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Case-Control Study of Motorcycle Crashes

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Case-Control Study of Motorcycle Crashes

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Abstract

This report presents the findings of the Case-Control Study of Motorcycle Crashes. The cases comprised 222 motorcycle crashes occurring on public roads in the Melbourne metropolitan area from late November 1995 to 30 January 1997 in which the rider or pillion was taken to one of the participating hospitals or died. The controls were 1195 motorcyclist trips which passed the crash site at the same time of day and day of week that the crash occurred.

The study collected three types of information:

- *detailed descriptive information about the crash and the resultant injuries*
- *comparison of features of cases and controls*
- *motorcycle exposure information (gathered as part of collection of control data).*

Keywords

MOTORCYCLE, MOTORCYCLIST, RIDER, CRASH, INJURY, HELMET, TRAINING, EXPOSURE

NOTES:

(1) FORS research reports are disseminated in the interests of information exchange.
(2) The views expressed are those of the author(s) and do not necessarily represent those of the Commonwealth Government.

EXECUTIVE SUMMARY

This report presents the findings of the **Case-control study of motorcycle crashes.** The cases were 222 motorcycle crashes occurring on public roads in the Melbourne metropolitan area from late November 1995 to 30 January 1997 in which the rider or pillion was taken to one of the participating hospitals or died. The controls were 1195 motorcyclist trips which passed the crash site at the same time of day and day of week as the crash occurred.

The study collected three types of information:

- detailed descriptive information about the crash and the resultant injuries
- comparison of features of cases and controls, and
- motorcycle exposure information (gathered as part of collection of control data).

CHARACTERISTICS OF CASES

Of the 222 crashes, 22 involved pillions. Twenty-two riders and three pillions were killed in the crashes, which had the following characteristics:

- most commonly occurred on Fridays
- generally highest frequencies from noon to 8 pm
- almost 20% occurred near the centre of Melbourne
- 80% in urban areas
- almost half were on major arterials
- 65% occurred in 60 km/h zones
- more than two-thirds on curves
- equally divided between intersection and non-intersection locations
- mostly on two-way undivided roads
- very few local area traffic management devices at crash sites
- the road was not clean at almost one-quarter of the sites and there was deformed pavement or a sudden change in road surface at many sites
- about half occurred on two-lane roads
- poles, kerbs and trees were present at most sites
- there was no evidence of braking at 85% of sites
- 9% occurred when it was raining
- about one-quarter occurred under difficult lighting conditions (glare, dusk or dawn, night-time)
- sun glare could have reduced visibility at 13% of sites
- glare from oncoming headlights was a potential problem at 8% of sites

Type of crash

- one-third were single vehicle crashes

- two-thirds of all crashes involved impact with an object or vehicle, in half of all crashes this was a moving car
- single vehicle crashes were more likely than multi-vehicle crashes to involve alcohol, to occur at night and to involve excessive speed
- 23% of crashes were judged to have involved excessive speed for the conditions
- the rider was judged to have contributed to about two-thirds of the multi-vehicle crashes, mainly by inappropriate positioning or failure to respond
- most riders did not consider themselves to be at fault in multi-vehicle crashes to which failure to respond was judged to contribute

Motorcycles
- 167 motorcycles were inspected
- 15% had travelled less than 5,000 kms
- more than 20% were judged to be not well cared for (dirt and mud etc)
- almost 40% were judged to have been in a poor to fair mechanical condition (compression, bearings etc.) prior to the crash
- clean motorcycles were mostly in good or excellent mechanical condition, whereas most of the motorcycles in poor mechanical condition were dirty
- about a quarter had under-inflated front or rear tyres
- a quarter had a worn or loose chain
- 15% had brakes in a poor condition, typically insufficient pad thickness
- 19% of rear tyres and 7% of front tyres were badly worn or bald

Helmets
- 145 helmets worn by riders and pillions were inspected
- over 50% were black or "dark"
- 20% of visors were tinted
- the average age was four years, with 16% more than 5 years old and so may no longer have been performing optimally
- more than 80% had obvious signs of damage, mostly scratches but some fractures
- in 43% the interior padding was visibly worn or compressed

INJURIES TO MOTORCYCLISTS IN NON-FATAL CRASHES

- the median Injury Severity Score (ISS) was greater for admitted motorcyclists than presentations (10 versus 5)
- 4% of all injured motorcyclists had severe head injuries
- 3 of the 5 motorcyclists not wearing helmets sustained head injuries
- facial injuries were uncommon and not significantly more common among those wearing open face helmets than full face helmets (8% versus 4%)
- chest injuries were uncommon but relatively severe when they occurred
- 44% of motorcyclists had upper limb injuries and 57% had lower limb injuries
- most common injuries overall were fracture of the knee or lower leg (28%) and fracture of the forearm (17%)

- external injuries (abrasions, contusions or lacerations) occurred to 88% of motorcyclists but were generally not severe
- there was no clear indication of differences in injury severity for riders and pillions in the same, non-fatal crashes
- single and multi-vehicle crashes did not differ in their injury severity
- injury severity and patterns of injury did not vary significantly as a function of speed zone
- wearing appropriate clothing did not significantly decrease the likelihood or severity of external injuries

CASE-CONTROL COMPARISONS

The data from 205 cases for which controls could be recruited and 1195 controls were compared. Where odds ratios are cited in this section, they are statistically significant.

Rider factors

The factors which were associated with significantly increased crash risk after adjustment for potential confounding factors were:

- age under 25 (compared with age 35 or over)
- never married
- unlicensed
- experienced off-road rider before gaining on-road licence
- having fewer years of on-road riding experience (after adjustment for BAC>.00)
- ride less than 3 days per week - this may be an artefact of the study design
- having completed a beginner course compared with an advanced course
- BAC>.05 (odds ratio of 38) - 13% of crashed riders for whom BAC was known had BAC>.05 compared with less than 1% of control riders
- BAC>.00 (odds ratio of 5)
- consumed alcohol in the previous 12 hours (odds ratio of 2)
- not wearing a helmet (2% of crashed riders and 1% of controls)

Other results included:

- 6% of crashed riders and 3% of control riders had used illicit drugs (mainly marijuana) in the previous 12 hours but the unadjusted and adjusted odds ratios were not statistically significant
- 11% of crashed riders and 8% of control riders had taken prescription drugs in the previous 12 hours but none of the odds ratios were statistically significant
- 2% of crashed riders and 3% of control riders had taken nonprescription drugs in the previous 12 hours but the numbers were too small to analyse
- after adjustment for BAC, there was no significant increase in risk associated with wearing an open face helmet compared to a full face helmet
- no significant increase in risk associated with wearing a helmet 5 to 10 years old or over 10 years old (compared with one less than 5 years old)

- no significant increase in risk associated with wearing a helmet that did not belong to the rider after adjustment for age and BAC
- none of the odds ratios associated with wearing protective gear were significantly different from one. However, these analyses were based on self-report data for cases and observation for controls and so may have been affected by a social desirability bias for cases.

Pillion factors

The presence of pillions could possibly contribute to either crash causation (e.g. by behaving inappropriately or simply by producing a higher centre of gravity) or increased crash severity (because they are another person who may be killed or injured).

- pillions were present in 10% of crashes and 7% of controls
- significant increase in crash risk associated with pillion carriage
- 70% of pillions in crashes were female, 57% of control pillions

Motorcycle factors

The factors which were found to significantly increase crash risk after adjustment for potential confounding factors were:

- riding a motorcycle with engine capacity of 750 cc and above compared to one of 260 cc or below (adjusted for licence status)
- the rider not being the owner of the motorcycle

Other results included:

- 5% of crashed motorcycles and 1% of control motorcycles were unregistered
- most motorcycles were manufactured in 1990 or later and so age of the motorcycle varied little between cases and controls
- two-stroke race replicas comprised 24% of the crashed 250 cc motorcycles compared with 9% of the control 250 cc motorcycles. The increased risk associated with riding these bikes was not significant after adjusting for the effect of alcohol but the adjusted odds ratio was still relatively high (2.7)
- headlights were on for most of the crashed and control motorcycles (both pre- and post-1992) - the odds ratios associated with pre-1992 motorcycles having headlights off were not statistically significant

Trip factors

- a significant increase in risk was associated with nonwork-related trips compared with work-related trips
- no significant increase in risk was associated with the rider being unfamiliar with the road
- the percentage of riders who estimated that they were travelling at above the speed limit was less at higher speed limits
- riders with BAC>.000 were more than twice as likely to state that they were travelling over the speed limit

The risk factors for which the contribution to crashes was greatest were:

- rider aged under 25
- BAC>.05
- BAC>.00
- unlicensed or unregistered or not ridden by the owner
- nonwork-related riding

It should be noted, however, that the analyses might have overestimated the risk associated with unlicensed or unregistered or not ridden by the owner if these riders were less likely to stop at the control sites than other riders.

EXPOSURE INFORMATION

Exposure estimates were calculated based on observations of 1121 motorcycles during 325 hours of sampling at or near the crash sites. The overall proportion of the traffic comprised by motorcycles was very low, about 0.5%.

The highest average number of motorcycles per hour was found on primary arterials (4.05), with the smallest number being found on collector roads (1.23). The proportion of the traffic which motorcycles comprise appears to be similar across road types.

Average motorcycles per hour was greatest during weekday and weekend days and the proportion of traffic that motorcycles comprise was highest on weekend days. Both the average number of motorcycles per hour and the proportion of traffic which motorcycles comprise were lower at night than during the day.

The mean number of motorcycles per hour accounted for 79% of the variance in the number of crashes (per time period or per road type). The regression equation describing the relationship in this particular study is:

Number of crashes=6.50 x mean number of motorcycles per hour

The median distance travelled per week was between 201 and 300 kilometres. Riders holding probationary and full licences rode further per week, on average, than holders of learner permits. Engine capacity per se showed little effect on distance ridden.

The comparisons of recent Australian motorcycle exposure studies showed general agreement although some differences occurred because of the different population base or the time of year that the survey was conducted. In general, the previous studies agreed with the current study's findings that non-novices rode further per week than novices and that greater distances were travelled by larger capacity motorcycles (greater than 500 cc or greater than 750 cc) than smaller capacity motorcycles.

The data presented here do not clearly indicate any changes in the exposure patterns of riders from 1988 to 1996. While the ABS Survey of Motor Vehicle Use showed that the number of registered motorcycles in Australia decreased from 1985 to 1988, the numbers have remained almost constant since then.

RIDING STYLES AND STRATEGIES

While there were some differences identified, in general, the riding styles and strategies adopted were similar across rider age groups, experience, licence status and training history. The observed differences are summarised below. The greater likelihood that younger riders, many of whom were not fully licensed, had completed at least one training course complicated the interpretation of the observed differences somewhat.

Summary of observed differences in riding styles and strategies:

observational skills	frequency of looking behind over one shoulder decreased with age group, more common with training
approaching intersection	inexperienced riders more likely to decrease speed, trained riders more likely to change position to improve visibility
position on roadway	younger riders and riders with training less likely to travel in the left-hand and more likely to travel in the right-hand wheel track (safer)
following distance	longer gap for inexperienced riders, shorter gap for 25 to 34 year old riders
response to tailgating	learner and probationary riders and riders with training less likely to speed up
using the horn	more by experienced riders
dealing with emergency situations	more near misses usually experienced per month by experienced riders (who ride more), youngest age group report most usual number of near misses per month, inexperienced and trained riders more likely to have practised emergency braking and/or counter-steering in the last six months, riders with probationary licences were the most confident about performing sudden swerves in emergency situations
usefulness of training	riders aged 35 and over most likely to use cornering skills learnt in training “always”

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- Dandenong Hospital
- Monash Medical Centre
- Mornington Peninsula Hospital
- Royal Melbourne Hospital
- Western General Hospital

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1. INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In 1996, 39 motorcyclists were killed and 631 were seriously injured in motorcycle crashes in Victoria, comprising 9.4% of road users killed and 10.4% of road users seriously injured. In Australia as a whole, 193 motorcyclists were killed in 1996 (9.8% of all road users killed).

When motorcyclists are injured in crashes, they are often injured more severely than other road users. Diamantopoulou, Brumen, Dyte and Cameron (1995) report that between 1984 and 1993, about 45% to 50% of motorcyclist casualties were fatalities or serious injuries, whereas only about 30% to 35% of all casualties were fatalities or serious injuries.

While the statistics for motorcyclists killed are likely to be quite reliable, significant under-reporting of injury crashes occurs. Diamantopoulou et al (1995) found that single motorcycle crashes were more common in hospital admission data than in the State Traffic Accident Record, confirming this pattern.

Diamantopoulou et al (1995) found that the number of motorcyclists killed during 1984 to 1993 decreased less in Victoria than in the rest of Australia. In New South Wales, the proportion of fatal crashes which involved motorcyclists halved during that period, compared with little change in Victoria. In Victoria, significant improvement was found only in multi-vehicle crashes in speed zones of 75 km/h or less.

However, the interpretation of changes in numbers of motorcycle crashes in recent years is complicated by issues of exposure. There is little information available about the amount of motorcycle riding that is done and how that has changed from year to year. More detailed information about motorcycle exposure, such as the time of day that trips occur, the reasons for travel and rider demographics, is even more sparse. The survey of motorised vehicle travel conducted for VicRoads in 1994 (Arup Transportation Planning, 1995), for example, provided data on only 46 riders on metropolitan arterial roads, 53 riders in rural towns and 52 riders on rural highways. The Australian Bureau of Statistics Survey of Motor Vehicle Usage in May 1995 included data from 138 motorcycle owners (171 surveyed, response rate 81%) from Victoria. Galambos and Haworth (1994) analysed the responses of 320 Victorian riders who completed a questionnaire designed by the Motorcycle Riders' Association of Australia. The response rate was very low, given that about 70,000 questionnaires were mailed with licence renewals.

1.2 OUTLINE OF THE STUDY

The **Case-control study of motorcycle crashes** included crashes from late November 1995 to 30 January 1997. The study collected three types of information:

- detailed descriptive information about the crash and the resultant injuries
- comparison of features of cases and controls, and
- motorcycle exposure information (gathered as part of the control collection process).

The cases were motorcycle crashes occurring on public roads in the Melbourne metropolitan area in which the rider or pillion was taken to one of the participating hospitals or died. The controls were motorcyclist trips which passed the crash site at the same time of day and day of week as the crash occurred.

