal life.

Those with severe injuries felt that their social life had lessened and they reported not having the same opportunities they once had to mix with people. Loss of previous friends was noted by several of the respondents because of changes following their crash. Others reported tension in the family due to short-tempers, moodiness and anxiety on their part. Marital status remained unchanged in all cases, although, four respondents did report problems and tensions between them and their spouse. In addition, loss of motivation and interest in activities, irritability and stress caused changes in their personal life for some respondents.

#### 4.6.12 Leisure Activities

Leisure activities also changed as a result of the accident for 46% of the respondents. This change included both a reduction in the level of activity as well as a switch to less strenuous activities. Table 4.2 shows the percentages of respondents who indicated change in their leisure activities (and the time spent at leisure) resulting from their accident by injury severity level. Of particular interest, all respondents with severe injuries reported changes in their leisure time while many of those with minor or moderate injuries reported no change.

Decrease of leisure activities was particularly noteworthy for those respondents unable to work or return to the same job. Reports of social isolation, frustration, lack of motivation, indifference to people and activities and boredom were noted for those not returning to normal work routines. Common reasons given for why leisure had changed included decrease in activities due to pain, restriction of movement, no energy, decreased control in hands, less patience, and lack of ability to concentrate.

SEVERITY	CHANGED	NOT CHANGED	TOTAL
MINOR	7 (50%)	7 (50%)	14
MODERATE	2 (22%)	7 (78%)	9
SEVERE	3 (100%)	0 (0%)	3
TOTAL	12 (46%)	14 (54%)	26

# TABLE 4.2 CHANGES IN LEISURE TIME FOLLOWING THE ACCIDENT BY INJURY SEVERITY LEVEL.

#### 4.7 SUMMARY OF FINDINGS

The pilot study examined a range of outcomes by injury severity following a road crash. Injuries ranged from minor to severe for all body regions and all respondents interviewed expressed some disability relating to injuries sustained.

Some association seemed apparent between severity of injury and level of disability, measured on a range of outcomes, such as length of hospital stay, loss of earnings, type and length of out-patient services required, social and personal or family changes.

The types of services required by respondents included physiotherapy, social work, hydrotherapy, work trial programs and occupational therapy. Physiotherapy was the most widely used service and it was found that respondents with head or face injuries and those with lower limb injuries required the longest duration of this service.

Community services were also used widely by respondents after injury, including council help, public transport, the Royal District Nursing Service and Meals on Wheels.

Most respondents indicated some level of disability after leaving hospital, involving ongoing pain, restricted movement, discomfort, loss of memory, concentration, control and feeling. Particular disabilities seemed to be related to specific body region injuries.

All respondents reported some loss of earnings. The majority of respondents with minor injuries returned to work within three months and hence their losses were relatively small. Of those with moderate and severe injuries, most returned to work within twelve months incurring much larger losses. Only a few respondents with severe injuries had not returned to work at time of interview.

All respondents reported some personal consequence of their injuries. Most reported a loss of confidence (particularly in driving) as a result of the accident. Of those with more severe injuries, reports of longer-term social, family, and leisure problems were apparent.

In general terms, those who suffered minor to moderate injuries (ISS<15) had shorter stays in hospital, slight disability on discharge, few rehabilitation and outpatient services over relative short durations, minimal behavioural changes, and practically all had returned to their previous employment or daily activities within 12 weeks.

On the other hand, those who experienced severe injuries (ISS>15) generally spent longer periods in hospital, reported severe disabilities on discharge, used rehabilitation and outpatient services extensively and for long periods, reported substantial behavioural and cognitive deficits, and were more likely not to have returned to work up to two years after their crash.

#### 4.7.1 Appropriateness of the Method

A major aim of the pilot study was to develop an appropriate method for gathering more detailed information on long-term consequences of road trauma and a questionnaire was subsequently compiled.

The results demonstrated the appropriateness of the instrument for eliciting long-term consequence data and confirmed that its widespread use would yield comprehensive useful data. For the most part, the questions were answered clearly and without hesitation, suggesting few ambiguities in their structure (the questionnaire was trialed earlier on several non-trauma subjects and initial ambiguities had been clarified). Where appropriate, all questions were answered by the patients with few instances of reservation expressed. There were no questions that the patients refused to answer. This is not to say however that the answers were necessarily accurate reflections of the patient's feelings at that time.

These data provide a comprehensive account of the outcomes and problems faced by road trauma victims up to two years after their crash. Unlike mass data, they provide elaborate details on the social and psychological consequences facing these people and are able to highlight the degree of support required for road trauma victims in their quest to overcome their injuries, fears, and phobias resulting from their crash.

However, it must be recognised that these data will be naturally biased against those who have difficulty in responding to written questionnaires (non-English speaking, brain damaged, or illiterate respondents). Moreover, these data will not include details of those who have experienced severe trauma and do not want to be reminded of it or cannot cope well with everyday life. In short, they are likely to be deficient of the most severe outcomes or consequences resulting from road trauma. It is difficult to see how this might be overcome, however, even if a different format was used as there is a fundamental need to respect an individual's right of privacy if they choose not to want to participate in this study.

## 5. GENERAL DISCUSSION AND CONCLUSIONS

This final chapter of the report aims to bring together the findings of the literature review, discussions with health service providers and experts, mass data analysis, and the results of the questionnaire to provide answers to the questions raised by the four study objectives listed on page 1. These will be addressed individually further on in this Chapter, however, it is worth reviewing first the strengths and weaknesses observed with the sources of information reviewed during the course of this study.

## 5.1 DATABASES AND INFORMATION COLLECTED

#### 5.1.1 Literature Review

The literature review undertaken in this pilot study provided a background into trauma outcome from relevant studies and an insight of key variables and risk groups associated with long-term outcome from road trauma. It should be noted that to date, most research on the social costs of injury has been limited to loss of employment and hospital costs.

This leads to a limited analysis of the nature of the crash, injuries sustained and a limited view of injury severity in terms of long-term disabilities and consequences. Little is known overall about duration of disabilities, length and cost of out-patient treatment, time taken to return to pre-accident employment, morbidity and psycho-social and economic consequences of road injury. Furthermore, a paucity of information is apparent on the relationship, if any, between the severity or type of injury and the duration and severity of disability.

Research is beginning to show that severe head injuries have significant costs five to ten years post-injury in aspects of life that have not been studied before. This injury has therefore been the focus of several studies on outcome due to its relative frequency and the significant morbidity and mortality associated with these severe injuries. However, this preliminary study has revealed that a significant amount of road trauma involves relatively minor injuries (such as face and soft tissue injuries), yet only a few outcome studies have focussed on these. Levine's (1986) study on the long-term effects of lower limb injuries indicated a substantial amount of treatment was required and permanent impairments were often associated with these injuries, which for some, develop and worsen with increased age. Moreover, Dooley (1986) showed that chronic pain, often associated with relatively minor soft tissue injuries, can have considerable long-term disability, typically disrupting a person's entire lifestyle and restricting their social activity.

In support of Lyle et al (1991) findings, considerable disability was also found in this study for patients with relatively minor injuries, although outcomes did not seem to be as longlasting or permanent as for severely injured patients. Minor trauma cases also appeared to have similar, albeit less severe, psycho-social and financial problems to severe trauma cases. Restrictions of leisure activities, time off work and financial hardship were reported frequently by those whose injuries are usually not considered serious in medical terms. These findings suggest that minor injury is an important public health issue and cause of temporary disability in the community because of the frequency with which it occurs.

Further examination of the literature revealed that there were very few studies giving an overview of injuries and their subsequent consequences. Most studies tended to focus on one category of injury and as a result significantly underestimated the full effects of road crashes on the community, the individual and his/her family. Galasko, Murray, Hodson, Tunbridge and Everest (1986) examined whether long-term disability was a consequence of particular injuries and whether there was any correlation between injury severity and subsequent disability. Similarly, the pilot study here sought to include a range of injuries sustained by vehicle occupants, focusing on correlating injury severity and injury type with subsequent long-term effects, to the degree possible from only a handful of cases.

It is clear from the literature review that the consequences of road trauma are broad and sweeping and not necessarily confined to particular types of injuries or road users. There is clearly a need for a more detailed study aimed at providing an overview of the range of outcome consequences for all injuries and road users to gain a better understanding of the pain, suffering, support services required, long-term consequences and cost of road crashes.