It should be noted that injuries resulting from off-road crashes are a significant issue (see Diamantopoulou et al, 1995; Haworth, Ozanne-Smith, Fox and Brumen, 1994) which is not addressed in this study.

1.3 AIMS

The study aimed to identify and assess the contribution of modifiable risk factors for severe motorcycle crashes resulting in death or serious injury. These factors will then be targeted for countermeasure development for the purposes of reducing the motorcycle specific component of the road toll.

1.4 STRUCTURE OF THIS REPORT

This report has been divided into chapters to assist the reader in locating those issues in which they have the most interest. Summaries of the characteristics of the crashes and the resulting injuries are described in Chapters 4 and 5. The characteristics of the controls are discussed in Chapter 6.

The methods used in the case-control comparisons are outlined in Chapter 7 and the results presented in Chapters 8 to 12. The reader who does not require this level of detail is encouraged to proceed directly from Chapter 6 to the summary of results in Chapter 13. Discussions and conclusions comprise Chapters 14 and 15.

The motorcycle exposure data is presented in Chapter 16, followed by the riding styles and strategies in Chapter 17.

2. STUDY DESIGN

2.1 SELECTION OF CASES

The cases comprised motorcycle crashes occurring on public roads in the Melbourne metropolitan area in which the rider or pillion was taken to one of the participating hospitals or died. The information gathered about the cases related to the rider, pillion, motorcycle, trip, crash and crash location.

2.1.1 Motorcyclists admitted to hospital

Motorcyclists admitted to seven hospitals (see Table 2.1) were invited to take part in the study. The definition of admission used by the hospitals was generally a stay of at least four hours.

The Alfred Hospital, Dandenong Hospital and Box Hill Hospital participated since the beginning of the study. Approval to access cases at the Monash Medical Centre was granted and collection began on 24 January 1996. In order to increase the rate of recruitment of cases and to increase the geographical area covered by the study, the Royal Melbourne Hospital, Mornington Peninsula Hospital and Western Hospital were added to the sample in early 1996.

Table 2.1. Date recruitment commenced at each of the participating hospitals.

Name of hospital	Date recruitment commenced	
	Admissions	Presentations
Alfred Hospital	1 December 1995	3 June 1996
Dandenong Hospital	1 December 1995	3 July 1996
Box Hill Hospital	1 December 1995	25 June 1996
Monash Medical Centre	24 January 1996	18 June 1996
Royal Melbourne Hospital	1 March 1996	1 August 1996
Mornington Peninsula Hospital	4 March 1996	26 June 1996
Western Hospital (Footscray)	3 April 1996	21 October 1996

2.1.2 Motorcyclists presenting but not admitted to hospital

In response to a lower than expected rate of recruitment of motorcyclists admitted to hospital, the study was extended to include motorcyclists who presented at hospital Accident and Emergency Departments for treatment but were not admitted to hospital. Only motorcyclists with injuries corresponding to an Injury Severity Score (ISS) of 5 or greater were included. An example of injuries comprising an ISS of 5 would be a simple break in one leg and abrasions or contusions to another body region.

Approval to extend the study to presentations was requested from each of the participating hospitals. The dates that approval was granted and recruitment of presentations began is summarised in Table 2.1.

2.2 SELECTION OF CONTROLS

In this study, the controls are motorcyclist trips which pass the crash site at the same time of day and week as the crash occurred. Like the cases, the controls have rider, pillion, motorcycle and trip aspects but the controls do not have crash or crash location characteristics.

Matching cases and controls by time of day and day of week of riding and location meant that estimates of relative risks could not be calculated for the matched variables.

The "control motorcyclists" comprised three groups, with an increasing amount of information available for later groups:

1. those who rode by but did not stop
2. those who stopped and were interviewed at the roadside but not contacted for a follow-up interview
3. those who stopped and were interviewed at the roadside and were contacted for a follow-up interview

A limited number of observational variables were collected for those motorcyclists who did not stop (Group 1). These variables are listed in Table 2.2. For those who stopped (Groups 2 and 3), additional information was collected, focussing on the current trip (including photographs and BAC if riders agreed). The follow-up telephone interview assessed longer term issues such as training and licensing. This means that the sample size is much greater for the variables collected by observation than for those only available from the follow-up interview.

Table 2.2. List of observational variables collected.

Pillion or not
Whether helmet worn by rider (and pillion, if relevant)
Type of helmet worn by rider (and pillion, if relevant)
Make and model of motorcycle
Headlight status
Colour, material and reflectivity of clothing worn
Footwear

2.3 CASES WITHOUT CONTROLS

Those cases for which no controls were recruited (no motorcyclists were observed) had to be dropped from the case-control study. These cases were retained in the descriptive study, however.

3. METHOD

3.1 IDENTIFICATION AND RECRUITMENT OF CASES

The Research Nurses contacted the participating hospitals three times per week to ask whether any motorcyclists had been admitted or had attended the Emergency Department. The designated hospital contact accessed the relevant records and provided information on motorcycle crash-related admissions and presentations to the Research Nurse, including whether any admitted motorcyclists were still in hospital.

3.1.1 Motorcyclists still in hospital

Once notified of a motorcyclist still in hospital, the Research Nurse rang the relevant ward to request permission from the Nurse Unit Manager of the Ward to interview the motorcyclist. The Unit Manager determined whether the motorcyclist was both fit and willing to be approached by the Research Nurse. If permission was granted by the Unit Manager, the Research Nurse visited the motorcyclist in the ward, described the study to the motorcyclist (including presenting the subject/patient information sheet appropriate for that hospital) and asked his/her consent to participate. If this was given, the Research Nurse verbally administered the questionnaire and wrote the motorcyclist's responses on the questionnaire form. If the motorcyclist became too tired or was unable for some other reason to complete the interview, the Research Nurse arranged to return at a later time.

In addition, the motorcyclist was asked for approval to access his/her medical records to determine his/her weight, height and injury details. Injury severity was coded using the Abbreviated Injury Scale.

If the Nurse Unit Manager of the Ward stated that the motorcyclist was not fit to be interviewed, the Research Nurse asked if it was appropriate to ring back at a later date to find out whether this had changed.

3.1.2 Motorcyclists who had left hospital

The hospitals provided the names and home telephone numbers of motorcyclists who had been discharged before they could be interviewed. In these instances, the Research Nurse rang the motorcyclists, explained the study and sought verbal consent. If consent was given, the Research Nurse conducted the interview by telephone and posted an information sheet and consent form to the motorcyclist who returned these by mail. If the consent form was not returned, the case was dropped from the study.

3.1.3 Fatal motorcycle crashes

The location and timing of fatal motorcycle crashes was notified by the Victoria Police. Five fatal crashes in this study were investigated by the Victoria Police Accident Investigation

Section (AIS) as part of a concurrent study of single-vehicle crashes. Details of other fatal crashes were provided by the investigating Police, witnesses, friends and relatives.

3.2 SITE INSPECTIONS

Site inspections were conducted as soon as possible after the injured motorcyclist was interviewed (or location information was supplied by the Police, for fatal motorcycle crashes). Most site inspections were conducted within a week of the case interview (see Table 3.1). This maximised the likelihood that debris or other identifying marks were available to indicate the point of impact. In some instances the point of impact was clear, e.g. bark missing from a tree but it was not always possible to pinpoint the crash location.

Each crash site was ridden through by an experienced motorcyclist and a report prepared on the characteristics of the crash site which may have contributed to the crash. These reports are presented in a separate volume entitled *Motorcycle Crash Site Characteristics*.

Table 3.1. Number of days from the crash to collection of data for hospital admission, hospital presentation and fatal crashes.

Days from crash to	Admission crashes		Presentation crashes		Fatal crashes *	
	median	range	median	range	median	range
Case interview	5.0	0 - 26	9.0	2 - 21	13.0	6 - 21
Site inspection	11.5	1 - 85	15.0	5 - 32	6.0	1 - 21
Motorcycle inspection	17.0	1 - 85	20.0	9 - 44	23.5	2 - 77
Helmet inspection	19.0	1 - 55	20.5	9 - 44	9.0	-

* based on very few cases for which all inspections were completed

3.3 MOTORCYCLE INSPECTIONS

Injured motorcycle riders were asked for their permission to inspect the motorcycle. Of the 222 motorcycles involved in crashes in the study, 167 were inspected. Some motorcycles were not inspected because permission was not given or the whereabouts of the motorcycle was unknown. Inability to locate the motorcycle occurred for many of the fatal crashes.

Motorcycle inspections for non-fatal crashes were conducted by experienced motorcyclists. For two fatal crashes, the inspection form was completed by the AIS Mechanical Inspection Team. There were sometimes delays in being able to access the motorcycle because of insurance procedures. On average, motorcycle inspections occurred about twelve days after the interview of the injured motorcyclist.

3.4 HELMET INSPECTIONS

Injured motorcyclists were asked for their permission to inspect their helmet. Of the helmets worn by persons interviewed, 145 were inspected. The reasons why the other helmets were not inspected included: whereabouts unknown, helmet yet to be inspected and helmet not requested because of severe head injuries (fatal crashes). On average, helmet inspections occurred about two weeks after the interview of the injured motorcyclist.

3.5 RECRUITMENT OF CONTROLS

3.5.1 Timing

Where possible initial interviewing of control motorcyclists was conducted at the crash site, one week after the crash, with follow up by telephone. In some instances, the control collection could not be attempted one week after the crash and was instead undertaken two (or occasionally more) weeks after the crash. This occurred when the injured motorcyclist was not identified or could not be interviewed sufficiently quickly for the controls to be recruited within one week of the crash. Where the crash occurred on a working day and one week later was a public holiday, the controls were recruited on the working day before or after the public holiday. The median time from occurrence of the crash to the recruitment of motorcyclists at the control site was 15 days (range 5 to 43) and from occurrence of the crash to the telephone followup was 24 days (range 6 to 66).

3.5.2 Location

Where the crash occurred on a local road or a collector road, controls were recruited on the closest arterial if one existed within one kilometre of the crash site. If there was no arterial within one kilometre of the crash site, then controls were recruited from the nearest arterial or collector road. The classification of roads was taken from the colour-coding in the Melway Street Directory.

For crashes which occurred on freeways, it was considered too dangerous to attempt to stop motorcyclists at the crash site if there was no emergency stopping lane. The controls were recruited on arterials which the crashed motorcyclists were intending to travel along after they left the freeway. It was assumed that many of the motorcyclists travelling in the sampled direction at the control site would have travelled on the freeway.

3.5.3 Control site procedures

A two-person (generally) team stopped motorcyclists with signs and procedures in accordance with the Vic Roads Code of Practice for Worksite Traffic Management. The care taken with signage and stopping procedures led to a high level of cooperation from motorcyclists. Most passing motorcyclists stopped if it was safe to do so. It was not considered safe to attempt to stop all motorcyclists in some circumstances, e.g. busy, multi-lane traffic.

Those motorcyclists who stopped were asked their date of birth, licence status, where they were looking prior to being stopped, whether their view was blocked in any way and were breath-tested using a Lion SD2 device. In addition, they were asked their first name and telephone number for a follow-up interview. On average, the roadside interview lasted about two minutes.

An attempt was made to photograph all motorcyclists as they approached the site. Those motorcyclists who stopped were photographed as they were being interviewed. Those motorcyclists who drove by without stopping were photographed as they passed the site.

The purpose of the photographs was to record basic data for all passing motorcyclists, including those who did not stop. Photographs were taken with a Nikon F50D camera, using 1600 ASA or 400 ASA slide film to optimise images of passing motorcyclists under poor light conditions. However, photographs taken at night were not always adequate.

3.5.4 Telephone interviewing

In the early months of the study, an attempt was made to conduct a follow-up telephone interview with all control motorcyclists who had supplied their telephone number. From March 1996, telephone follow-ups were continued only until a maximum of three was completed for each case. Three attempts were made to ring each motorcyclist.

3.6 QUESTIONNAIRES

Questionnaires were developed based on those used in the University of Auckland Case-Control Study of Motorcycle Crashes and input from the project sponsors. The set of questionnaires for the cases comprised:

- motorcycle accident questionnaire - administered to injured motorcyclist (or proxy) by Research Nurse
- site inspection form - completed by MUARC inspector
- motorcycle inspection form - completed by MUARC inspector
- helmet inspection form - completed by MUARC inspector

The questionnaires for the controls comprised:

- roadside observer questionnaire - completed by member of MUARC roadside team for every motorcyclist who passed the control site (including those who did not stop)
- roadside interviewer questionnaire - administered by member of MUARC roadside team to those motorcyclists who stopped at control site
- motorcycle control site master form on which MUARC staff recorded details of the site where control motorcyclists were recruited, weather conditions and traffic counts
- motorcyclist follow-up questionnaire - telephone interview by MUARC staff of motorcyclists who had stopped and given a telephone number

A copy of the questionnaires is included as Appendix 1.

4. CRASH CHARACTERISTICS

This chapter describes the characteristics of the crashes investigated as part of this study. Information regarding the timing and location of crashes and the results of the inspections of motorcycles and helmets are presented here. Information that is available for both crashed and control motorcyclists is presented in the later comparisons of cases and controls. This information includes rider details such as age, riding experience and BAC and vehicle details such as engine capacity.

4.1 NUMBERS OF RIDERS AND PILLIONS INVOLVED

The cases in this study were 222 motorcycle crashes resulting in injury or death to the motorcycle rider or pillion. Two hundred of the crashes involved a rider only while in 22 of the crashes there was both a rider and a pillion on the motorcycle (see Table 4.1). In total, 234 crashed motorcyclists were interviewed for this study (192 riders, 9 pillions and 33 proxy interviews).

Table 4.1. Numbers of riders and pillions in rider-only and rider and pillion crashes interviewed.

Total number of crashes	222
Number of rider-only crashes	200
Riders in rider-only crashes interviewed	176
Proxies for riders in rider-only crashes interviewed	24
Number of rider and pillion crashes	22
Both rider and pillion interviewed	8
Rider only interviewed	4
Pillion only interviewed	1
Proxy interview	9
Total riders interviewed	192
Total pillions interviewed	9
Total proxy interviews	33

Table 4.2 shows that 22 riders and three pillions were killed in the crashes, while 166 riders and 13 pillions were admitted to hospital. Overall 33 riders, and three pillions presented to hospital but were not admitted. Three pillions involved in motorcycle accidents did not present to hospital and whether they sustained an injury is not known. One rider was injured in a crash but did not present to hospital. The nature of the injuries sustained is described in Chapter 5.

Table 4.2. Injury severity of riders and pillions involved in crashes.

Injury severity	Riders	Pillions	Total
Uninjured	0	0	0
Did not present to hospital, injury status unknown	0	3	3
Injured, did not present to hospital	1	0	1
Presented to hospital	33	3	36
Admitted to hospital	166	13	179
Killed	22	3	25
Total	222	22	244

In addition to the 222 cases included in the study, a number of potential cases were identified. Table 4.3 shows that a total of 441 injured motorcyclists (including both riders and pillions) were identified throughout the duration of the study. The dates of commencement of recruitment at each hospital are listed in Table 2.1. With the exception of one fatal case where a relative gave a (proxy) interview, fatally injured motorcyclists are not included in Table 4.3.

Table 4.3. Summary of hospitalised motorcyclists identified during recruitment period.

Hospital	**Interviewed**	**Presentations ISS<5**	**Out of area**	**Off-road**	**Refused**	**Not fit to interview**	**Missed**	**Unable to contact**	**Unknown**	**Total**
Alfred	75	8	12	10	12	3	13	1	4	**138**
Dandenong	39	10	6	22	1	1	7	5	0	**91**
Box Hill	29	11	3	6	3	0	2	2	0	**56**
Monash Medical Centre	19	4	0	2	3	0	8	1	0	**37**
Royal Melbourne	16	1	0	4	6	1	4	0	0	**32**
Western	17	0	3	7	8	0	4	0	1	**40**
Mornington Peninsula	16	2	1	18	0	2	3	4	1	**47**
Total	**211**	**36**	**25**	**69**	**33**	**7**	**41**	**13**	**6**	**441**

In total 230 injured motorcyclists were identified but were not included in the study. The reasons for their exclusion were because the crash occurred off-road (69), they were not admitted to hospital and their injuries were not severe enough for inclusion in the study (36), the injured motorcyclist refused to participate in the study (33), or the crash occurred outside the study area (25). Seven motorcyclists were too ill to be interviewed. Overall 13 motorcyclists were identified but were unable to be contacted and an additional six failed to enter the study for reasons unknown. A total of 41 motorcyclists were missed and only identified later.

Most injured motorcyclists were recruited from the Alfred (75), Dandenong (39) and Box Hill Hospitals (29).

4.2 TEMPORAL CHARACTERISTICS OF THE CRASHES

The crashes occurred between November 1995 and January 1997 inclusive. As such, for November and January there was one full and one partial month of collection, and for December, two complete months of collection. For December, the number of cases was greater in the second year than in the first (16 versus 7). It is unclear whether this reflects true variability in the number of crashes which occurred or the influence of the introduction of additional hospitals and non-admitted patients to the study after January 1996 (see Table 2.1). The monthly distribution of crashes occurring between January 1996 and December 1996 is summarised in Table 4.4.

Table 4.4. The monthly distribution of crashes.

Month	Number of crashes	Percent of crashes
January	8	4
February	8	4
March	14	7
April	10	5
May	17	9
June	18	9
July	10	5
August	20	11
September	18	9
October	24	13
November	28	15
December	16	8
Total	191	100

Note: The above table summarises the number of crashes from January 1996 - December 1996 only

The days of the week when crashes occurred are summarised in Table 4.5. Friday was the most common day for crashes to occur, with crashes being least frequent on Tuesday.

Overall, crashes were most common from midday to 6 pm (42%) and least frequent from midnight to 6 am (7%) (see Table 4.6). However, crashes in which the rider had BAC>.05 were most common from 6 pm to 6 am.

Table 4.5. The days of the week that the crashes occurred.

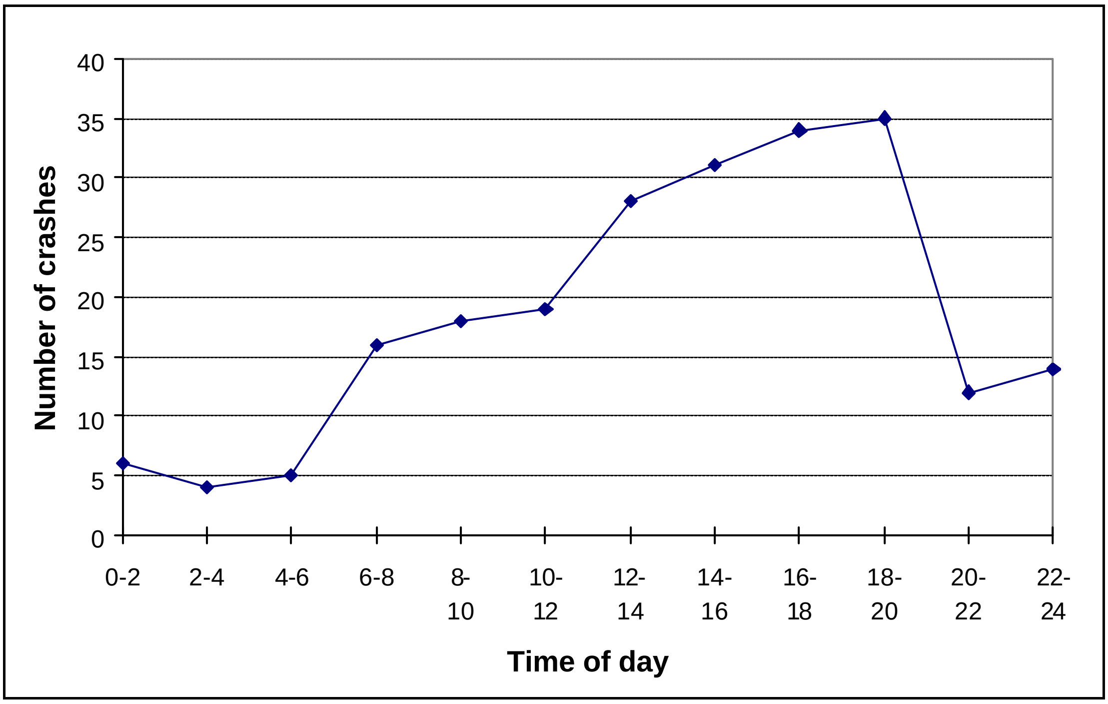
Day of the week	Number of crashes	Percent of crashes
Monday	28	13
Tuesday	22	10
Wednesday	33	15
Thursday	29	13
Friday	43	19
Saturday	34	15
Sunday	33	15
Total	222	100

Table 4.6. The times of day that the crashes occurred - all crashes and where the rider had BAC>.05.

Time of day	Percent of crashes		
	BAC<=.05 (n=124)	BAC>.05 (n=22)	All crashes (n=222)
Midnight to 6 am	5	32	7
6 am to midday	27	14	24
Midday to 6 pm	47	18	42
6 pm to midnight	22	36	28
Total	100	100	100

Figure 4.1 presents the time of occurrence in greater detail. It shows that crash frequencies were generally highest from 4 pm to 8 pm and lowest between midnight and 4 am.

Figure 4.1. Number of crashes during each two-hour period of the day.



4.3 LOCATION OF CRASHES

The locations of the crashes are plotted in Figure 4.2.

4.3.1 Local government area

Table 4.7 shows the local government areas in which crashes occurred. Almost 20% of the crashes occurred within the inner City (Melbourne, Hobsons Bay, Port Phillip).

Table 4.7. Local government areas in which crashes occurred.

Local government area	Number of crashes	Percent of crashes
Banyule	1	<1
Bayside	3	1
Boroondara	13	6
Brimbank	7	3
Cardinia	7	3
Casey	11	5
Frankston	6	3
Glen Eira	7	3
Greater Dandenong	13	6
Hobsons Bay	3	1
Hume	3	1
Kingston	7	3
Knox	6	3
Manningham	2	1
Maribyrnong	5	2
Melbourne	20	9
Melton	1	<1
Monash	11	5
Moonee Valley	5	2
Moreland	4	2
Mornington Peninsula	13	6
Nillumbik	5	2
Port Phillip	19	9
Stonnington	16	7
Whitehorse	13	6
Wyndham	4	2
Yarra	3	1
Yarra Ranges	14	6
Total	222	100

Table 4.8 shows that almost 80% of crashes occurred in urban areas and about 20% in rural areas. The land use adjacent to the crash site was most commonly urban residential (38%) or urban commercial (31%).

Table 4.8. Land use adjacent to the crash site.

Adjacent land use	Number of crashes	Percent of crashes
Urban residential	84	38
Urban commercial	68	31
Urban industrial	9	4
Urban parkland	14	6
Rural residential	17	8
Rural farmland	22	10
Rural forest	8	4
Total	222	100

4.3.2 Type of road

Almost half of the crashes occurred on major arterials (see Table 4.9). When a crash occurred at an intersection, the road type was coded with respect to the road on which the rider was travelling.

Table 4.9. Type of road on which the crash occurred.

Road type	Number of crashes	Percent of crashes
Freeway	16	7
Major arterial	105	47
Minor arterial	44	20
Collector	12	5
Local	37	17
Other	8	4
Total	222	100

The traffic flow was considered heavy at 28% of the crash locations, medium at 33% and light for 38% of the crash locations. The traffic flow estimate was unknown for three of the crash locations.

The speed limits at the crash sites are summarised in Table 4.10. Overall, 65% of the crashes occurred in 60 km/h speed zones.

Table 4.10. Speed limit at the crash site.

Speed limit (km/h)	Number of crashes	Percent of crashes
60	144	65
70	10	5
80	26	12
100	35	16
Unknown	7	3
Total	222	100

4.3.3 Road geometry

More than two-thirds of the crashes occurred on curves (70%).

The crashes were roughly evenly divided between intersection and mid-block locations (see Table 4.11). Overall, 53% of the multi-vehicle crashes were found to occur at intersections compared with 42% of single vehicle crashes.

Table 4.11. Type of intersection at the crash site.

Intersection type	Number of crashes	Percent of crashes
Not an intersection	113	51
X-intersection	47	21
Y-intersection	10	5
T-intersection	44	20
Multi-leg intersection	8	4
Total	222	100

More than 60% of crashes occurred on two way undivided roads, followed by 24% on divided roads without service roads (see Table 4.12).

Table 4.12. Road configuration at the crash site.

Road configuration	Number of crashes	Percent of crashes
One way	8	4
Two way undivided	142	64
Two way undivided with service roads	2	1
Divided road without service roads	53	24
Divided road with service roads	17	8
Total	222	100

4.3.4 Road furniture

There was no median at 138 of the crash sites (see Table 4.13). Of the 84 crash locations where a median was present, 63% were paved, gravel or low level landscapes, with or without trees.

At 16 crash sites there was an outer separator present, which comprised paved or gravel or low level landscaping with or without trees. Barrier kerbing was present at almost 70% of the crash locations (see Table 4.14).

There was a side drain present for approximately 50% of crashes which was navigable for about three quarters of these cases.

Table 4.13. Type of median at the crash site.

Median type	Number of crashes	Percent of crashes
No median	138	62
Painted	4	2
Paved, gravel or low level landscape	28	13
Paved, gravel or low level landscape with trees	25	11
Physical barrier	11	5
Tram safety zone	7	3
Other	9	4
Total	222	100

Table 4.14. Type of kerbing at the crash site.

Kerb type	Number of crashes	Percent of crashes
No kerbing	49	22
Mountable kerb	20	9
Barrier kerb	151	68
Unknown	2	1
Total	222	100

4.3.5 Traffic controls and local area traffic management devices

There were no traffic controls present at 55% of all sites - 15% of intersection sites and 74% of midblock sites (see Table 4.15). The most common traffic controls were traffic control signals (22%) and Give Way signs (17%).

There were very few local area traffic management devices at the crash sites (see Table 4.16). Such devices were present at only seven crash locations. Roundabouts were present at five crash sites and speed humps at two.

Table 4.15. Traffic controls at the crash site. More than one possible per site.

Traffic controls present	Number of crashes	Percent of crashes
None	122	55
Stop sign	29	13
Give Way sign	38	17
Roundabout	8	4
Double unbroken lines	3	1
Flashing sign	3	1
Traffic control signals	49	22
Railway crossing	1	<1
Pedestrian crossing	9	4
School crossing	1	<1

Police officer or road worker	0	0
Warning signal	19	9
Road closure barriers	1	<1

Table 4.16. Local area traffic management devices at the crash site. More than one possible per site.

Local area traffic management devices	Number of crashes	Percent of crashes
Speed humps	2	1
Raised pavements	0	0
Chicanes/slow points	0	0
Threshold treatments	0	0
Roundabouts	5	2

4.3.6 The road surface

The surface material of the road pavement at the crash site was asphalt for 96% of the crashes. The remaining crashes occurred on gravel (four crashes), chip seal (four crashes) slick bitumen (one crash) and dirt (one crash). In 73% of cases, the surface coarseness of the road pavement was coded as “medium” (17% coarse, 10% fine). The surface cleanness of the road pavement is summarised in Table 4.17. At approximately a quarter of the crash sites the road was not clean (59 crashes).

There were surface irregularities at a considerable number of crash sites (see Table 4.18). The most common were deformed pavement (24%) and sudden change in road surface (24%).

Table 4.17. Surface cleanness of the road pavement.

Surface cleanness	Number of crashes	Percent of crashes
Clean	163	73
Muddy	6	3
Oily	18	8
Loose material	35	16
Total	222	100

Table 4.18. Surface irregularities at the crash site. More than one possible per site.

Surface irregularity	Number of crashes	Percent of crashes
Potholes	32	14
Pitlids	38	17
Deformed pavement	54	24
Poor pavement integrity	33	15
Sudden change in road surface	53	24

There was no shoulder at 65% of the crash sites (see Table 4.19). Where there was a shoulder, the surface material was most commonly asphalt (15% of all crashes) and gravel/crushed rock (13%).

Table 4.19. Surface material of the road shoulder.

Surface material	Number of crashes	Percent of crashes
No shoulder	145	65
Gravel or crushed rock	29	13
Asphalt	34	15
Slick bitumen or chip seal	14	6
Total	222	100

4.3.7 Delineation

The number of lanes in both directions at the crash site was recorded. Table 4.20 shows that the number of lanes varied from one (one-way city lane and narrow dirt roads) to nine. Almost half of the crash sites comprised two-lane roads (49%) and more than 20% of crash sites comprised four lane roads (ie: two lanes travelling in either direction).

Table 4.20. Number of lanes at the crash site.