#### 5.1.2 Transport Accident Commission Data

The Transport Accident Commission (TAC) system in Victoria is probably the most comprehensive source of road trauma data available in this country, linking crash and road user circumstances with injuries sustained and treatment received for up to 18 months after the crash (and beyond in some instances). While there is a \$312 threshold for entry into the system, this effectively overlooks only the very minor injury claims which are unlikely to result in severe and long lasting outcomes. It had the potential to be an extremely valuable source of information for this long term outcome study, however, a number of limitations became apparent with these data throughout the course of this study that reduced the scope of the findings possible from this analysis.

While the strength of the TAC data was in the amount of detail available on the crash, the claimants' personal characteristics, their injuries sustained and the initial treatment received, the amount of detail provided on subsequent services beyond the initial hospital treatment, however, was less clear. Importantly, there were only a limited number of TAC claim categories available which grouped particular services together such as medical, paramedical, and rehabilitation. Hence, it was not always possible to identify specific types of services used (eg; physiotherapy) from these broad categories. In addition, the full details of many of these data were not always available because of the need to maintain confidentiality and legal ramifications. In particular, it was not possible to obtain the number of claims and the dates of each claim on the TAC, making temporal analysis impossible.

It should be stressed that the TAC's primary role is that of a state-wide insurance company responsible primarily for injury compensation, hence its database is not necessarily suited to providing research data of the kind required here.

## 5.1.3 Follow-Up Questionnaires

A detailed follow-up of a representative sample of road trauma victims has the best potential to provide comprehensive data on long term outcome for a range of road trauma victims. The sample of patients interviewed here was extremely small and restricted to vehicle occupants (26 patients in total who were hospitalised after a vehicle crash). It should be stressed, however, that this study was undertaken simply to test the suitability of the questionnaire and interview method and was never intended to provide definitive data. Thus, a more comprehensive study is still required to provide these data. These preliminary results, nevertheless, do provide hints about the services and support road trauma victims require, although care should be taken not to infer too much from these extremely limited findings.

#### 5.1.4 Conclusion on Information Available

The literature review showed that there has not been a lot of research conducted in this area to date, especially overview studies. This is partly a function of the lack of comprehensive data available for analysis. The Transport Accident Commission in Victoria maintain comprehensive records of statewide injury claims from road trauma sufficient to permit a limited number of overview analyses to be undertaken on the long-term consequences of road trauma in this state. Yet, even this comprehensive data source was not sufficient to permit a thorough overview of the range of services used and the psychological and social outcomes of road trauma in Australia. Follow-up data is clearly necessary for a representative sample of road trauma patients to provide complete and meaningful comparisons to be made on treatment, rehabilitation, services required and used, and the long term consequences for the individuals and family involved.

# 5.2 OUTCOME SEVERITY AND THE NATURE OF LONG-TERM CONSEQUENCES

The first objective of the study was to identify the types of long-term consequences to people involved in road trauma, comprising physical, psychological and social disabilities, impairments or handicaps, as well as community and financial hardships. The sources of information available for this assessment were chiefly the Transport Accident Commission of Victoria's state-wide injury compensation database, previous reports from the literature, and any findings of use from the limited number of patients sampled in the pilot interview study.

It should be noted from the previous discussion that these sources were only of limited value in identifying the full range of outcomes and that a detailed prospective study of a large representative group of road users is the best means of providing a comprehensive overview.

#### 5.2.1 Outcome Severity

Reasonable detail was available from the TAC on outcome severity from the crash. A number of correlations were found between outcome severity (denoted by the need for and length of stay in hospital) and several cost variables. As the severity of outcome increased, the probability (and level) of claim for medical, para-medical, out-patient and in-patient rehabilitation costs, loss of earnings and loss of earnings capacity and impairment payments also increased. Serious crash outcomes (involving people who are killed or hospitalised for more than a few days) clearly is of concern, although more minor severities should also not be ignored in any program describing disability and associated outcome consequences.

Analysis of these TAC data provided the opportunity to assess the probability of claiming by outcome severity by other relevant variables as well.

**FATALITIES AND HOSPITALISATION** - Of those claiming on the TAC, only 3.7% were killed and of those, pedestrians were over-represented. Total TAC payment for those killed, however, amounted to 19% of the total amount paid for all claimants on the TAC, confirming the relatively high cost to society from a fatal crash during 1987 and 1988 in Victoria.

Fatalities, however, constituted only 2% of the total hospitalisation charges from road trauma, no doubt a function of the number of road users who are killed at the scene and bypass the hospital system. For those who died in hospital, the average acute hospital claim was higher than that of survivors who were hospitalised for less than six days, indicating a reasonably long and resource intensive stay in hospital for these cases.

**HOSPITAL STAY** - Not surprisingly, as outcome severity increased for survivors, so too did the average amount claimed and total amount claimed for acute hospital stay. Those hospitalised more than 6 days made up 60% of the total cost, those hospitalised for less than 6 days constituted 8% and those not hospitalised constituted 13% (presumably costs were for Accident and Emergency and other outpatient treatment).

The data from the questionnaire added general support to this finding in that as the AIS severity of injury increased, so too did the reported length of hospital stay. The majority of respondents with minor injuries (shown by an ISS score of under 9) stayed in hospital for periods up to 7 days, while those with severe injuries (shown by an ISS score of 16 or above), generally stayed in hospital for more than 21 days.

**TIME OFF WORK** - Again, as outcome severity increased, the probability of claiming, and the average amount claimed, for loss of earnings also increased. Of the total amount paid for loss of earnings, 51% was paid to those hospitalised more than 6 days, while only 15% was paid to those hospitalised for less than 6 days.

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Interestingly, 33% of the total amount paid for loss of earnings was for those not hospitalised at all, presumably due (in part) to chronic pain and other symptoms preventing a return to work by people sustaining relatively minor injuries, such as face and soft tissue injuries. While these minor cases generally had lower average costs than for those hospitalised, the total lost work time costs were nevertheless still substantial, showing the serious consequences of even the less severe road trauma.

**COST TO THE COMMUNITY** - As noted above, as outcome severity level increased, so too did the average claim cost on the TAC. Serious outcomes involving extensive hospital stays, medical treatments and rehabilitation services are a great cost to the community, not only in terms of payments for medical services, but in lost productivity too where the injured person is unable to work for lengthy periods.

**REHABILITATION** - Costs for rehabilitation were high for those staying in hospital for more than 6 days and constituted 98% of the total amount paid for rehabilitation. Consistent findings were obtained from the questionnaire data too where those with moderate to severe injuries required lengthy stays in rehabilitation centres while those with more minor injuries did not. These findings again show that serious (survivable) outcomes have greater long term consequences for the individual and society by requiring more extensive rehabilitation and medical services to return to their pre-crash state of health (if it is ever reached) than the more minor cases.

LEVEL OF LONG-TERM DISABILITY - Payment for impairment at 18 months is the best indicator in these TAC data of long-term disability. The probability of an impairment claim was highest for those hospitalised more than 6 days and the average claim and total amount claimed by these people were greater than for minor outcome cases.

Consistent with other reports in the literature, a correlation was also apparent between outcome severity and disability in these data. There was a trend for people with severe injuries to have long-term disability and corresponding physical and psycho-social sequelae. Where the injury was more severe, there also appeared to be a higher likelihood of persisting deficits and continued interruption of various aspects of daily life. For those cases with severe injuries who were interviewed, vocational, social and personal outcomes, and quality of life after the event seemed poorer than for minor injury respondents.

## 5.2.2 Services and Support

As noted earlier, very few details were provided by the TAC on individual services used by claimants and the amount of personal support required. The interview sample did at least provide indications of the types and ranges of services used by injured vehicle occupants, although these data need to be interpreted carefully because of the small number of cases included in this database at this time.

**TYPE OF SERVICES REQUIRED** - Results indicated that over 73% of those involved in crashes required some sort of service or help after leaving hospital. Services used included physiotherapy, orthodontics, occupational therapy, neurology, psychology, psychiatry, social work support, vocational counselling, and work trial programs. It would be interesting to examine these findings further, especially by type of injury sustained and road user group when sufficient data becomes available.

Not surprisingly, the amount of the service required as an outpatient generally increased as the severity of the injury increased (shown by ISS score plus length of hospital stay). Moreover, when comparing the types of injuries sustained by the length of physiotherapy used, it was found that respondents with abdomen and pelvic injuries generally required less than 6 weeks service, while those with head, face, and limb injuries, required more lengthy services generally over 20 weeks.