Number of lanes	Number of crashes	Percent of crashes
1	4	2
2	109	49
3	9	4
4	46	21
5	16	7
6	17	8
7	8	4
8	11	5
9	2	1
Total	222	100

At 81% of the crash sites, the number of lanes was not changing. At 19 crash locations there was a turn slot in the median opening. The remaining sites were a mixture of types of lane configuration with no particular type predominating (see Table 4.21).

Table 4.21. Lane configuration at the crash site.

Lane configuration	Number of crashes	Percent of crashes
Number of lanes not changing	179	81
Loss of lanes due to merging	3	1
Exit lane	7	3
Merging - entry lane	8	4
Turn slot in median opening	19	9
Tram lines and stops or safety zones	6	3
Total	222	100

Table 4.22 shows that the road markings at the crash site were mostly thermoplastic and paint (47% and 37%).

Table 4.22. Type of road markings at the crash site..

Road markings	Number of crashes	Percent of crashes
No markings	27	12
Paint	83	37
Thermoplastic	104	47
Raised reflective pavement markings	8	4
Total	222	100

4.3.8 Roadside objects

The most common roadside objects at crash sites were poles (83%), kerbs (76%) and trees (67%) (see Table 4.23).

Table 4.23. Roadside objects at the crash site. More than one possible per site.

Roadside object	Number of crashes	Percent of crashes
Kerb	168	76
Pole	184	83
Tree	149	67
Fence	81	37
Guard rail	15	7
Building	39	18
Railway crossing	0	0
Bridge abutment	2	1
Culvert end walls	12	5
Other object	43	19

4.3.9 Site inspections

Each crash site was ridden through by an experienced motorcyclist and a report prepared on the characteristics of the crash site which may have contributed to the crash.

There was no evidence of braking at 85% of the sites inspected. The most common marks were straight skids (5%) and rear tyre hooked skids (3%). Debris were identified at 65 crash sites (29%). The debris were most commonly broken glass or broken pieces of plastic bodywork from the motorcycle.

4.4 ENVIRONMENTAL FACTORS

About two-thirds of the crashes occurred when the weather was fine and an additional 14% of crashes occurred when it was cloudy or overcast (see Table 4.24). Almost nine percent of crashes occurred while it was raining. Anecdotal observations made when recruiting controls supported the widely-held view that little riding occurs when it is wet.

Table 4.24. Weather at the time of the crash.

Weather conditions	Number of crashes	Percent of crashes
Fine	149	67
Cloudy or overcast	30	14
Light rain or drizzle	14	6
Heavy rain	5	2
Fog	3	1
Unknown	21	9
Total	222	100

Table 4.25 shows that 28% of crashes occurred under difficult lighting conditions (glare, dusk or dawn, night-time). It was overcast at 17% of crash sites. Almost 40% of the crashes took place where there were no street lights. The street lights were on for almost 20% of the crashes (see Table 4.26).

Table 4.25. Light conditions at the time of the crash.

Light conditions	Number of crashes	Percent of crashes
Sunny	106	48
Glare	3	1
Overcast or cloudy	38	17
Dusk or dawn	11	5
Night-time	47	21
Other	3	1
Unknown	14	6
Total	222	100

Table 4.26. Street lighting at the time of the crash.

Street lighting	Number of crashes	Percent of crashes
No street lights	86	39
Street lights on	43	19
Street lights off	67	30
Unknown	26	12
Total	222	100

At the site inspection, it was judged that glare from the sun could reduce visibility at 13% of sites. Pavement reflection of artificial lighting was considered to have been a possible problem at four sites (2%). Glare from oncoming headlights was judged to have been a possible problem at 17 sites (8%).

4.5 CRASH TYPES

Crashes were coded as single vehicle crashes if no vehicle other than the motorcycle was involved. Those crashes which involved another vehicle, either moving or stationary, whether or not there was a collision between the motorcycle and that vehicle, were coded as multi-vehicle crashes. For example, a crash in which a motorcycle managed to avoid a collision with a car approaching from a side street and finally collided with a tree would be coded as a two-vehicle crash despite the lack of impact between the motorcycle and the car.

About 60% of the crashes involved two vehicles (ie: the motorcyclist and another vehicle) (see Table 4.27). Close to one third of the total crashes were single-vehicle crashes. Only 5.9% of crashes involved more than two vehicles. The fatal crashes appeared to be somewhat more likely to involve more than one vehicle than the injury crashes (75% vs 67%) but this difference was not statistically significant ($\chi^2(1)=0.7$, $p>.05$).

Table 4.27. Percentages of injury and fatal crashes according to the number of vehicles involved.

Number of vehicles	Injury crashes (n=198)	Fatal crashes (n=24)	All crashes (n=222)
One	33	25	32
Two	60	71	61
Three	5	4	5
Four	1	0	1
Unknown	1	0	1
Total	100	100	100

More than two-thirds of the crashes involved impacts with objects or vehicles (see Table 4.28). The most commonly involved object was a moving car (108 crashes - see Table 4.29). Seven additional crashes resulted from the rider falling off while trying to avoid an impact. Overall, 27% of crashes resulted from a loss of control for any other reason.

Table 4.28. Percentages for injury and fatal crashes according to crash type.

Crash type	Injury crashes (n=198)	Fatal crashes (n=24)	All crashes (n=222)
Impact with object or vehicle	69	67	69
Fell off trying to avoid impact	3	4	3
Loss of control - any other reason	28	21	27
Unknown	<1	8	1
Total	100	100	100

Table 4.29. Type of object hit or swerved to avoid hitting. Includes only crashes where there was impact with object or vehicle or fell off trying to avoid impact.

Type of object	Single vehicle		Multi-vehicle	
	Impact with object or vehicle	Fell off trying to avoid impact	Impact with object or vehicle	Fell off trying to avoid impact
Parked or stationary vehicle			18	2
Animal	3			
Pedestrian	1			
Another motorcycle			1	
Moving car			105	3
Moving light commercial vehicle			6	
Bus or heavy truck			5	
Pole or tree	3	1		
Kerb	1			
Other	6			
Unknown	1	1	3	
Total	15	2	138	5

4.5.1 Comparison of single and multi-vehicle crashes

There was a greater involvement of alcohol in single vehicle than multi-vehicle crashes. The rider had a BAC of greater than zero in 31% of single vehicle crashes, compared with 15% of multi-vehicle crashes. The rider had a BAC of greater than .05 in 26% of single vehicle crashes, compared with 10% of multi-vehicle crashes.

There was no clear difference in the percentages of single and multi-vehicle crashes according to the day of week of occurrence (see Table 4.30, $\chi^2(6)=10.6$, $p>.05$). Similar percentages of single and multi-vehicle crashes occurred on weekends.

The time of day pattern of single and multi-vehicle crashes differed significantly ($\chi^2(3)=13.1$, $p<.05$). Table 4.31 shows that proportionally more single vehicle crashes occurred between midnight and 6 am and fewer between 6 am and noon.

Table 4.30. Percentages of single vehicle and multi-vehicle crashes according to the day of the week.

Day of week	Single vehicle crashes (n=72)	Multi-vehicle crashes (n=149)	All crashes (n=221)
Monday	18	10	13
Tuesday	13	9	10
Wednesday	13	16	15
Thursday	6	17	13
Friday	19	20	19
Saturday	13	17	16
Sunday	19	12	15
Weekdays	68	71	70
Weekends	32	29	30

Table 4.31. Percentages of single vehicle and multi-vehicle crashes according to the time of day.

Time of day	Single vehicle crashes (n=72)	Multi-vehicle crashes (n=149)	All crashes (n=221)
midnight to 6 am	15	3	7
6 am to noon	18	27	24
noon to 6 pm	42	42	42
6 pm to midnight	25	28	27

4.6 CONTRIBUTORY FACTORS TO CRASHES

The Motorcycle Consultant reviewed the cases and identified several common contributory factors to crashes: failure to respond, ineffective braking, inappropriate positioning and mechanical faults. For 94 crashes (42%) there was insufficient information available to judge whether any of these factor had contributed to the crash. Crashes were separately coded for whether excessive speed for the conditions had contributed to the crash. This was able to be coded for all crashes. Overall, 23% of crashes involved excessive speed for the conditions.

The contributory factors are summarised in Table 4.32. Ineffective braking was the most common contributor to crashes with excessive speed. In about one third of the crashes without excessive speed, the rider was judged not to have contributed to the crash. Mechanical faults contributed to about 10% to 12% of crashes.

Table 4.32. Rider contribution to crashes with and without excessive speed for the conditions. Percentages are of known.

Rider contribution to the crash	Crashes with excessive speed (n=10)	Crashes without excessive speed (n=118)	All crashes (n=128)
Failed to respond	0	19	17
Ineffective braking	60	16	20
Inappropriate positioning	30	20	20
Mechanical fault	10	12	12
No rider contribution	0	34	31

Excessive speed for the conditions was judged to have contributed to 35% of single vehicle crashes and 17% of multi-vehicle crashes. Thus it is not surprising that ineffective braking was the most common contributor to the occurrence of single vehicle crashes (see Table 4.33). The rider was judged to have contributed to about two-thirds of the multi-vehicle crashes, mainly by inappropriate positioning or failure to respond.

Table 4.33. Rider contribution to single and multi-vehicle crashes. Percentages are of known.

Rider contribution to the crash	Single vehicle crashes (n=29)	Multi-vehicle crashes (n=99)	All crashes (n=128)
Failed to respond	3	21	17
Ineffective braking	41	13	20
Inappropriate positioning	3	25	20
Mechanical fault	28	7	12
No rider contribution	24	33	31

Excessive speed was judged to have contributed to 48% of crashes where the rider BAC was greater than zero and 25% of crashes where the rider BAC was zero ($\chi^2(1)=6.2$, $p<.05$).

There may be some association between drink riding and poor mechanical condition of the motorcycle. In crashes where the rider had BAC>.000, mechanical fault was judged to contribute to 18% (2/11) of crashes. In contrast, mechanical fault was judged to contribute to only 7% (5/72) of crashes where the rider had BAC=.000 (see Table 4.34).

A similar pattern was found when the judgements of mechanical condition made during the motorcycle inspections were examined: where BAC=.000, 11% (10/94) of motorcycles were judged to be in poor or fair mechanical condition but this was found for 29% (6/21) of motorcycles inspected where BAC>.000. Where BAC was unknown, 13% (7/52) of motorcycles inspected were judged to be in poor or fair mechanical condition.

Table 4.34. Rider contribution to crashes with and without alcohol. Percentages are of known.

Rider contribution to the crash	BAC=.000 (n=72)	BAC>.000 (n=11)	All crashes with BAC known (n=83)
Failed to respond	14	9	13
Ineffective braking	21	9	19
Inappropriate positioning	25	46	28
Mechanical fault	7	18	8
No rider contribution	33	18	31

4.6.1 The role of braking in crashes of experienced and inexperienced riders

In order to examine the effect of rider inexperience, we defined inexperienced riders as those who had ridden on the road for less than three years or ride less than three days per week or ride less than 100 km per week. Of the 25 crashes in which ineffective braking played a role, information on rider experience was available for 17 crashes. Of these 17 crashes, 9 riders were inexperienced and 8 experienced. Overall 55% of crashed riders were inexperienced and 45% were experienced.

There is insufficient data to examine separately the role of braking in single and multi-vehicle crashes of experienced and inexperienced riders.

4.6.2 Judged contributory factors and rider attributions of fault

Table 4.35 shows that half of the riders judged that the other person was at fault in the crash. One-quarter of the riders judged that they were solely at fault. In single vehicle crashes, almost half of the riders judged that they were at fault. Only 14% of riders in multi-vehicle crashes judged that they were solely at fault.

Table 4.35. Rider judgements of who was at fault in single and multi-vehicle crashes. Percentages are of riders interviewed.

At fault	Single vehicle crashes (n=66)	Multi-vehicle crashes (n=130)	All crashes (n=196)
No-one	32	2	12
Rider	47	14	25
Other person	11	70	50
Both parties	0	6	4
Don't know	11	8	9

Table 4.36 compares the percentages of riders who judged themselves to be at fault with the contributory factors to the crash as judged by the Motorcycle Consultant. In single vehicle crashes, riders were more likely to judge themselves to be at fault in crashes which

involved ineffective braking or a mechanical fault. In multi-vehicle crashes, riders were again unlikely to consider themselves at fault in crashes involving failure to respond.

Table 4.36. Percent of riders who judged themselves to be at fault in single and multi-vehicle crashes according to judged rider contribution to the crash. Percentages are of known.

Rider contribution to the crash	Single vehicle crashes (n=28)	Multi-vehicle crashes (n=87)	All crashes (n=115)
Failed to respond	0	5	5
Ineffective braking	58	14	38
Inappropriate positioning	0	22	24
Mechanical fault	57	17	24
No rider contribution	14	3	10

4.7 MOTORCYCLE INSPECTIONS

Of the 222 motorcycles involved in crashes, 167 were able to be inspected (75%). Table 4.37 shows that the distribution of makes of motorcycles inspected was similar to that of the complete crash sample.

Table 4.37. Percentages of make of motorcycle inspected and all motorcycles involved in the crashes.

Make	Inspected (n=167)	Crashed (n=222)
BMW	4	3
Ducati	1	<1
Griffin	0	<1
Harley Davidson	10	9
Honda	23	23
Kawasaki	25	25
KTM	1	<1
Moto Guzzi	1	1
Norton	1	<1
Suzuki	20	21
Triumph	0	1
Yamaha	16	15
Unknown	0	<1
Total	100	100

The odometer readings are summarised in Table 4.38. More than 70% of the motorcycles had odometer readings of 10,000 kms or more, but 15% were relatively new, having travelled less than 5,000 kms.

Overall, 69% of the motorcycles inspected had a current registration label. For four motorcycles, it was not possible to see whether there was a current registration label.

Table 4.38. Odometer readings of the crashed motorcycles inspected.

Odometer reading	Number of motorcycles	Percent of motorcycles
Less than 100 kms	2	1
100-999 kms	4	2
1000-4999 kms	19	11
5000-9999 kms	10	6
10000 kms or more	120	72
No odometer	10	6
Unknown	2	1
Total	167	100

The dirtiness and amount of rust of the motorcycles was assessed to provide an indication of the degree to which the motorcycle had been well cared for. Overall, just under 60% of the motorcycles inspected were clean and more than 20% were so dirty that it was considered that they were not well cared for (see Table 4.39). Forty-four (26%) of the motorcycles inspected showed signs of rust.