In addition, there appeared to be a number of factors that determined the extent to which any given individual suffered long-term disability as a result of a road traffic crash. These included not only the nature and severity of the injury sustained, but also the amount and type of rehabilitation received, the individual's age and state of health prior to the crash, the type of work prior to the crash, whether the injuries prevented the individual from returning to his/her previous occupation, and the amount of support received from family and friends.

AMOUNT OF SUPPORT REQUIRED - Community services were widely used by a number of these injured respondents, including council help, Meals On Wheels, Royal District Nursing Service, and special transport arrangements. In addition, length of services required ranged from one week for minor injuries to over 100 weeks for those sustaining moderate and severe injuries. This clearly shows a large demand for these resources by road trauma victims.

**FINANCIAL COSTS** - The average annual cost to the TAC for road trauma in Victoria during 1987 and 1988 was over \$100 million. Other insurance agencies including workcare, social security, other government agencies and private health insurances also contribute to the cost of road crashes in this state. However there are elaborate processes involved to obtain this information and it was not possible to secure approval for these details during this pilot study. Clearly, this costing information would be critical in any further outcome study.

Approximately 19% of the total TAC costs was paid for medical, para-medical and outpatient rehabilitation claims, while a further 8% was paid for in-patient rehabilitation. Results from the questionnaire suggested that a large proportion of road crash victims require some service after leaving hospital. As well as the burden created on the public purse, road trauma also results in substantial costs to the particular individual involved. Most respondents in the sample indicated that they had incurred some personal (additional) cost, ranging from \$100 to over \$15,000 from their accident. These costs included TAC excess for hospital and medical bills, replacement of vehicle, loss of wages, and various court payments.

**OTHER SOCIAL COSTS** - A wide range of social costs were identified in this pilot study, through the literature review and the questionnaire responses. These include time to return to work and changes in social contacts, leisure time, and daily activities. Questionnaire respondents indicated they had taken differing lengths of time to return to work, and, as expected, this time seemed to increase with the severity of their injury. Most respondents returned to their previous work within three months, although a number of respondents (those with severe injuries) were still not able to work two years after the event, either because of a physical restriction or from an acquired inability to cope with the stress of working.

The consequence of the crash on an individual's social contact was also measured in the questionnaire. The majority of respondents indicated that the crash had impacted on their personal and family life to some degree. Furthermore, this did not appear to be confined to those with severe injuries as those with minor injuries also reported disruption, such as a decrease in leisure time due to difficulty in moving, a decrease in activities due to pain, loss of confidence in mixing with people, less patience and concentration.

Loss of motivation, social isolation, indifference to people and activities, boredom and frustration were common responses for those with severe injuries and unable to return to normal work routines at this time. A small number of respondents noted changes in their family life due to tempers, moodiness and anxiety on their part. Tension was apparent due to irritability and stress still lingering from the crash.

**BEHAVIOURAL AND PERSONAL CHANGES** - Various mental and behavioural changes were reported by many of the respondents in the questionnaire. For instance, for those sustaining moderate to severe injuries, changes in memory and concentration ability were especially noted involving low concentration spans, difficulty in long-term mental abilities, and lack of concentration in driving. In addition, for all injury severity levels, greater anxiety and loss of confidence post-crash were commonly reported. Reports of loss of confidence when driving or as a passenger in a vehicle were also quite common, as well as avoidance of the site of the accident and recurrent feelings that a similar accident may happen again.

Irritability, frustration, depression and short tempers were also reported 2 years after the crash. While marital status remained unchanged in all 26 patients interviewed, 4 respondents did report growing problems and tensions with their spouses. A number of respondents also indicated that their goals and ambitions had changed since their accident. It would be interesting to re-examine these results after more than two years had elapsed to determine just how long these psychological disabilities remain.

It is difficult to know, though, how many of these behavioural and personality changes are a direct result of the patient's road trauma without a control group for comparison. This would seem particularly important in any follow-up study.

## 5.2.3 Long-Term Consequence Conclusion

Details were available from the TAC data on circumstances of the crash, injuries sustained, and length of stay in hospital for treatment and rehabilitation, although temporal analyses were not possible on these data. The cost and duration of time off work was also useful, while the 18 month assessment details provided (mainly costs) enabled some conclusions to be made about disability and impairment. However, details on the types of services used involving payment were incomplete and there was no information available on non-payment services, psychological and social costs, and degree of support required. The preliminary data from the follow-up study of 26 patients provided the basis for collecting more detailed information on the long-term consequences of road trauma. However, this study was only a pilot program of research and not intended to be a comprehensive data collection exercise.

## 5.3 THE LONG-TERM CONSEQUENCES OF PARTICULAR INJURIES

The second objective of this study was to indicate the relationship between injury and outcome and the various problems and associated long-term consequences.

TAC data contained details on up to 5 body region injuries for each claimant using ICD9 codes (World Health Organisation 1975), on average, approximately 2 injuries/person. In addition, the TAC code one of these injuries as the "*principal injury*" for each claimant, based on their assessment of the relative seriousness (life threatening consequences) of each injury. Hence, an analysis was possible of particular body region injury groups using the principal injury sustained by each claimant.

The most frequent types of injuries were limb fractures, head injuries, other fractures and soft tissue injuries (ie. whiplash). Injury categories were associated with outcomes such as length of hospital stay, medical, para-medical and rehabilitation services, loss of earnings and loss of earnings capacity. Type of injury varied also for the different types of road users.

## 5.3.1 Spinal Injuries

Spinal injuries were the most commonly sustained injuries by motor cyclists and pedestrians. Despite their low frequency in general, they do nevertheless represent a large cost to the community and have a severe outcome (permanent impairment) for the victim. Not surprisingly, severe spine and spinal cord injury was associated with a high probability of claiming (and a high average cost of claim) for acute hospital stay, medical, para-medical and rehabilitation. The severe long-term consequences of these injuries were evident by the high probability (and average claim cost) for loss of earnings and capacity, and impairment payment at 18 months.

In support of these results, the few respondents in the questionnaire sample who sustained a spinal or spinal cord injury also reported lengthy hospital stay for acute and rehabilitation treatment, continued out-patient rehabilitation service requirements, loss of earnings and loss of earnings capacity, permanent impairment and major changes to their lifestyle and quality of life. Their costs to the community are considerable.

## 5.3.2 Head and Face Injuries

Head and face injuries were over-represented among vehicle occupants, pedestrians and bicyclists (ie; all those except for motorcyclists who wore a helmet). A high probability of an acute hospital claim, medical, para-medical and out-patient rehabilitation services was observed, although the average claim costs for these services were not particularly high. This is presumably due to a wide range of injury severities, ranging from minor face injury to severe head injury included in this category. While probability was fairly low, the average claim cost for rehabilitation for head injured patients was notably high, indicating the need for long-term rehabilitation for the severely head injured. Similarly, the questionnaire results found extended in-patient rehabilitation stay and extensive out-patient service needs for those with severe head injuries.

Average amount claimed for loss of earnings capacity and impairment at 18 months was also relatively high for those with head and face injuries, although the probability of these claims was quite low. This suggests that the majority of these types of injuries were minor and had less impact on a person's ability to work. However, for those who did sustain a severe head and face injury and lodged a claim for impairment and loss of earning capacity, it appeared that there was little chance of these people ever returning to a normal life.

## 5.3.3 Chest and Abdominal Injuries

Chest and abdominal injuries in the TAC data included internal and other serious life threatening injuries. There was a higher propensity for vehicle occupants and motor cyclists to sustain these injuries than pedestrians or bicyclists.

The probability of claiming for acute hospital stay, medical, para-medical and out-patient rehabilitation services for chest and abdominal injuries was quite high, although the average amount claimed was relatively low. This suggests that these claimants tended to have relatively short stays in hospital involving less high cost treatments.

Claims for loss of earnings, loss of earning capacity, and impairment, however, were high, possibly due to the disabilitating nature of internal chest and abdominal injuries. Probability of a claim for impairment at 18 months for these injuries was also quite high, presumably due to the slow healing process and resultant disability of these injuries. This was also seen in the questionnaire survey responses, too, where patients sustaining injuries to the chest and abdomen often required extended time off work.

## 5.3.4 Limb Injuries

Limb fractures were quite frequent among TAC claimants, comprising 12% of all major injuries recorded. Lower limb injuries were more frequently recorded by motor cyclists and vehicle occupants, while the latter also registered frequent upper limb injury. The probability of claiming for acute hospital stay, as well as medical, para-medical, and out-patient rehabilitation, was high for severe limb injuries, however, average claim amounts were markedly lower than for other serious injury categories.

Similarly, the average claim amount for loss of earnings and earning capacity and impairment at 18 months was lower for limb than for abdominal and chest injuries. Again, this may reflect superior healing processes for these injuries and lower likelihood of permanent disability for people sustaining these injuries. It was not possible to add much from the questionnaire sample because of the lack of data.

## 5.3.5 Soft Tissue Injuries

Whiplash and minor injuries accounted for 8% of all principal injuries yet 17% of them lead to a claim for loss of earnings and some for a considerable period of time. Vehicle occupants were, by far, more likely to claim soft tissue injuries of the neck than other road users. It is understood that there was a high degree of surveillance for fraudulent whiplash claims at the TAC during the data collection period, hence these findings cannot be explained solely by over-claims for these injuries.

The probability of claiming acute hospital, medical, para-medical, rehabilitation (both as inpatient and out-patient services), loss of earnings, loss of earning capacity and impairment was relatively low for those sustaining these injuries, compared with other more severe injuries and the average claim amounts paid, too, were low for acute hospital, medical, paramedical and rehabilitation services.

However, average claim amounts for loss of earnings, loss of earning capacity and impairment at 18 months for those sustaining soft tissue injuries were relatively high, suggesting a relatively long period of rehabilitation and possibly a high degree of chronic pain associated with what is classified as a relatively minor injury (AIS 1 or 2). Results from the questionnaire further indicated that the long-term consequences for those sustaining neck injuries in road crashes included substantial loss of wages, lengthy medical treatments, and continuing out-patient rehabilitation care.

While these injuries may appear to represent relatively small costs individually to the community, soft tissue injuries collectively cost a substantial amount of money for what is classified as a relatively minor injury. Previous studies have grossly under-estimated the long-term effects of these minor injuries, yet clearly there is a need for more research into the long-term consequences of these injuries. In particular, a detailed explanation of the mechanism of whiplash injuries is urgently needed.

## 5.3.4 Injury and Outcome Conclusion

The limited injury data collected by the TAC enabled a reasonable account of differences in long term outcome by the *principle injury* sustained by claimants. Severe life threatening injuries were commonly associated with severe outcomes and on-going trauma care. Detailed injury severity analysis was not possible as severity scoring is not systematically undertaken on these data. However, the crude severity proxy based on survival, length of stay in hospital, or non-hospital treatment did enable some conclusions to be made about long term consequences by type of injury. It would be useful to examine ways in which this information could be supplemented in the future to expand on these findings.

## 5.4 THE LONG-TERM CONSEQUENCES FOR PARTICULAR ROAD USERS

The third objective was to describe the relationship between road user and outcome nominating high risk target groups and the problems and services involved. Again, the mass data analysis was able to identify particular road user groups who were especially at risk of sustaining severe injuries and likely to end up with long-term disability.

## 5.4.1 Motor Cyclists

Motor cyclists were shown to be at highest risk of sustaining severe injuries and long-term disability than any other road user type [6% involvement but 11% of total claim costs]. Motor cyclists had a high probability of claiming for acute hospital, medical, para-medical and rehabilitation, loss of earnings, loss of earnings capacity, and impairment at 18 months. Furthermore, their average claim amounts for acute hospital, medical, para-medical and outpatient rehabilitation, and impairment were also particularly high.

The probability of motorcyclists claiming for loss of earnings and loss of earning capacity was markedly higher than for any other type of road user, indicating that injuries sustained by motorcyclists were generally severe, required extensive care and resulted in prolonged time off work. They are, therefore, a source of major concern to the community.

## 5.4.2 Pedestrians

Like motorcyclists, pedestrians were also over-represented among those sustaining severe injuries that required long-term medical care and rehabilitation. Pedestrians were involved in 9% of TAC claims, accounting for 17% of the total TAC costs. The probability of claiming for acute hospital, rehabilitation and impairment was markedly higher, while average claims for hospital and rehabilitation costs and impairment payments were marginally higher for pedestrians than other road users.

The likelihood of pedestrians claiming for loss of earnings and loss of earnings capacity, however, was low, although the average claim amounts were high. This might suggest that injuries sustained by pedestrians result in longer periods of rehabilitation requiring lengthy time off work than for other road users. The low probability of claiming loss of earnings is probability due to the fact that many pedestrians are either children or older people and less likely to be in the work force.

## 5.4.3 Vehicle Occupants

By far, the most common type of road user involved in a claim at the TAC was a vehicle occupant. They constituted 79% of the total number of claimants, although they did tend to have a lower average claim cost than other road users (68% of total claims). This probably reflects the higher degree of protection afforded by motor vehicles for these road users.

Vehicle occupants were also less likely to claim for acute hospital and, on average, their hospital claim amounts were lower than other road users. The same was true also for medical, para-medical and out-patient rehabilitation claims as well as impairment amounts. In addition, these road users were also less likely to claim for rehabilitation than other types of road users, however, their average amount claimed was substantial. The same was true for claims of loss of earnings and loss of earnings capacity.

The injuries sustained by vehicle occupants were generally representative of total road trauma, although there was a suggestion that they were slightly less severe than for other road users. They do not appear to require extensive medical, rehabilitation and acute hospital care, although they made substantial claims for rehabilitation, loss of earnings and loss of earnings capacity. This may reflect differences in affluence of vehicle occupants than the other types of road users.

## 5.4.4 Bicyclists

The analysis further revealed a low frequency of claims involving bicyclists (4%) and a low relative share of the total TAC cost (3%). This may be due to the criteria imposed on bicyclists for eligible to claim through the TAC (eligible bicyclists must have crashed with a motorised vehicle such as cars, car derivatives, buses, trains, trams, etc to enter the system). There are, presumably, many other bicycle accidents not involving motorised vehicles that do not show up in these data.

Despite the low frequency of bicyclists in the data, however, a number of observations were still possible. Bicyclists generally had low probabilities of claiming for medical, paramedical, and rehabilitation services, both as in-patients and out-patients. This could be a function of a lower level of injury sustained by bicyclists (conceivably their crashes are often at lower impact speeds) or because of the particular age groups of bicyclists and perhaps the better resilience of children and young adults to injury than older road users. This warrants further investigation. Similarly, probability of claiming and average claim amounts were low for loss of earnings, loss of earning capacity, and impairment payments for bicyclists. Again, this suggests that bicyclists are often children or young adults who are either not yet in the work force, on relatively low salaries, or experience fewer long-term consequences from injury.

#### 5.4.5 Road User and Outcome Conclusion

Analysis of the TAC data was helpful in determining the probability of a severe outcome and the long term consequences for various types of road user (bearing in mind the limitations of these data). It was possible to relate likelihood of hospitalisation, rehabilitation, loss of earnings and impairment at 18 months for each road user group to demonstrate the relative burden of trauma on the community for each class of road user. It would be useful to expand on these findings if additional information became available. In particular, special services and support required for different road user groups would be extremely valuable information in planning future road safety campaigns and allocating relative costs of trauma by the various road user groups.

## 5.5 THE NEED FOR ADDITIONAL RESEARCH

It has been noted on several occasions that the results of this pilot study were severely limited because there were insufficient details available on rehabilitation services in the TAC mass data system. The final objective of this study was to justify the need for additional research and if necessary, outline an appropriate strategy for conducting a larger scale follow-up study of a representative sample of road trauma patients. To this end, it is also worth reviewing the methodological issues that emanated from this research.

## 5.5.1 Benefits of Further Research

The need for further research into the long-term consequences of road trauma has been alluded to on a number of occasions throughout this report. Previous studies have tended to focus on the consequences of particular injuries (eg; head and spine trauma) which may or may not have been the result of a road crash. Moreover, some of these studies have been somewhat biased by demographic constraints or the findings may not be totally applicable in this country. What is clearly required is more detail on the extent of recuperation and services required as well as a better understanding of the social and psychological consequences of road trauma.

There would be several benefits from this additional research. First, the information would help improve our understanding of the full ramifications of road trauma and demonstrate whether existing services and facilities for patient care and rehabilitation in the broad sense are adequate. Second, it would further elucidate the on-going social and psychological consequences of road crashes and the need for greater attention in this area. The work related consequences such as lost productive time could be better quantified which might eventually lead to intervention strategies to minimise these effects. Finally, evaluating the effects of countermeasures would be improved with these data enabling a more thorough appreciation of the consequences of trade-off effects in trauma management. For instance, this information would show the full consequences of reducing deaths in terms of any undesirable increase in permanent disability and the cost-effectiveness consequences.