Table 4.39. State of cleanliness of the crashed motorcycles inspected.

State of cleanliness	Number of motorcycles	Percent of motorcycles
Clean	98	59
Light dirt only	28	17
Dirty	36	22
Dirty from crash	2	1
Unknown	3	2
Total	167	100

The inspectors found that it was possible to judge the mechanical condition prior to the crash of all but six (4%) of the motorcycles (see Table 4.40). They judged that 39% of the motorcycles inspected were in poor or fair condition prior to the crash, 37% were in good condition and 21% were judged to be in excellent condition prior to the crash. Several of the motorcycles which were judged to have been in excellent condition prior to the crash were almost new.

State of cleanliness and mechanical condition appeared to be related. Almost all of the clean motorcycles were judged to be in good or excellent mechanical condition. The dirty motorcycles ranged from poor to good mechanical condition. Most of the motorcycles in poor mechanical condition were dirty. Often leakage of oil and other fluids had contributed to the build-up of grime on these motorcycles.

Table 4.40. Mechanical condition of the crashed motorcycles inspected.

Mechanical condition before crash	Number of motorcycles	Percent of motorcycles
Poor	17	10
Fair	48	29
Good	61	37
Excellent	35	21
Unknown	6	4
Total	167	100

Approximately 60% of the motorcycles inspected had dents or scratches on their petrol tanks. Just over a third of the motorcycles inspected were found to have the correct tyre pressure. Approximately a quarter of the motorcycles inspected had under-inflated front or rear tyres (see Table 4.41).

Table 4.41. Percentages of crashed motorcycles inspected according to tyre pressures.

Tyre pressure	Front (n=167)	Rear (n=167)
Deflated due to crash	7	4
Under-inflated	27	25
Correct pressure	34	39
Overinflated	3	3
Unknown	29	29
Total	100	100

The head and tail lights, indicators and brake lights were examined. Table 4.42 shows that all lights were still functioning after the crash for approximately 50% of the motorcycles inspected. Further it was established that the lights were functioning prior to the crash for a further 9% of the motorcycles inspected. All lights were broken in only 3% of the motorcycles.

Table 4.42. Condition of the lights of the crashed motorcycles inspected.

Condition of the lights	Number of motorcycles	Percent of motorcycles
All lights functioning	86	51
All lights functioning prior to crash	15	9
All broken	5	3
Indicator(s) only broken	14	8
Some damage to lights	26	16
Not fitted	13	8
Unknown	8	5
Total	167	100

The steering was not damaged for approximately two-thirds of the motorcycles inspected (see Table 4.43). In two of the crashes there was evidence that there may have been steering problems prior to or contributing to the crash, however in one case this could not be ascertained due to the extent of crash damage. In total, 14 motorcycles were found to have defective steering, however it was not known whether this was due to crash damage or to a pre-existing problem. Ten of the motorcycles were damaged so that assessment of the steering was not possible.

Table 4.43. Condition of the steering of the crashed motorcycles inspected.

Condition of the steering	Number of motorcycles	Percent of motorcycles
Good	113	68
Damaged - good before crash	29	17
Damaged - possible problem before crash	2	1
Damaged - unclear before crash	1	1
Damaged beyond assessment	1	1
Defective	14	8
Unknown	7	4
Total	167	100

The condition of the drivetrain was good for approximately 60% of the motorcycles inspected (see Table 4.44). In almost a quarter of the cases, however, there was evidence of a worn or loose chain.

Table 4.44. Condition of the drivetrain of the crashed motorcycles inspected.

Condition of the drivetrain	Number of motorcycles	Percent of motorcycles
Good	103	62
Worn or loose chain	41	25
Damaged in crash	1	1
Not applicable - shaft drive	19	11
Unknown	3	2
Total	167	100

Approximately 15% of the motorcycles inspected had brakes in poor condition (front 16% and rear, 18%) (see Table 4.45). The most common problem with the brakes was insufficient pad thickness (2 mm or less).

About two thirds of the motorcycles inspected were observed to be free of oil leakage. Oil leaks were identified for 51 motorcycles (31%), but it was unclear the extent to which the leaks preceded the crash.

Table 4.45. Percentages of crashed motorcycles inspected according to the condition of the brakes.

Condition of the brakes	Front (n=167)	Rear (n=167)
Good	82	78
Insufficient pad thickness	11	15
Poorly adjusted, too much travel	1	1
Damaged in crash	4	2
Unknown	2	4
Total	100	100

In total, 92% of the motorcycles inspected had road tyres. Only six of the motorcycles inspected had off-road tyres (4%) and seven had combination tyres (4%). Table 4.46 shows that problems with tyre tread were more common for rear tyres (19%) than front tyres (7%).

Table 4.46. Percentages of crashed motorcycles inspected according to the condition of the tyres.

Condition of the tyres	Front (n=167)	Rear (n=167)
Little sign of wear	46	44
Tread somewhat worn	44	35
Tread badly worn	7	14
Bald	1	5
Unknown	3	1
Total	100	100

4.8 HELMET INSPECTIONS

An attempt was made to inspect the helmets of both riders and pillions. In total, 145 helmets were inspected, 138 belonging to riders and seven belonging to pillions. Of the 145 helmets inspected, 121 were full-face helmets (83%) and 24 were open face helmets (17%). The main colours of the helmets are summarised in Table 4.47. Over 50% of the helmets inspected were black or "dark". Just over 20% of the helmets inspected were white or light in colour. Of the 104 visors available to be inspected, 20 (19%) were tinted.

The helmets comprised a wide variety of brands (see Table 4.48), the most common being AGV (29%), Shoei (24%) and Nolan (10%). Three of the helmets (2%) inspected did not carry an ASA 1698 approval sticker. Two of these (an FM helmet manufactured in 1990 and an HGP EXR manufactured in 1995) are ASA approved but the sticker had fallen off or been removed. The other helmet was a Bell Dot manufactured in 1996 which complies with US standards.

Table 4.47. Colours of the helmets inspected.

Main colours	Number of helmets	Percent of helmets
Black	52	36
Dark (inc black with other colours)	26	18
Red or purple	13	9
Blue	10	7
White	30	21
Light	3	2
Multi-coloured	11	8
Total	145	100

Table 4.48. Brands of the helmets inspected.

Brand	Number of helmets	Percent of helmets
AGV	42	29
Arai	10	7
AXO	1	1
Bell	2	1
Bieffe	4	3
BMW	1	1
Boeri	2	1
FM	5	3
GP	2	1
HGP	8	6
HJG	1	1
Kiwi	3	2
Lazer	4	3
MHG	2	1
Nava	1	1
Nolan	15	10
Shoei	35	24
THM	3	2
Unknown	4	3
Total	145	100

The inspectors were able to identify the year of the helmets manufacture for 137 of the 145 helmets inspected. Of these, the average age of the helmets inspected was found to be four years (calculated from 1996). Overall, seven of the helmets inspected were more than ten years old (see Table 4.49). Approximately 15% were more than five years old so may no longer have been performing optimally.

Of the 145 helmets inspected, 120 (83%) had obvious signs of damage. These included chips and scratches (113), damage to the chin bar (5), fractures (6) and visor detached (9). The interior padding was visibly worn or compressed for 63 helmets (43.4%). The chin bar of two AGV helmets fractured.

Overall, thirty-one (21%) of the helmets had stickers other than the ASA sticker. In total three helmets had been painted.

Table 4.49. Year of manufacture of the helmets inspected.

Year of manufacture	Number of helmets	Percent of helmets
Pre-1981	1	1
1981-1985	6	4
1986-1990	16	11
1991-1996	114	79
Unknown	8	6
Total	145	100

5. INJURIES TO MOTORCYCLISTS IN CRASHES

The Research Nurses recorded and coded the motorcyclist's injuries from the medical record at the treating hospital. Thus the injury information relates only to non-fatal crashes. There were 200 riders and 19 pillions involved in non-fatal crashes and 22 riders and 3 pillions in fatal crashes. The injury scales used in coding are described in the section which follows.

5.1 INJURY SCALES

The Abbreviated Injury Scale (AIS) is a consensus derived, anatomically based system that classifies individual injuries by body region on a six-point severity scale ranging from AIS 1 (minor) to AIS 6 (currently untreatable). Over 2000 injury descriptions are included for coding in the 1990 revision of the AIS manual. The AIS does not assess the combined effects of multiple injuries (AAAM, 1990).

The maximum AIS (MAIS), which is the highest single AIS code in a patient with multiple injuries, has been used by investigators to describe overall severity. Its usefulness remains important in motor vehicle injury research concerned with vehicle design changes. The MAIS value is not a good predictor of death as this outcome also depends on the AIS value for the second most severe injury.

The Injury Severity Score (ISS) developed by Baker, O'Neill, Haddon and Long (1974) is a mathematically derived code number determined by adding the squares of the highest possible AIS codes in each of the three most severely injured body regions. An ISS of 75 is the highest possible. Persons with an injury coded AIS 6 are automatically assigned an ISS of 75. It should be noted that a major limitation of the ISS is that it only recognises one severe injury for each body region. For example, a person with fractures in both legs has the same ISS as a person with a fracture in only one leg.

5.2 INJURY SEVERITY SCORES

In general, the injury severity scores were not normally distributed (or truly continuous) so nonparametric tests were used in the analyses.

The ISS values ranged from 1 to 69 with a median of 9. The criterion initially set for a crash to be included in the study was that a rider or pillion from the crash was admitted to hospital or presented to the Emergency Department with injuries of ISS 5 or above. Of the 19 motorcyclists with ISS<5, three were included because the other person on the motorcycle met the criteria for inclusion in the study (by being admitted or being a presentation with ISS>=5) and 10 were admitted with an ISS of less than 5. Six of the 19 motorcyclists were presentations who were judged to have had an ISS of at least 5 when interviewed by telephone but examination of the medical record afterward showed that the ISS was lower than 5 (mostly ISS=4).

The ISS for admissions ranged from 1 to 69, with a median value of 10. The ISS for presentations ranged from 1 to 21, with a median value of 5. A Mann-Whitney U test showed that the ISS for admissions was significantly greater than that for presentations (z=-4.9, p<.01).

5.3 INJURY PATTERNS

This section describes the frequency and severity of injuries to the six body regions defined by the AIS coding system.

Table 5.1 shows that most motorcyclists had external injuries (abrasions, contusions or lacerations) or injuries to the extremities (upper or lower limbs). Multiple injuries to these body regions were also common. The head was the next most commonly injured body region but most motorcyclists with head injuries had only one injury to that region.

Table 5.1. Number of injuries to each body region and number of motorcyclists with injuries in each body region.

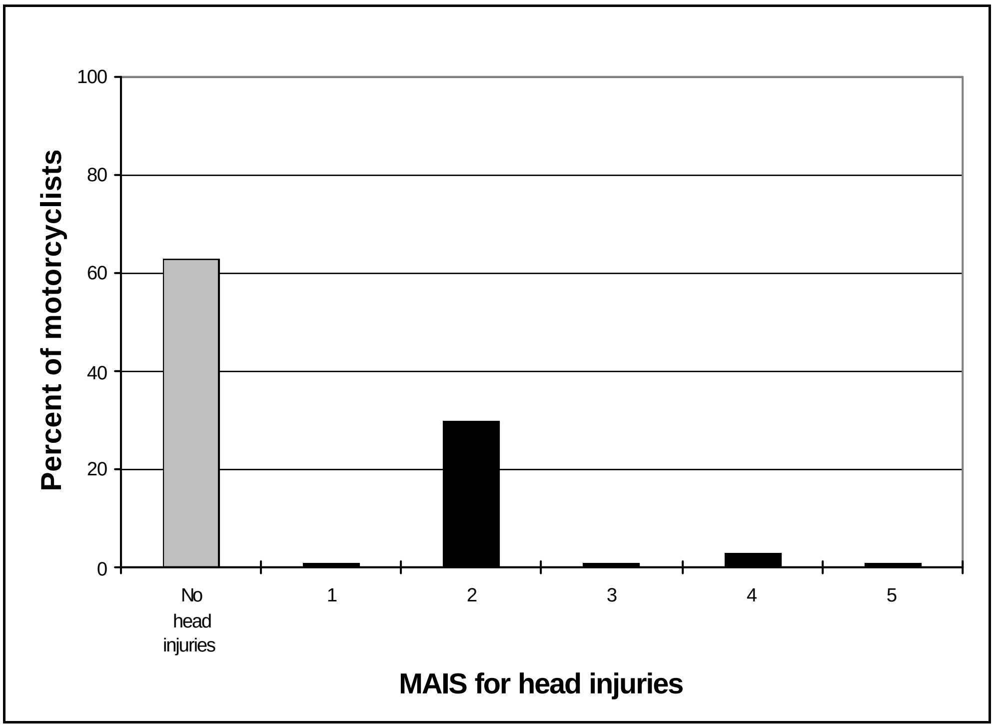
Body Region	Number of injuries to this body region			Number of motorcyclists with injury to this region
	One	Two	More than two	
Head	60	14	3	77
Face	7	2	1	10
Chest	19	8	2	29
Abdomen	16	4	3	23
Extremities	66	51	43	160
External	67	60	57	184

Figures 5.1 to 5.6 summarise the data for each of the six body regions. The figures show the percentages of motorcyclists who had no injury to that body region and the distribution of maximum AIS score (MAIS) for the motorcyclists who sustained an injury to that body region.

More than 60% of injured motorcyclists did not have head injuries (see Figure 5.1). Of those who had head injuries, the median MAIS was 2. About 10% of those with head injuries (4% of all injured motorcyclists) had MAIS of 4 or 5, indicating very severe injuries.

There were five motorcyclists not wearing helmets, none of whom were killed. Three of these riders sustained head injuries: all three had loss of consciousness for less than one hour (AIS 2) and one had a frontal lobe haemorrhage (AIS 4).

Figure 5.1. Body region 1: Head. Percentages of motorcyclists with no head injuries and percentages with head injuries at each level of Maximum Abbreviated Injury Scale (MAIS). Motorcyclists from nonfatal crashes only.



Facial injuries were relatively uncommon, with 95% of drivers having no injuries in this body region (see Figure 5.2). The median MAIS for those with facial injuries was 2. Injuries to the face appeared to be more common to those wearing open faced helmets than full face helmets (8% versus 4%) but this difference was not statistically significant ($z=-0.92$, $p>.05$).