Current mass data systems are generally inadequate at providing these data; detailed followup procedures would be required to collect the necessary level of detail. While an on-going system would be the most desirable means of data collection, the costs would be prohibitive. A representative sample of road trauma patients would provide an adequate sample using a questionnaire format. A prospective study would enable changes to be monitored as they occur or alternatively, the questionnaire could be administered at regular intervals to assess changes as they occur from shifting trauma patterns or intervention effects.

## 5.5.2 Follow-Up Format

The procedure developed and trialed in this pilot study generally proved to be successful, although there is clearly scope for further refinements and improvements. Telephone interviews were chosen to minimise the cost of administration of the questionnaire while still maintaining personal contact between interviewer and patient, of benefit for eliciting accurate responses and for follow-up of items of specific interest. This aspect of the study appeared to work well in eliciting responses to particularly sensitive questions. Patients were generally agreeable to interview and, for the most part, answered practically every question. There were no adverse effects emanating from the procedure. The need for interviewers sensitive to the needs of the patient was evident during the pilot study.

Any extension or further use of this approach, though, needs to consider some associated ethical considerations. Patient's consent to be interviewed is paramount and prior approval critical for the success of technique. Furthermore, the patient's wishes to respond or not respond to any particular question need to be taken into account in its administration.

## 5.5.3 Questionnaire Topics & Design

The range of factors included in the questionnaire were established following the literature review and in consultation with the expert panel assembled for this study. The pilot experience suggested that the topics and issues raised in the questionnaire appeared to be relevant and extensive for a long term trauma outcome overview. Moreover, while the length of the instrument seemed to be overwhelming at first, the study demonstrated that patients were not offended or put-off by it and in many cases, welcomed the opportunity to discuss these issues and their concerns with the interviewer.

It should be remembered that the sample of patients who responded to the questionnaire were all adult vehicle occupants who had been hospitalised following a motor car crash. Many of the questions, therefore, were targeted specifically at this group. A more broad sample of trauma patients, including different road users and age groups, would require modifications to some of the questions [or wording]. A recommendation of the expert group was for "questionnaire modules" to be developed for special groups [i.e., children and pensioners] which would seem to be an excellent suggestion. These modules could be based on a common set of interview items or topics but with subtle changes for the particular target group. Developing a more appropriate means of interview might also be necessary for children's responses.

## 5.5.4 Linking Treatment With Outcome

The findings of the pilot study reinforce the need for any additional research in this area to ensure that outcome details are matched with injury, etiology, and treatment information. The database established for this work was rich in terms of the level of analysis possible and the amount of information subsequently available. The number of variables was adequate to offer a detailed explanation of long term trauma outcome in terms of various road users, injuries, and treatments which is critical for specifying countermeasures to minimise post trauma consequences or effects.

The biggest weakness in terms of the data collected was in the quantity of cases included in this study. Additional efforts in this area need to ensure that adequate details are included on the circumstances of the trauma, patient and road user characteristics, type and severity of injury, treatment information and outcome data. As this requires data input from multiple sources, it is wise to link any future outcome study with a database containing the necessary supplementary information.

#### 5.5.5 Sample Size & Refusal Rates

Twenty six vehicle occupant victims were interviewed in this pilot study to test the questionnaire and the procedure, representing 48% of those who were sent letters seeking their agreement to be interviewed. However, an additional 15% of the letters were returned "address unknown" or arrived too late to be included in this study (no effort was spent trying to locate their new address in this study). This meant, therefore, that 63% of the patients who received letters were either interviewed, agreed to be interviewed but were not, or could not be located at their previous address, while 37% actually failed to respond to their letter. This latter category can be considered to be the real rejection cases, although its conceivable that even a proportion of these may have failed to receive their letter of request (the letter may have been disposed of because of a change of address without being returned to the sender).

It should be pointed out that these patients had previously agreed to participate in an earlier Monash University Accident Research Centre trauma study, hence they were conceivably more likely to agree a second time than the general population of trauma victims. However, the earlier study only experienced a 7% rejection rate for vehicle trauma patients presenting at the four study hospitals involved, therefore suggesting that the patient sample approached was generally representative of hospitalised vehicle occupants. Hence, it might be expected that acceptance and rejection rates observed here are fairly typical of what would be expected for a more detailed study on trauma outcome without the benefit of previous contact.

It is difficult to be too definitive about the number of patients necessary for a full and detailed trauma outcome study without an appreciation of what constitutes critical information. Statistical [power] analysis will enable calculation of necessary sample size for a given level of precision and coefficient of variation. On the basis of length of stay in hospital for the various road users and major injuries sustained in the TAC data, a sample size of at least 500 would seem to be the minimum necessary to ensure statistical reliability of these findings.

#### 5.5.6 Methodological Limitations

While there are a number of benefits to be gained from this research, it would be remise not to mention the limitations associated with this study design. Information based solely on mortality and morbidity data alone will significantly under-estimate the scope of crashes and outcomes because of the entrance requirements. While this is less of a problem for long term outcome assessment, given the close relationship between outcome and injury severity, nevertheless it is likely that a number of trauma outcomes are ignored using this approach.

Studies based on patient samples are necessarily limited by the lack of incidence data on the use of community services, psychological difficulties, etc. It is conceivable, albeit highly unlikely, that some of the patient responses reflect nothing more than their general social and psychological status. Exposure or control data is important here, although often unavailable. In terms of outcome measures, there is an absence of consensus on definitions such as those of serious injury, impairment, disability, and handicap. Moreover, while AIS is a good measure of injury severity in terms of threat to life, it does not take into account the disability resulting from a non-fatal crash. These problems are evident by the large variance in the results of this study and are somewhat inherent in this research.

Finally, there is the matter of response bias introduced from those who did not participate (up to 37% of patients who were contacted). It is always difficult to know whether non-respondents were substantially different to the respondents without further information on why they did not respond. It may simply have been that the number who forgot or decided not to respond was random (there did not appear to be any systematic bias by type of injury among these people). We do know that the respondents tended to be older and more likely female compared to the non-respondents in the pilot study but this cannot tell us much about differences in motivations, attitudes, etc. It remains a possibility that non-respondents may have experienced more traumatic outcomes than respondents. Clearly, every effort should be made in any future study to minimise rejections without unduly pressurising these people.

## 5.5.7 Collecting Additional Data

Notwithstanding these limitations, however, this design has the potential for use in a more widespread long-term outcome study. A number of potentially interesting findings have come out of this preliminary work that need to be investigated fully.

Further work in understanding the longer term consequences of road crashes should most usefully concentrate on obtaining follow-up questionnaire data on a larger, more representative sample of people than was possible in the pilot study.

The current work suggested that a telephone interview approach is feasible and the use of the questionnaire developed would be both an appropriate and efficient data gathering instrument for this approach. Because the collection of follow-up data is apt to involve significant resources, it would be important to target the sample of patients carefully.

Several sub-groups would be appropriate for further study. The sample could be determined by those who constitute the bulk of long-term disability and costs (ie; vehicle occupants) or those at higher risk of longer term consequence, given crash involvement (ie; unprotected road users). Alternatively, the focus could be defined in terms of severity level of injury with greater attention to particular injury types or severities (eg; high frequency "minor" injuries such as whiplash, which although not life threatening, have a significant consequence to the individuals involved and the community at large).

As in all follow-up studies, there is likely to be a number of technical issues that need to be addressed, including gaining access to confidential lists of potential subjects, locating people sometime after their crash, agreement by all those involved to participate in the study, and questions about the reliability and representativeness of the data. The exact nature of the proposed study and the means by which these difficulties can be overcome will determine the likely effectiveness of future work in this area.

## 5.6 CONCLUSIONS AND RECOMMENDATION

The pilot study into long term trauma outcome has produced some novel findings regarding long-term consequences of road trauma. A number of road user groups and injuries were shown to be over-represented in terms of sustaining long term consequences from the original trauma, involving considerable inconvenience, loss of productive capacity, and pain and suffering to the individual and his or her family, and considerable costs in rehabilitation and support services to the community.

Target road user groups include pedestrians and motorcyclists [high risk] and vehicle occupants [high frequency]. While severe spine, head, and chest injuries are most likely to result in long term consequences, disabilities, and impairments, less life threatening limb and other fractures and soft tissue [whiplash] injuries too were seen to have marked long term consequences for those unfortunate enough to sustain these injuries in a road accident.

The telephone administered follow-up questionnaire developed in this study was seen to be an efficient and effective means for collecting long term outcome data on people injured from road crashes two years previously. The literature review and expert panel discussions revealed a shortage of data generally on long term road trauma outcomes.

It would be useful, therefore, to continue to collect outcome data on vehicle occupants to ensure robust findings for these predominant road users. However, it would also be prudent to add outcome data from higher risk pedestrians and motorcyclists when suitable crash and injury data for those hospitalised and non-hospitalised become available.

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## APPENDIX A

# QUESTIONNAIRE USED IN THE PILOT STUDY OF VEHICLE OCCUPANT TRAUMA CONSEQUENCES

# LONG-TERM OUTCOMES OF ROAD CRASHES FOLLOW-UP QUESTIONNAIRE



THANK YOU FOR AGREEING TO HELP US WITH ADDITIONAL INFORMATION ABOUT THE ACCIDENT WE FIRST SPOKE TO YOU ABOUT IN HOSPITAL.

WE NEED TO CHECK SOME OF THE DETAILS OF THE ACCIDENT WITH YOU AND FIND OUT MORE ABOUT HOW YOU HAVE PROGRESSED SINCE THEN.

THIS INFORMATION IS CONFIDENTIAL. YOUR NAME AND ADDRESS WILL NOT BE LISTED ON OUR DATABASE AND THE DETAILS CANNOT BE TRACED TO YOU.

THE INFORMATION WILL BE USED TO GAIN A BETTER UNDERSTANDING OF THE FULL EFFECTS OF ROAD ACCIDENTS ON PEOPLE SUCH AS YOURSELF.

IT IS IMPORTANT THAT YOU ANSWER EACH OF THE QUESTIONS AS ACCURATELY AS YOU CAN. TAKE AS MUCH TIME AS YOU NEED WHEN ANSWERING EACH QUESTION.

IS THERE ANYTHING FURTHER YOU WOULD LIKE TO KNOW ABOUT OUR STUDY BEFORE WE START ?

## ACCIDENT AND INJURY DETAILS

1.	FIRSTLY, I BELIEVE THE DATE OF YOUR ACCIDENT WAS
2.	COULD YOU PLEASE DESCRIBE THE CIRCUMSTANCES OF THE ACCIDENT AGAIN FOR ME (including such things as what the vehicle hit and whether it ran off the road or hit another car)?
	· · · · · · · · · · · · · · · · · · ·

3.	COULD YOU PLEASE TELL ME WHAT WERE YOUR MAJOR INJURIES? (code up to 3 regions)		
	01=head 02=face 03=chest 04=abdomen	05=pelvis 06=shoulder & arms 07=thigh & knee 08=leg & foot	09=spine 10=other (specify) 99=unknown
4.	HAVE YOU BEEN INVOLVED IN AN ACCIDENT OF ANY KIND SINCE THIS ACCIDENT?		T OF ANY KIND
	1=yes	2=no	9=unknown
	If yes, give details		
	What injuries did you	receive?	

## IF THE PATIENT HAS BEEN INVOLVED IN ANY RECENT TRAUMA SINCE THE ORIGINAL ACCIDENT, SUSPEND THE INTERVIEW NOW

## HOSPITAL TREATMENT (ACUTE HOSPITAL)

5. OUR RECORDS SHOW THAT YOU WERE DISCHARGED FROM THE ALFRED HOSPITAL AFTER ......DAYS IS THIS CORRECT? (code correct no. of days) \_\_\_\_\_\_

6.	WHERE DID YOU GO AFTER YOU WERE DISCHARGED FROM THE
	ALFRED HOSPITAL?

00=not discharged 01=other hospital 02=rehab.centre 03=home alone 04=home (family) 05=home (assist) 06=extended care 07=nursing home

08=psych. unit 09=other (specify)

99=unknown

7.	SINCE THEN, HAVE YOU BEEN RE-ADMITTED TO THE ALFRED OF ANY OTHER HOSPITAL FOR FURTHER MEDICAL TREATMENT TO THE INJURIES YOU SUSTAINED IN THIS ACCIDENT? (code number of re-admissions)	
7a.	Date of first re-admission	
	Duration (days)	
	Purpose (common code)	
7b.	Date of second re-admission	
	Duration (days)	
	Purpose (common code)	
7c.	Date of third re-admission	
	Duration (days)	
	Purpose (common code)	
7d.	Date of fourth re-admission	
	Duration (days) Purpose (common code)	
7e.	Date of fifth re-admission	
	Duration (days)	
	Purpose (common code)	
8.	ON DISCHARGE FROM THE ALFRED HOSPITAL, DID YOU SUFFER FROM ANY DISABILITY AS A RESULT OF THE ACCIDENT, FOR INSTANCE, LOSS OF MOVEMENT, LOSS OF SPEECH, LOSS OF SIGHT? (code up to 3 disabilities - common code)	·
8 <b>a</b> .	First disability	
8b.	Second disability	
8c.	Third disability	

#### 9. HAVE YOU HAD ANY VISITS TO OUTPATIENTS, SPECIALISTS OR YOUR LOCAL DOCTOR SINCE THE ACCIDENT TO GET FURTHER MEDICAL TREATMENT FOR THE INJURIES YOU SUSTAINED IN THIS ROAD ACCIDENT?

1=ves	2=no	9=unknown	 
If yes, roughly how m	any times to O.P. (days)		
If yes, roughly how m	any times to specialists (	lavs)	
If yes, roughly how m	any times to G.P. (days)		

#### 10. DID YOU HAVE ANY MEDICAL PROBLEMS BEFORE THE ACCIDENT? (common code - up to 3)

10a.	First condition	
10b.	Second condition	
10c.	Third condition	

#### **REHABILITATION IN HOSPITAL**

11. WERE YOU ADMITTED TO A REHABILITATION HOSPITAL AFTER TREATMENT FOR YOUR INJURIES? \_\_\_\_\_\_

2=no

1=yes		

9=unknown

I NEED TO ASK YOU SOME QUESTIONS ABOUT YOUR STAY IN THIS HOSPITAL AND THE SERVICES YOU MAY HAVE USED.

12.	WHAT WAS THE NAME OF THE REHABILITATION HOSPITAL IN WHICH YOU WERE YOU ADMITTED AFTER MEDICAL TREATMENT? (code hospital number)	
	Name	

13. HOW LONG WERE YOU ADMITTED FOR? (days) \_\_\_\_

14. WERE YOU INVOLVED IN ANY OF THE FOLLOWING TREATMENTS OR PROGRAMS WHILE IN THIS HOSPITAL? (code up to 5 services) \_\_\_\_\_

00=none 01=physiotherapy 02=speech therapy 03=neuropsychology 04=psychiatrist 05=other counselling 06=social worker

07=recreaction therapy
08=occupational therapy
09=work trial program
10=other (specify)

99=unknown

15.	DID YOU HAVE ANY OTHER REHABILITA	FURTHER ADMISSIONS TO THIS O TION HOSPITAL?	R ANY		
	1=yes	2=no	9=unknown		
16.	IF YES, WHAT WAS I	'HE SECOND HOSPITAL? (code hosp	ital number)		
	Name				
16a.	How long were you adr	nitted for?			
16b.	What treatment/progra	ams were you involved in? (code up to 5	5 services)		
	00 <b>≓none</b>	07=recreation	therapy		
	01=physiotherapy	08=occupation	al therapy		
	02=speech therapy	09=work trial	program		
	03=neuropsychology	10=other (spec			
	04=nsvchiatrist		,		
	05-other counselling	<u>99–110known</u>			
	06=social worker				
17.	IF YES, WHAT WAS THE THIRD HOSPITAL? (code hospital number)				
	Name				
17a	How long were you adr	nitted for?			
17b.	What treatment/programs were you involved in? (code up to 5 services)				
	00=none	07=recreation	therapy		
	01=physiotherapy	08=occupation	al therapy		
	02=speech therapy	09=work trial	program		
	03=neuropsychology	10=other (spec	uty)		
	04=psychiatrist		<u>[ [ [ ]</u>		
	05=other counselling 06=social worker	99=unknown			
18.	WHAT WAS YOUR AS WHEN YOU LEFT TH	SSESMENT OF YOUR LEVEL OF DIS IE ALFRED HOSPITAL?	SABILITY		
	0=not applicable	4=severe			
	1=nil	5=very severe			
	2=slight 3=moderate	9=unknown			
19.	WHAT WAS YOUR AS WHEN YOU LEFT TH	SESMENT OF YOUR LEVEL OF DIS E REHABILITATION HOSPITAL? _	ABILITY		
	0=not applicable	4=severe			
	1=nil	5=very severe			
	2=slight	9=unknown			
	3=moderate				

# 20. WHERE DID YOU GO AFTER YOU WERE DISCHARGED FROM THE REHABILITATION HOSPITAL?

07=nursing home

04=home (family)
05=home (assist)
06=extended care

08=psych. unit 09=other (specify)

99=unknown

## **REHABILITATION AFTER HOSPITAL**

00=not discharged

01=other hospital

02=rehab.centre

03=home alone

I NOW NEED TO ASK YOU ABOUT ANY ONGOING SERVICES OR PROGRAMS YOU HAVE UNDERTAKEN SINCE YOU LEFT HOSPITAL.