Less than 15% of motorcyclists had chest injuries (see Figure 5.3). The median MAIS was 3, however, indicating that chest injuries, when they occurred, were relatively severe. Abdominal injuries were sustained by only 11% of motorcyclists, with a median MAIS of 2 (see Figure 5.4).

Injuries to the extremities (upper and lower limbs) were sustained by more than three-quarters of the motorcyclists (see Figure 5.5). Overall, 44% of motorcyclists in non-fatal crashes had upper limb injuries and 57% had lower limb injuries.

The median MAIS for extremities was 2, with no values of greater than 3. Thus, injuries to the extremities appear to be common but not life-threatening.

The nature of the injuries to the upper and lower limbs are summarised in Tables 5.2 and 5.3, respectively.

Figure 5.2. Body region 2: Face. Percentage of injured motorcyclists with no facial injuries and percentages with facial injuries at each level of Maximum Abbreviated Injury Scale (MAIS). Motorcyclists from nonfatal crashes only.

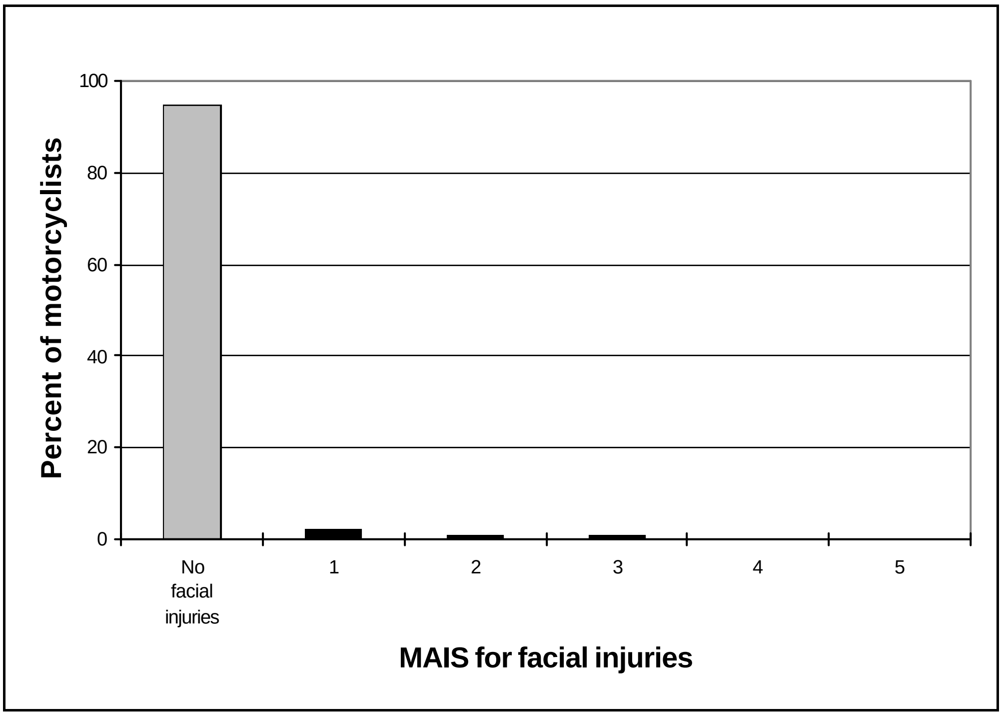


Figure 5.3. Body region 3: Chest. Percentage of injured motorcyclists with no chest injuries and percentages with chest injuries at each level of Maximum Abbreviated Injury Scale (MAIS). Motorcyclists from nonfatal crashes only.

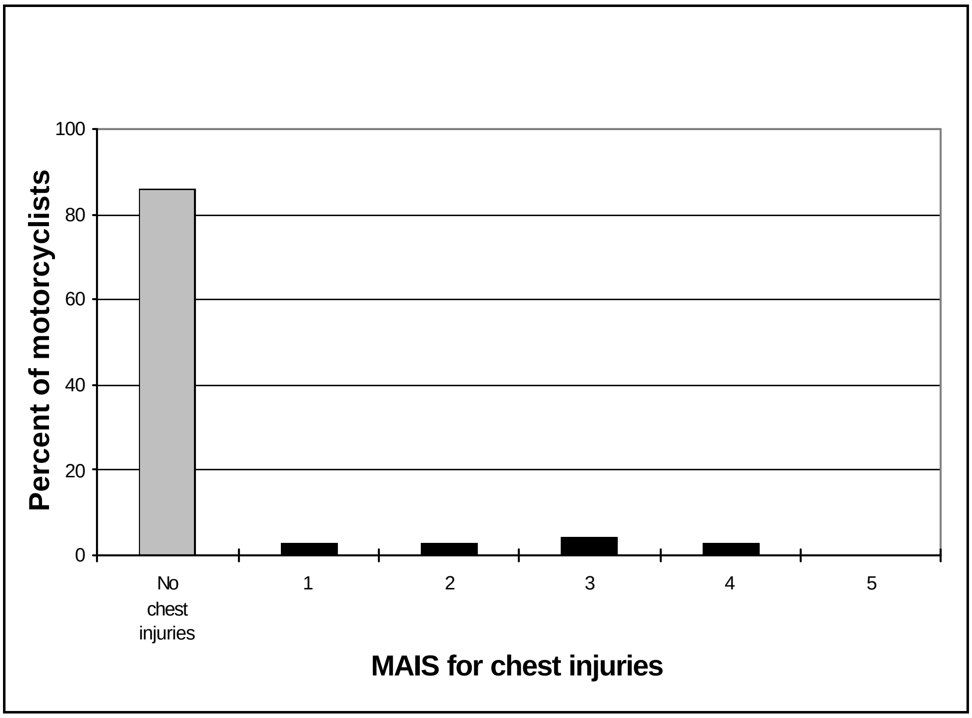


Figure 5.4. Body region 4: Abdomen. Percentage of injured motorcyclists with no abdominal injuries and percentages with abdominal injuries at each level of Maximum Abbreviated Injury Scale (MAIS). Motorcyclists from nonfatal crashes only.

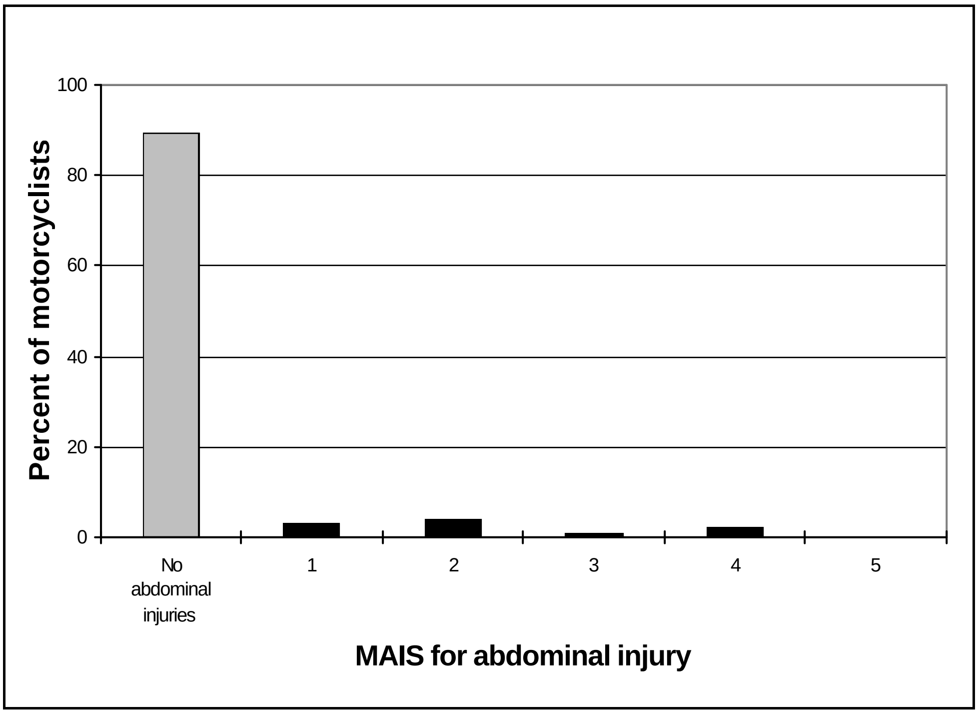


Figure 5.5. Body region 5: Extremities. Percentage of injured motorcyclists with no injuries to extremities and percentages with injuries to extremities at each level of Maximum Abbreviated Injury Scale (MAIS). Motorcyclists from nonfatal crashes only.

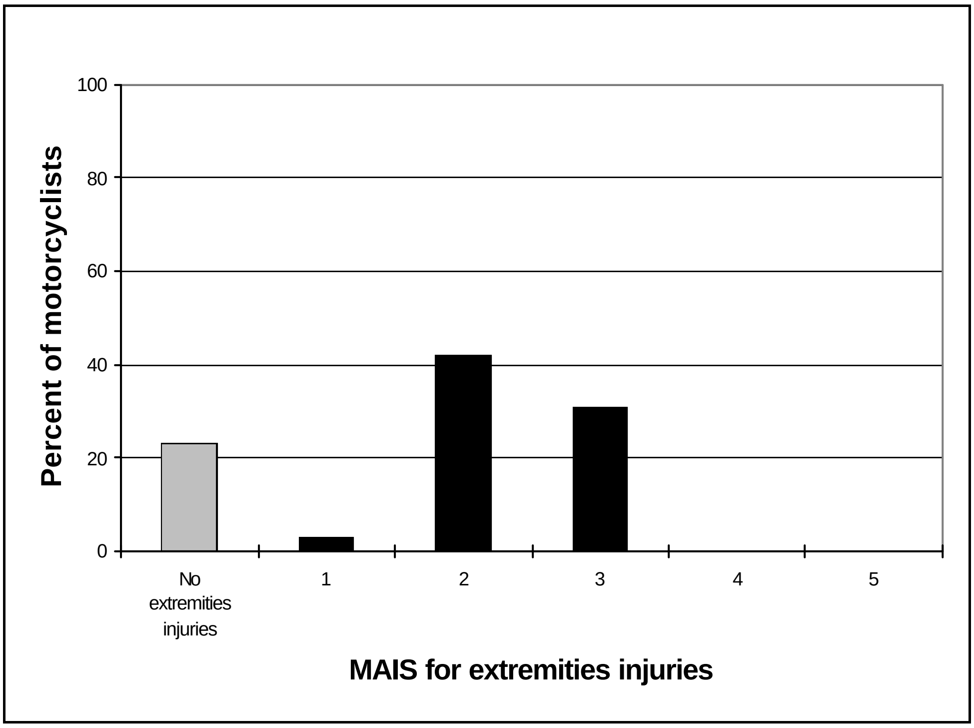


Table 5.2. Summary of injuries to the upper limb sustained in the motorcycle crashes.

Type of upper limb injury	Number injured	Percent of those motorcyclists with upper limb injuries	Percent of all injured motorcyclists
Fracture of forearm	35	38	17
Fracture of humerus	9	10	4
Fracture of scapula	10	11	5
Fracture of clavicle	14	15	7
Finger fracture	17	18	8
Partial/full hand amputation	0	0	0
Partial/full arm amputation	0	0	0
External injury (AIS >=2)	10	11	5
Fracture of hand/wrist	16	17	8
Other	9	10	4

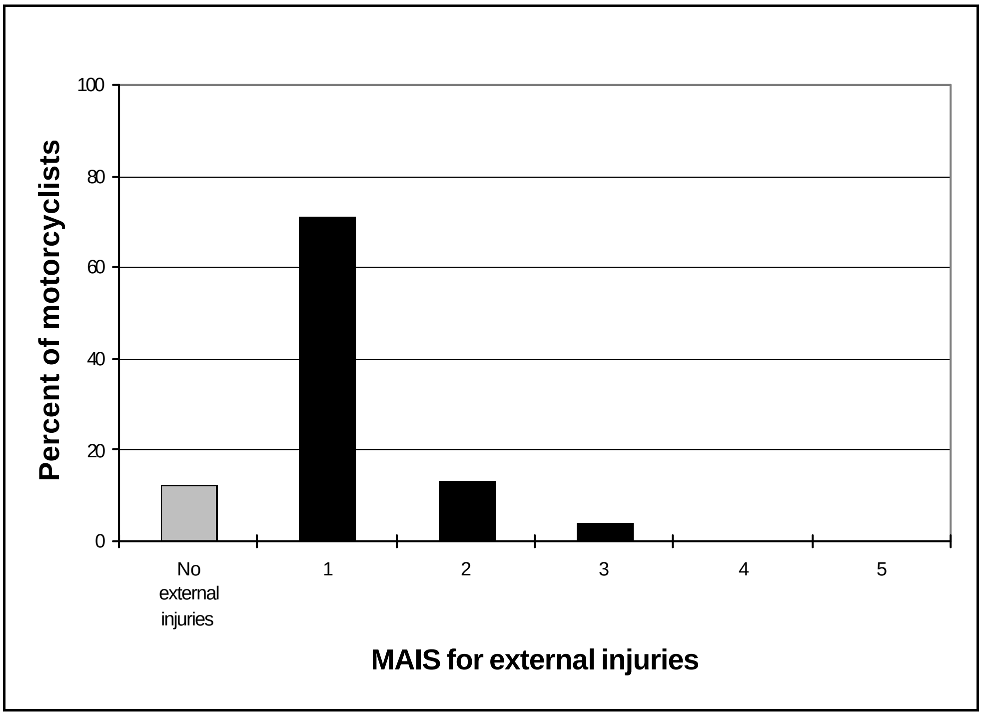
Table 5.3. Summary of injuries to the lower limb sustained in the motorcycles crashes.

Type of lower limb injury	Number injured	Percent of those motorcyclists with lower limb injuries	Percent of all injured motorcyclists
Fractured femur	29	24	14
Fractured pelvis	12	10	6
Fracture of knee or lower leg	58	49	28
Fractured foot/ankle	16	13	8
Fractured toe	11	9	5
Toe amputation	1	1	<1
Partial/full foot amputation	1	1	<1
Partial/full leg amputation	0	0	0
External injury (AIS >=2)	21	18	10
Other	25	21	12

The most common upper limb injury was a fracture of the forearm - 38% of motorcyclists with upper limb injuries and 17% of all motorcyclists in non-fatal crashes sustained this injury. A fracture of the knee or lower leg was the most common lower limb injury, sustained by 49% of motorcyclists with lower limb injuries and 28% of all injured motorcyclists.