#### 21. HAVE YOU USED ANY OF THE FOLLOWING SERVICES BEFORE OR AFTER THE ACCIDENT?

21a.	physiotherapist						
	1=yes-yes 2=yes-no 3=no-yes 4=no-no 9=unknown						
	how long (weeks)	╞═┫┖──║──┘					
21b.	speech therapist						
	how long (weeks)						
21c.	orthodontics						
	how long (weeks)						
21d.	neurologist	╶┝══╣┌╌╌┑┌╌╌┑					
	how long (weeks)						
21e.	psychologist - personal or family therapy						
	how long (weeks)						
21f.	psychiatrist						
	how long (weeks)						
21g.	social workers						
	how long (weeks)						
21h.	support groups, eg headway						
	how long (weeks)						
21i.	recreation therapy						
	how long (weeks)						

21j.	occupational therapy			
	1=yes-yes 2-yes-no 3=no-yes 4=no-no 9=unknown			
	how long (weeks)			
21k.	vocational counsellor			
	how long (weeks)			
<b>21</b> l.	work trial programs		ļ	
	how long (weeks)			
21m.	other - specify		ļ	
		r	<u> </u>	<b>م</b> ر
	how long (weeks)			
22.	HAVE YOU USED ANY OF THE FOLLOWING COMMUNITY SERVICES BEFORE OR AFTER THE ACCIDENT?	<b></b>	1	
22a.	home help - attendant care			
	1=yes-yes 2=yes-no 3=no-yes 4=no-no 9=unknown		)[	<b>]</b> []
	how long (weeks)		<u> </u>	
22b.	Royal District Nursing Service	ļ	 	<b>ر</b> آر
	how long (weeks)	 		
22c.	meals on wheels			11
	how long (weeks)		L	
22d.	red cross		 	
	how long (weeks)			
22e.	public transportation	<u> </u>		1
	how long (weeks)	 	 m	
22f.	community care programs	Ļ		ــــار
	how long (weeks)	ļ	L	
22g.	council help	 	 	3
	how long (weeks)	 		
22h.	family therapy			<b>،</b> ا
	how long (weeks)			

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22i.	respite accon	nodation				
	1≃yes-yes	2=yes-no	3=no-yes	4=no-no	9=unknow	<sup>n</sup> []
00:	how .	long (weeks)				_ []
22 <b>j</b> .	other assista	nce, specny				
	how 1	long (weeks)				
23.	HAVE YOU RESULT OF	HAD TO TAKE	E ANY REGUI NT?	AR MEDICATIO	ONS AS A	
	1=ye	s	2=no	9=u	nknown	
		<u></u>				
DRU	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	]
DRU	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	
DRU	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	
DRU	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	
	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	
	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	
	G NAME	DAILY DOS	SAGE	WHAT TAKEN	N FOR	
	G NAME	DAILYDOS	SAGE		N FOR	
	G NAME	DAILY DOS	SAGE			

## EMPLOYMENT STATUS.

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24.	WHAT TYPE OF WORK DID YOU DO BEFORE THE ACCIDENT?	Í.
	(common code)	L

.....
25.	WHICH OF THE FOLLOW YOUR EMPLOYMENT STA	ING CATEGO ATUS PRIOR	RIES BEST DESCRIBES
	0=unemployed 1=full time employment 2=part time employment 3=casual employment 4=housewife/home duties		6=student 7=retired 8=other (specify) 9=unknown
	5=self employed		
26.	HAVE YOU BEEN ABLE T	0 WORK SIN	CE THE ACCIDENT?
	1=yes	2=no	9=unknown
27.	IF NO, WHEN DO YOU EX	PECT TO RE	TURN TO WORK? (wks)
28.	IF YES, HOW LONG DID I	T TAKE TO R	ETURN TO WORK? (wks)
29.	WERE YOU ABLE TO RET ACCIDENT?	URN TO THE	JOB YOU HAD BEFORE THE
	1=yes	2=no	9=unknown
	If no, specify current job		
	Why were you unable to ret	urn to previou	s work?
30.	HAVE YOU HAD ANY CHA	ANGE OF DU	TIES SINCE THE ACCIDENT?
	1=yes	2=no	9=unknown
	If yes, specify		
31.	HOW MANY DIFFERENT . ACCIDENT?	JOBS HAVE	YOU HAD SINCE THE
32.	HAVE YOU NOTICED ANY WORK SINCE THE ACCID	CHANGE IN	VYOUR ATTITUDE TOWARDS
	1=yes	2=no	9=unknown

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If yes, specify	 	 

# COSTS ASSOCIATED WITH THE ACCIDENT

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33.	TO THE NEAREST \$ YOU PERSONALLY?	100, HOW MUCH HAS T	HIS ACCIDENT COST				
	Hospital and Medical	treatment			<u> </u>		
	Rehabilitation Service	s			<u>  </u>		
	Transport						
	Home Modifications _			_[			
	Other (specify)				][		
34.	WHAT WAS THE TO in \$100's)	TAL TAC COST TO TH	E NEAREST \$100? (code			][	]
35.	HAVE ANY OF THE I CONTRIBUTE TO YC	FOLLOWING ORGANISA UR INJURY OR REHAB	ATIONS HELPED BILITATION COSTS?				
35a.	Transport Accident Co	mmission					
	1=yes	2=no	9=unknown	-			
35b.	Medicare						
	1=yes	2=no	9=unknown	_,			
35c.	Workcare	·					
	1=yes	2=no	9=unknown				
35d.	Private Health Insura	nce					
	1=yes	2=no	9=unknown				
35e.	Previous employer						
	1=yes	2=no	9=unknown	-1			
35f.	Other participants in t	he crash					
	1=yes	2=no	9≠unknown				

35g.	Social Security		
	1=yes	2=no	9=unknown
35h.	Other, (common code)		
	1=yes	2=no	9=unknown
	specify		

### LIVING AND SOCIAL CONSEQUENCES

I NEED TO ASK YOU SOME QUESTIONS ABOUT THE EFFECTS OF THE ACCIDENT ON YOUR PRESENT LIFE STYLE AND LIVING ARRANGEMENTS.

I STRESS AGAIN THAT THIS INFORMATION IS STRICTLY CONFIDENTIAL AND WILL NOT BE IDENTIFIED WITH YOU ON OUR DATABASE.

I APPRECIATE THAT SOME OF THESE QUESTIONS MIGHT BE A BIT DIFFICULT FOR YOU TO ANSWER - PLEASE SAY IF YOU'D PREFER NOT TO ANSWER ANY OF THESE QUESTIONS.

36. HAVE YOU CHANGED ANY OF THE FOLLOWING ACTIVITIES SINCE THE ACCIDENT?

36a.	Smoking				
	1=yes-yes	2=yes-no	3=no-yes	4=no-no	9=unknown
36b.	Drinking				
36c.	Take Regular	r Medication			
36d.	Other Drugs				
37.	HAVE YOU ' HEALTH SI	TAKEN ANY P NCE THE ACC	PARTICULAR S	TEPS TO IMPI	ROVE YOUR
	1=yes	8	2=no		9=unknown
	If yes, specify	/			

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38.	DO YOU NEED ASSISTANCE WITH ANY OF THE FOLLOWING ACTIVITIES AS A RESULT OF THE ACCIDENT?							
38a.	bathing (1=yes, 2=no, 9=unknown)							
38b.	showering(1=yes, 2=	10, 9=unknown)						
38c.	toiletting (1=yes, 2=no, 9=unknown)							
38d.	dressing (1=yes, 2=no, 9=unknown)							
38e.	moving around (1=yes, 2=no, 9=unknown)							
39.	HAVE YOU NOTICE ABILITY TO CONCE	D ANY CHANGE IN YOUR INTRATE SINCE THE ACC	MEMORY OR YOUR					
	1=yes	2=no	9=unknown					
	If yes, specify							
40.	HAVE YOU HAD TO ARRANGEMENTS A	CHANGE YOUR HOME OI S A RESULT OF THE ACCI	R LIVING					
	1=yes	2=no	9=unknown					
	If yes, specify							
41.	HAVE YOUR LEISU BECAUSE OF THE A	RE OR SPORTING ACTIVIT	TIES CHANGED					
	1=yes	2=no	9=unknown					
	If yes, specify							
<b>4</b> 2.	HAVE YOU CHANG	GED YOUR GOALS OR AM	BITIONS AS A RESULT					
	1=yes	2=no	9=unknown					
	If yes, specify							