External injuries were common, being found in about 88% of injured motorcyclists (see Figure 5.6). The median MAIS was only 1, however, indicating that most external injuries are minor abrasions, lacerations and contusions.

Figure 5.6. Body region 6: External. Percentage of injured motorcyclists with no external injuries and percentages with each level of Maximum Abbreviated Injury Scale. Motorcyclists from nonfatal crashes only.



5.4 INJURIES BY CRASH CHARACTERISTICS

5.4.1 Riders and pillions

The injury data presented thus far in this chapter has included both riders and pillions. This section compares the extent of injuries to riders and pillions.

For all riders in non-fatal crashes, the ISS ranged from 1 to 69 with a median of 9 (n=197). The ISS value was missing for one rider. The one rider who was uninjured (did not attend hospital) had an ISS of 1.

The ISS was available for 12 of the 19 pillions in non-fatal crashes. The ISS for these pillions ranged from 1 to 13 with a median of 7. A Mann-Whitney U test showed that there was no significant difference between the median ISS scores of riders and pillions in non-fatal crashes (z=1.8, p=.07).

It could be argued, however, that crashes in which pillions are involved differ from those without pillions and that a truer comparison would be of the riders and pillions from the same crashes. Table 5.4 presents a comparison of the injury status of riders and pillions from the same crashes. In non-fatal crashes it was unusual for the injury status of the pillion to be more severe than the rider. For the small number of fatal crashes, there was little evidence that pillions were injured less severely than riders.

Table 5.4. Comparison of the injury status of riders and pillions from the same crashes.

Injury status		Number of crashes	Percent of pillion crashes
Riders	Pillions		
Non-fatal crashes			
Admitted	Admitted	10	43
Admitted	Presentation	2	9
Admitted	Not admitted	3	13
Admitted	Unknown	1	4
Presentation	Admitted	1	4
Presentation	Presentation	1	4
Not admitted	Admitted	1	4
Fatal crashes			
Killed	Killed	1	4
Killed	Admitted	1	4
Admitted	Killed	1	4
Presentation	Killed	1	4

Of the 19 non-fatal crashes involving riders and pillions, ISS was known for both rider and pillion for 12 crashes, for the rider only for 6 crashes and for the pillion only for one crash. The rider ISS (where it was known) ranged from 1 to 19, with a median of 7.5. The pillion ISS ranged from 1 to 13, with a median of 5.0. If cases where ISS was missing and it was known that the rider or pillion was uninjured are coded with ISS=0 (3 pillions), then the comparison of injury severity of the rider and pillion can be made for 15 crashes. For these 15 crashes, the median ISS for riders is 10 and that for pillions remains at 5. From this small sample, there is a suggestion but no clear indication that pillions are injured somewhat less severely than riders in the same, non-fatal crashes.

5.4.2 Single and multi-vehicle crashes

Overall, one-third of the non-fatal crashes in the study were single-vehicle crashes and two-thirds were multi-vehicle crashes. The injury severities of these two types of crashes were similar. The ISS for single-vehicle crashes ranged from 1 to 40, with a median of 9. The ISS for multi-vehicle crashes ranged from 1 to 69, with a median of 9.

Table 5.5 shows the percentage of persons with each body region injured for single and multi-vehicle crashes. In general, the percentages are similar. While injuries to the extremities appear to be somewhat more common in multi-vehicle crashes, this difference was not statistically significant ($z=1.2$, $p>.05$). The MAIS values for each body region were also generally similar for single and multi-vehicle crashes (see Table 5.6). However, there was a trend for chest injuries to be more severe in single than multi-vehicle crashes (Mann-Whitney U test, $z=-1.92$, $p=.05$).

Table 5.5. Percentages of motorcyclists with the body region injured for single and multi-vehicle crashes.

Body region	Single vehicle (n=66)	Multi-vehicle (n=131)
Head	33	39
Face	4	5
Chest	17	14
Abdomen	11	12
Extremities	73	80
External	85	88

Table 5.6. Median of MAIS score for each body region (for motorcyclists with injuries in that body region) for single vehicle and multi-vehicle crashes.

Body region	Single vehicle	Multi-vehicle
Head	2	2
Face	2	2
Chest	3	2
Abdomen	2	2
Extremities	2	2
External	1	1

5.4.3 Injuries by speed zone

All other things being equal, more severe injuries would be expected at higher crash speeds. While crash speed was not available, it is assumed here that crash speeds would be higher in higher speed zones. Therefore, more severe injuries would be expected at higher speed zones.

Table 5.7 summarises the ISS values for each of the speed zones. A Kruskal-Wallis nonparametric one-way analysis of variance showed that none of the median ISS values differed from the others ($\chi^2(3)=1.4$, $p>.05$).

Table 5.7. Range and median Injury Severity Score (ISS) for each speed zone.

Speed zone	Range	Median ISS
60	1-58	9
70	5-18	9
80	4-32	10
100	4-69	8

Table 5.8 presents the percentages of motorcyclists injured for each body region at the different speed zones. There is no clear pattern of more motorcyclists injured in crashes in higher speed zones.

Table 5.8. Percentages of motorcyclists with the body region injured in different speed zones.

Body Region	Speed zone (km/h)			
	60 (n=132)	70 (n=9)	80 (n=22)	100 (n=29)
Head	39	33	36	35
Face	5	0	9	3
Chest	11	22	32	10
Abdomen	8	0	27	14
Extremities	78	89	73	72
External	89	89	91	90

Table 5.9 summarises the median MAIS scores for each body region at the different speed zones. While the number of chest injuries was small, there was a trend to an increase in severity with speed zone (Kruskal-Wallis one-way ANOVA, $\chi^2(3)=6.7$, $p=.08$). The analyses showed no statistically significant effects of speed zone on MAIS for the other body regions.

Table 5.9. Median highest AIS score assigned to each body region (for motorcyclists with injuries in that body region) for different speed zones.

Body region	Speed zone (km/h)			
	60	70	80	100
Head	2	3	2	2
Face	1.5	-	2.5	-
Chest	2	-	3	4
Abdomen	2.5	-	2	1.5
Extremities	2	2	2	2
External	1	1	1	1

5.5 EXTERNAL INJURIES AND PROTECTIVE CLOTHING

The effectiveness of wearing appropriate protective clothing in preventing external injuries was examined. The definition of appropriate clothing was wearing a jacket and long pants made of leather, heavyweight material or waterproof material and motorcycle boots or laced heavy shoes. Clothing was defined as inappropriate if it did not meet this definition.

The details of the clothing worn were reported by the injured motorcyclist and were not able to be verified. Inspection of clothing was trialed in the pilot study and the low success rate in locating the clothing led to the decision to use self-reported clothing descriptions in this study.

The data enabled the identification of 108 motorcyclists wearing appropriate protective clothing and 22 who were wearing inappropriate clothing. Overall, 86% of motorcyclists wearing appropriate protective clothing sustained external injuries, compared with 95% of those wearing inappropriate protective clothing. These percentages are not statistically different ($z=-1.2$, $p>.05$).

The MAIS for external injuries ranged from 0 to 3 (median 1) for appropriate clothing and 0 to 2 (median 1) for inappropriate clothing. A Mann-Whitney U test showed that the median MAIS values did not differ significantly ($z=1.1$, $p>.05$).

6. CHARACTERISTICS OF THE CONTROLS

This chapter summarises the characteristics of the controls who were recruited into the study. It also details the number and characteristics of cases for which no controls could be recruited. The implications of the pattern of the controls for the case-control analyses are then discussed.

6.1 SUMMARY OF RECRUITMENT OF CONTROLS

The control recruitment procedure is summarised in Figure 6.1. There were 222 cases. For two cases, it was discovered some time later that the crash had occurred at a different time than had been originally notified (B093 and X017). The control sessions which had been conducted were then classified as invalid and the controls which had been recruited during these two control sessions were removed from the analysis.

For 24 cases, no controls were recruited at the first session. A repeat control site was undertaken for 17 cases where it was thought probable that controls could be recruited on a repeat session (e.g. it was raining during the first session). No controls were collected on the second attempt for 8 of these cases.

Seven cases were repeated because only observational data were collected for motorcyclists on the first attempt (ie. motorcyclists rode past but none stopped). Some controls were recruited on the second attempt for all of these cases (only observational data for two cases, B094 and X023).

There remain 15 cases with no controls at all and the 2 discarded cases. These 17 cases for which no controls were recruited were dropped from the case-control comparisons. Therefore, the case-control comparisons include data for 205 cases and 1195 controls (the controls comprising 1195 riders and 84 pillion passengers).

6.2 NUMBER OF CONTROLS PER CASE

Table 6.1 summarises the number of controls per case. The number of controls in this table refers to the number of controls for which at least observational information was collected.

Figure 6.1. Summary of the control recruitment procedure.

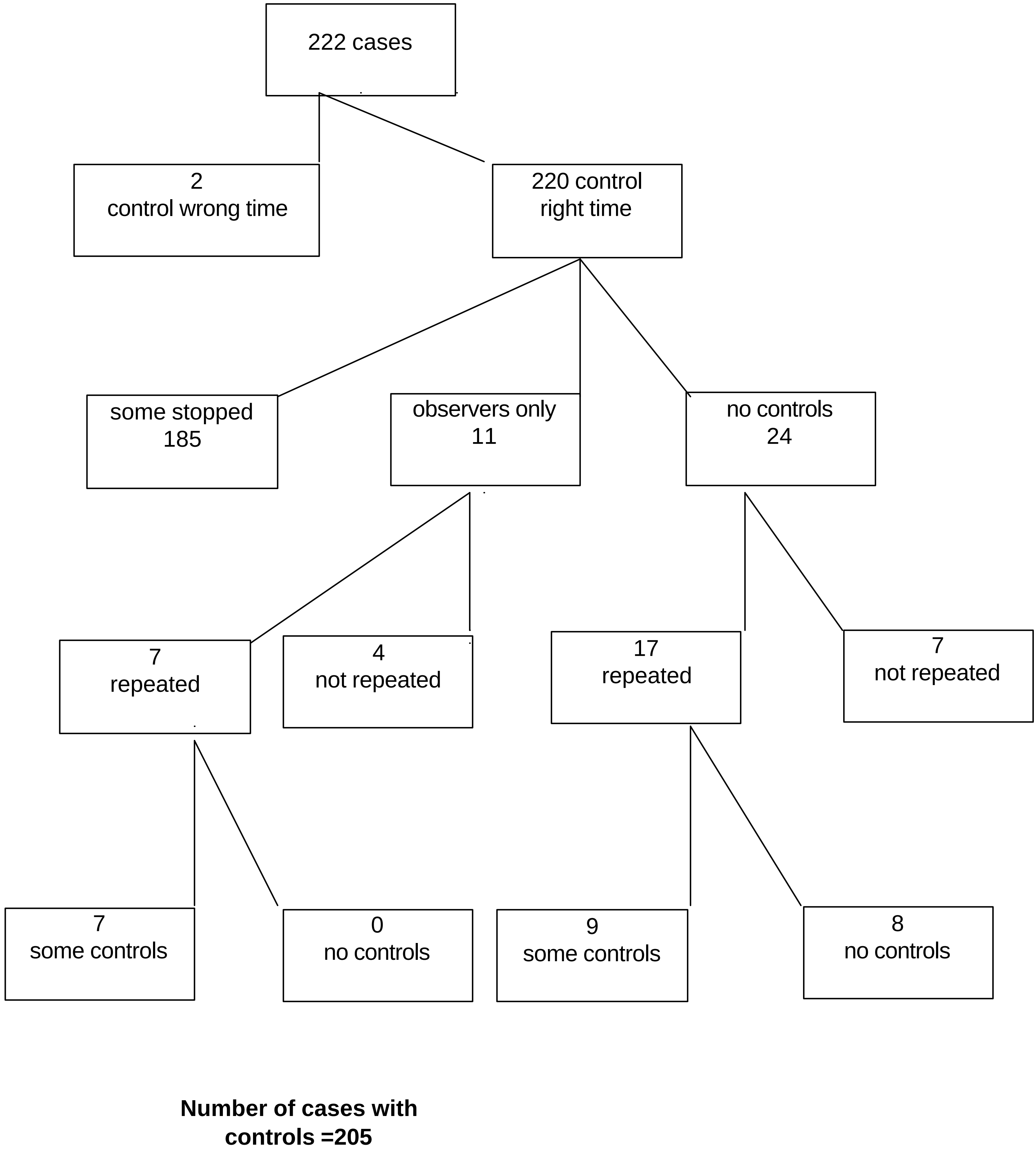


Table 6.1. Number of controls per case.

Number of controls	No. of cases	% of all cases	% of cases with some controls
0	17	8	
1	44	20	22
2	23	10	11
3	28	13	14
4	22	10	11
5	17	8	8
6-10	36	16	18
11-20	29	13	14
More than 20	6	3	3
Total	222	101	101

6.3 COMPLETENESS OF INFORMATION COLLECTED

Three sets of information were collected for controls: roadside observations, roadside interviews and follow-up telephone interviews. Roadside observations were the only information available for those who rode by without stopping. Observational and roadside interview data were the only sets of information available for those motorcyclists who were not followed up.

Table 6.2 presents the number of cases with each level of completeness of control information. About 84% of all cases (91% of cases with controls) had at least one control which included a follow-up interview.

Table 6.2. Number of cases according to completeness of control information.

Data collected	No. of cases	% of all cases	% of cases with some controls
At least one follow-up	187	84	91
At least one roadside interview	7	3	3
At least one observation	11	5	5
No controls	17	8	
Total	222	100	99

Table 6.3 summarises the number of control riders for which each set of information was available. It shows that 563 of the 1195 control riders observed were interviewed (either at the roadside or at the roadside and by telephone follow-up). While early in the study an attempt was made to follow up every rider who was interviewed by the roadside, from March 1996 the process was terminated after three successful follow-ups.

Table 6.3. Number of controls according to completeness of control information for riders.

Extent of information	No. of controls	% of controls
Observer, roadside interview and follow-up	383	32
Observer and roadside interview only	180	15
Observer only	632	53
Total	1195	100

The number of controls with follow-up interviews completed per case is summarised in Table 6.4. For 170 cases (77% of all cases, 83% of cases with controls) there were one, two or three controls with follow-up interviews. There were 35 cases for which there were no follow-up interviews (including the 17 cases where there were no controls at all) and 17 cases for which there were more than 3 follow-up interviews.