DO YOU FEEL YOU HAVE LOST CONFIDENCE IN ACTIVITIES SUCH AS DRIVING, WORKING, OR MIXING WITH PEOPLE AS A RESULT OF THE ACCIDENT?				
1=yes	2=no	9=unknown		
If yes, specify				
SINCE THE ACCIDE GREATER ANXIETY	NT DO YOU REGULARLY	Y EXPERIENCE		
1=yes	2=no	9=unknown		
If yes, specify				
SINCE THE ACCIDE GREATER PAIN?	NT DO YOU REGULARLY	Y EXPERIENCE		
1=yes	2=no	9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT (	2=no RE HAS BEEN A CHANG OF THE ACCIDENT?	9=unknown E IN YOU QUALITY OF		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes	2=no RE HAS BEEN A CHANG OF THE ACCIDENT? 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify	2=no TRE HAS BEEN A CHANG OF THE ACCIDENT? 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify	2=no TRE HAS BEEN A CHANG OF THE ACCIDENT? 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown		
l=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify	2=no TRE HAS BEEN A CHANG OF THE ACCIDENT? 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify	2=no TRE HAS BEEN A CHANG OF THE ACCIDENT? 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify DO YOU FEEL THER THE ACCIDENT ON T	2=no TRE HAS BEEN A CHANG OF THE ACCIDENT? 2=no 2=no E HAS BEEN A MAJOR O YOUR PERSONAL OR FA	9=unknown FE IN YOU QUALITY OF 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify DO YOU FEEL THER THE ACCIDENT ON T 1=yes	2=no THE HAS BEEN A CHANG OF THE ACCIDENT? 2=no E HAS BEEN A MAJOR OF YOUR PERSONAL OR FA 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown CONSEQUENCE OF MILY LIFE? 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify DO YOU FEEL THER THE ACCIDENT ON 1=yes If yes, specify	2=no ERE HAS BEEN A CHANG OF THE ACCIDENT? 2=no E HAS BEEN A MAJOR ( YOUR PERSONAL OR FA 2=no	9=unknown SE IN YOU QUALITY OF 9=unknown CONSEQUENCE OF MILY LIFE? 9=unknown		
1=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify DO YOU FEEL THER THE ACCIDENT ON 1=yes If yes, specify	2=no THE HAS BEEN A CHANG OF THE ACCIDENT? 2=no E HAS BEEN A MAJOR OF YOUR PERSONAL OR FA 2=no	9=unknown SE IN YOU QUALITY OF 9=unknown CONSEQUENCE OF MILY LIFE? 9=unknown		
l=yes DO YOU THINK THE LIFE AS A RESULT ( 1=yes If yes, specify DO YOU FEEL THER THE ACCIDENT ON 1=yes If yes, specify	2=no ERE HAS BEEN A CHANG OF THE ACCIDENT? 2=no E HAS BEEN A MAJOR OF YOUR PERSONAL OR FA 2=no	9=unknown FE IN YOU QUALITY OF 9=unknown CONSEQUENCE OF MILY LIFE? 9=unknown		

## PERSONAL DETAILS

LASTI QUES ACCII	LY, FOR STATISTICAL ANALYSIS, I WOULD LIKE TIONS ABOUT YOUR BACKGROUND AT THE TIM DENT.	TO ASK YOU A FEW E OF THE
18	WHAT WAS YOUR COUNTRY OF BIRTH (morbidi	ty codes)
40.		<i>(</i> , (((((((((((((((((((((((((((((((((((
	please specify	
49.	WHAT WERE YOUR LIVING ARRANGEMENTS A THE ACCIDENT?	T THE TIME OF
	1=living alone	6=boarder
	2=living with parents 3=married with spouse	7=transient 8=other (specify)
	4=married with spouse & children 5=living with others	9=unknown
50.	HAS THIS CHANGED SINCE THE ACCIDENT?	
	1=yes 2=no	9=unknown
	If yes, specify	
51.	WHAT WAS YOUR MARITAL STATUS AT THE TI ACCIDENT?	ME OF THE
	1=single	3=defacto
	2=married	9=unknown
52.	HAS THIS CHANGED SINCE THE ACCIDENT?	
	1=yes 2=no	9=unknown
	If yes, specify	
		[]
53.	HOW MANY CHILDREN DO YOU HAVE?	[]
53a,	IF YES, HOW MANY LIVE WITH YOU?	

54. WHAT WAS YOUR SALARY LEVEL AT THE TIME OF THE ACCIDENT?

0=none 1=<\$10000 2=\$10-20000 3=\$20-30000 4=\$30-40000

5=\$40-50000 6=\$50-75000 7=\$75-100000 8=>\$100000 9=unknown

55. WHAT WAS YOUR EDUCATION LEVEL AT THE TIME OF THE ACCIDENT?

0=none 1=primary 2=secondary - pre yr 12 3=trade qualification 4=secondary - VCE 5=tertiary degree 6=higher degree 7=professional 8=other (specify)

9=unknown

#### 56. WERE YOU OR ANY OTHER PARTY IN YOUR VEHICLE IMPLICATED IN CAUSING THE ACCIDENT?

1=yes

2=no

9=unknown

If yes, please explain .....

## THANK YOU FOR YOUR PARTICIPATION IN THIS IMPORTANT

#### PART OF OUR RESEARCH.

COMMENTS:

# APPENDIX B

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# LETTER SENT BY THE ALFRED HOSPITAL TO PREVIOUS VEHICLE OCCUPANT PATIENTS

## THE ALFRED GROUP OF HOSPITALS



ALFRED HOSPITAL

Commercial Road Prahran Victoria Australia 3181 Telephone (03) 276 2000 Facsimile (03) 529 4551

Dear

On , you were admitted to this hospital following your involvement in a car crash. You may recall that during your stay with us, you were approached by a member of the Monash University Accident Research Centre and agreed to participate in their research into vehicle occupant protection.

This information was most valuable in helping identify ways in which car safety can be improved and they are in the process of preparing a report to the Federal Office of Road Safety on their findings.

The Centre has again approached this hospital about following up patients such as yourself who wereincluded in the original study to find out more about any difficulties or problems you may have had as a result of your car crash. Because of their promise to you about confidentiality, they no longer have your name and address, hence we have agreed to make this initial contact on their behalf.

The Monash University Accident Research Centre needs this additional information to gain a full picture of the consequences of road trauma such as how long it took for you to recover, what rehabilitation was required, any long-term disabilities you may have suffered, what were the effects of your injury on the rest of your family, as well as the degree of pain and suffering you had to bear.

Like the earlier research, this study is ultimately aimed at reducing road accidents and the consequences of them among the community.

If you are agreeable, would you please sign and return the attached form to the Centre (a return stamped envelope is enclosed) whose officers will contact you shortly to obtain this extra information. Please note that this information will also be treated in strict confidence, just as your original accident details were.

I believe that this research is important and worthwhile and hope that you will be able to participate in this study with the Centre.

Yours faithfully,

Dr. L. Dziukas, Director, Emergency Services To: The Director, Monash University Accident Research Centre, Wellington Road, CLAYTON. VICTORIA. 3168.

Dear Dr. Vulcan,

#### REFERENCE: ROAD CRASH INFORMATION, CASE NO:

I have received a letter from the Alfred Hospital regarding your request for additional information concerning a road crash I was involved in for which you previously collected information.

I hereby consent to being involved further in your research and am willing to supply additional information on the consequences of my accident since leaving hospital.

I understand that officers of your Centre will contact me shortly to make arrangements about collecting this information. I also understand that this information will be treated in strictest confidence and will be used for research purposes only.

SIGNATURE		 	<u>.</u>	 
FULL NAME _	_			 
_			_	

CONTACT ADDRESS \_\_\_\_\_

CONTACT TELEPHONE NUMBER \_\_\_\_\_

If you wish to discuss this request before agreeing to participate, please telephone Dr. Brian Fildes on (03) 565 4369 during business hours.

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