Table 6.4. Number of controls with follow-up interviews per case.

Number of follow-ups	No. of cases	% of all cases	% of cases with some controls
0	35 *	16	9
1	86	39	42
2	56	25	27
3	28	13	14
4	5	2	2
5	3	1	2
6-10	8	4	4
11-20	1	<1	<1
Total	222	100	100

* 18 cases with some controls

6.3.1 Riders and pillions

Both cases and controls included pillion passengers if they were present. In total, 84 controls were pillion passengers. Table 6.5 shows that complete information was available for only 16 pillions.

Table 6.5. Number of controls with pillions according to completeness of control information for pillion.

Extent of information	Number of controls	Percent of controls
Observer, roadside interview and follow-up	16	19
Observer and roadside interview only	7	8
Observer only	61	73
Total	84	100

6.4 WHERE THE CONTROLS WERE RECRUITED

For 75% of cases, controls were collected at the crash site or at a short distance upstream or downstream of the crash site. For the remaining 25% of cases, the controls were collected on a different road than that on which the crash occurred. Most of these site changes involved a move to an arterial or collector road when the crash had occurred on a local road. Several additional changes were necessary because the crash had taken place on a freeway where it was unsafe to collect controls. The location of the control site by the number of crashes and the number of controls is summarised in Table 6.6.

Table 6.6. The location of the control site by the number of cases and the number of controls.

Location of control site	No. of all cases	No. of cases with some controls	No. of controls recruited
At crash site	52	45	227
Upstream or downstream on same road	115	111	632
Different road	53	49	336
Total	220	205	1195

6.5 DETERMINANTS OF THE NUMBERS OF CONTROLS PER CASE

The tables presented in the previous sections show that the number of controls per case varied. This section seeks to examine the determinants of the numbers of controls per case and focuses on two characteristics of cases: type of road and time period. Road type was identified from the colour coding used in the Melway street directory. The time periods chosen to match those in VicRoads Exposure Survey (Arup Transportation Planning, 1995).

Table 6.7 shows the mean number of controls per case as a function of road type and time period. There were fewer controls per case on collector roads but similar numbers of controls per case were recruited on other types of roads. The mean number of controls per case was greatest on weekday days, followed by weekend days, weekend nights and weekday nights.

The numbers of cases for which no controls were recruited or observational data only was collected are presented in Table 6.8 as a function of road type and time period. The percent of cases with no controls or only observational data was greatest on collector roads and secondary arterials and on weekday nights.

Table 6.7. Number of controls per case as a function of road type and time period of the crash.

Crash characteristic	No. of cases with controls	Mean no. of controls per case	Range
ROAD TYPE (of control)			
Local	4	5	1-11
Collector	15	2	1-7
Secondary arterial	56	5	1-18
Primary arterial	130	7	1-37
TIME PERIOD			
Weekday day	96	7	1-37
Weekend day	42	6	1-26
Weekday night	28	3	1-15
Weekend night	39	4	1-17

Note: Weekday day=6am to 6pm Monday-Friday, Weekend day=6am to 6pm Saturday-Sunday, Weekday night=6pm to 6am Sun-Mon, Mon-Tue, Tue-Wed, Wed-Thur), Weekend night=6pm to 6am Thur-Fri, Fri-Sat, Sat-Sun).

Table 6.8. Characteristics of cases with no controls or observational data only.

Crash characteristic	No. of cases without controls	No. of cases with observational data only	% of cases with no controls or observational data only
ROAD TYPE (control)			
Local	0	0	0
Collector	4	1	26
Secondary arterial	9	3	19
Primary arterial	2	7	7
TIME PERIOD			
Weekday day	4	3	7
Weekend day	4	1	11
Weekday night	6	3	27
Weekend night	1	4	13

6.6 IMPLICATIONS OF THE STRUCTURE OF THE CONTROL SAMPLE FOR CASE-CONTROL ANALYSIS

The preceding sections have identified a number of characteristics of the control sample which could have implications for the case control analysis. They are:

1. there are no controls for some cases
2. there are no controls with follow-up interviews for some cases
3. the number of controls per case varies
4. the mean number of controls per case differs according to road type and time of day

These characteristics will now be discussed in detail.

6.6.1 No controls for some cases

Those cases for which there are no controls were not included in the case-control analysis. The only alternative would have been if there was another case near the same site at the same time which had "spare" controls which could have been transferred to the case without controls.

The implications for the results of the case-control analysis of dropping cases is that the sample of crashes remaining may become unrepresentative if the characteristics of the cases dropped differed from the characteristics of the other cases in the study. We have identified that crashes without controls are more common on collectors and secondary arterials than local roads and primary arterials and more commonly occur on weekday nights (see Table 6.8). Thus it is possible that the results of the case-control analysis might underestimate any effects of local area traffic management (because of the under-representation of collectors) or overestimate factors related to alcohol in riding at night (because of the over-representation of weekend nights compared with weekday nights), for example.

There may be other ways in which the cases without controls vary from the other cases which we have not yet identified.

6.6.2 No controls with follow-up interviews for some cases

The lack of follow-up interviews for some cases means that those cases are effectively deleted from the analyses for those variables which were collected in the follow-up interviews. The variables include driver training and experience details, riding style and demographic information.

The implications of lack of follow-up information for the results of the analysis is similar to that of having no controls but is restricted to a subset of the variables.

6.6.3 Number of controls per case varies (overall and according to road type and time of day)

The case-control analysis of this study matches controls and cases. In effect, the analysis procedure compares each case and its associated controls individually, then combines the results of the case-by-case comparisons to produce the overall odds ratio. While an uneven number of controls per case might be problematic for an unmatched design, it is not a problem for a matched design. In fact, the example given in the EPI INFO manual for matched designs has an uneven number of controls per case.

6.7 REFUSALS AND UNSUCCESSFUL FOLLOW-UPS

A total of 54 of the 563 control riders (9.6%) interviewed by the roadside refused to be breath-tested. The characteristics of those who refused to be breath-tested are examined in Table 6.9. There were no significant differences between the riders who were breath tested and those who refused. There was a trend for riders who refused to be more likely to be wearing adequate protective clothing. The analyses presented here do not identify any biases in the sample of riders who agreed to be breath tested.

Table 6.9. Comparisons of selected characteristics of controls who stopped according to whether they were willing to be breath-tested or not. Figures presented are percentages who had that characteristic.

Characteristic	Breath-tested (n=509)	Refused breath test (n=54)	Probability value
Completed follow-up interview	68	65	$\chi^2(1)=0.3$, p>.05
Male rider	95	94	$\chi^2(1)<0.1$, p>.05
Rider age			
under 25	22	24	
25 to 34	46	54	
35 and over	32	22	$\chi^2(2)=2.0$, p>.05
Licence status			
unlicensed	<1	0	
learner	10	15	
probationary	8	8	
full licence	80	77	$\chi^2(4)=2.1$, p>.05
Pillion present	8	7	$\chi^2(1)<.01$, p>.05
Inadequate protective clothing	22	12	$\chi^2(1)=3.3$, p=.07
Not wearing helmet	<1	0	$\chi^2(1)=0.2$, p>.05
Open face helmet	13	19	$\chi^2(1)=1.5$, p>.05
Headlight not on *	13	13	$\chi^2(1)<.01$, p>.05
Engine capacity (cc)			
less than 260	32	40	
260 to 749	22	19	
750 and over	46	40	$\chi^2(2)=1.4$, p>.05
% weekend	69	63	$\chi^2(1)=0.9$, p>.05
Mean age	31.9	31.1	>.05
Median age	30.9	29.7	>.05

* could not be calculated for post-1992 alone because year of manufacture was known only for follow-ups

A small number of motorcyclists completed the roadside interview but were not willing to provide contact details for a follow-up interview. Some of the motorcyclists who gave contact details were unable to be contacted on any of three attempts or were not followed up because three follow-up interviews had already been completed for that case.

6.7.1 Comparisons of motorcyclists who stopped and those who did not

Not all motorcyclists who were observed but did not stop were unwilling to stop. There were 54 sites where it was not possible to attempt to stop all motorcyclists observed. This was because there were multiple lanes of traffic and the motorcycle could not be safely stopped or because the interviewers were busy with other stopped motorcyclists.

The observational variables which were collected for controls who did not stop related to pillion carriage, helmet use and type, protective clothing, motorcycle make and model, headlight use and engine capacity. Riders who did not stop were less likely to be wearing an open face helmet, less likely to be riding a motorcycle of less than 260 cc and more likely to be riding a motorcycle of 750 cc and greater (see Table 6.10). In addition, there were relatively fewer riders who did not stop on the weekend. The findings that riders who did not stop were less likely to be wearing an open face helmet and less likely to have been observed on the weekend are related: overall 39% of all open face helmets were observed on the weekends, compared with only 23% of all full face helmets on the weekend.

6.7.2 Comparisons of those who were followed-up with those who had only roadside interviews

Control motorcyclists (riders and pillions) who were followed-up and those who had only roadside interviews were compared on a range of variables (see Table 6.10). Riders who were followed-up were two years older on average than those who had only roadside interviews. The increased mobility of younger people (and therefore difficulty in contacting by telephone) may have contributed to this difference.

The riders who were followed up were also less likely to have been wearing open face helmets than those interviewed at the roadside only. The data in Table 6.10 suggest that they were also less likely to have been riding motorcycles with capacities of less than 260 cc. This would be consistent with the age differences noted in the previous paragraph.

Table 6.10. Comparisons of selected characteristics of controls for whom different levels of information were available. Figures presented are percentages who had that characteristic.

Characteristic	Observer only (n=632)	Roadside only (n=180)	Followup (n=383)	Probability value
Male rider	-	94	95	$\chi^2(1)=0.2$, $p>.05$
Rider age				
under 25	-	31	19	
25 to 34	-	43	49	
35 and over	-	26	33	$\chi^2(2)=11.5$, $p<.01$
Refuse breath test	-	11	9	$\chi^2(1)=0.3$, $p>.05$
BAC>.000	-	4	3	$\chi^2(1)=0.1$, $p>.05$
BAC>.050	-	1	0	$\chi^2(1)=2.2$, $p>.05$
Licence status				
unlicensed	-	0	<1	
learner	-	15	9	
probationary	-	9	8	
full licence	-	76	81	$\chi^2(4)=6.1$, $p>.05$
Pillion present	7	8	7	$\chi^2(2)=0.6$, $p>.05$
Inadequate protective clothing	21	20	22	$\chi^2(2)=0.1$, $p>.05$
Not wearing helmet	1	1	<1	$\chi^2(2)=1.2$, $p>.05$
Open face helmet	13	19	11	$\chi^2(2)=7.1$, $p<.05$
Headlight not on *	10	11	14	$\chi^2(2)=4.3$, $p>.05$
Engine capacity (cc)				
less than 260	28	38	31	
260 to 749	17	18	23	
750 and over	55	45	46	$\chi^2(4)=14.1$, $p<.05$
% weekend	20	34	30	$\chi^2(2)=21.2$, $p<.05$
Mean age	-	30.5	32.4	<.05
Median age	-	29.0	31.3	<.05

* could not be calculated for post-1992 alone because year of manufacture was known only for follow-ups

6.7.3 Implications for the case-control analyses

The most representative data is that for variables observed for all motorcyclists. These variables include: pillion present, helmet and protective gear, make and model, and engine capacity.

Those riders who had completed the follow-up interview had also completed the roadside interview. Therefore in assessing any bias in the variables collected during the roadside interview, there is a need to compare the responses of the observer only sample with those for the combination of the roadside only and follow-up groups. The data suggest that the roadside only and follow-up samples contain too many controls riding motorcycles of less than 260 cc and not enough of 750 cc and over - and too many weekend controls compared to all observed. This implies that the follow-up sample may over-represent the responses of recreational riders.

Occupation, education, training, ownership of the motorcycle are from the follow-up questionnaire and so there is a need to adjust all analyses using the follow-up data only to take account of age group because there is a smaller proportion of under 25s in the follow-up group than in the roadside interview group.

There were no detectable biases in the riders who agreed versus disagreed to be breath-tested.

The comments above relate to the interpretation of the estimates of the prevalence of particular characteristics in the control population. The analyses of odds ratios were matched and so may not have been as affected by these differences.

7. INTRODUCTION TO CASE-CONTROL COMPARISONS

The case-control comparisons presented here relate only to those cases where controls were collected. There were 205 crashes with 1195 control trips included in the analyses.

7.1 VARIABLES ANALYSED

A large number of variables were collected for cases and controls. The variables analysed and presented are those for which:

- the amount of missing data was not excessive for cases or controls
- there was a satisfactory level of data reliability

There were some variables which had a large amount of missing data for cases or controls. The details about licensing and experience as a pillion were collected for those pillions for whom a follow-up interview was conducted. Since the number of those interviews was small, there was insufficient information to analyse licensing and experience variables for pillions.

The data reliability for some variables was found to be so poor that analyses of these variables are not presented in this report. Preliminary analyses of some of the questionnaire items showed that crashed riders appeared to be giving more "socially desirable" responses than controls. These items particularly related to riding strategies. Unfortunately these items were collected by self-report and there was no way to verify the responses given. Given the social desirability effect, comparisons of the responses of cases and controls would give misleading results. Instead, the responses on these items are presented for controls only in a later chapter.

In addition, there were some questionnaire items which were collected by self-report for cases but by observation for controls (e.g. wearing a helmet). Analyses of these variables are presented with warnings that the data may be more reliable for controls than cases.

7.2 MATCHED DESIGN

This study utilised a matched design where an attempt was made to collect a set of controls for each case which were matched on time and location of riding. A matched analysis (conditional logistic regression) was used to calculate the odds ratios. The matched analysis had the advantage of overcoming difficulties associated with having differing numbers of controls per case but meant that cases for which controls were unable to be recruited had to be dropped from the study.

Matching for time and location of the crash has the potential to lead to an underestimation of odds ratios for variables which may be related to time and location. If a crash occurred during the night where the rider has a positive BAC, then the controls collected at that time may be more likely to have positive BACs than controls collected during the day. This will lead to a lower odds ratio for alcohol involvement from a matched study than an unmatched study.

7.3 PRESENTATION OF RESULTS

In the chapters which follow, the percentages of cases and controls which possess a certain feature are presented in a table before the odds ratios are presented. The percentages in the table are of their nature unmatched and so do not relate directly to the odds ratios.

7.3.1 Sample sizes

As noted earlier in the report, some information about control motorcyclists was collected by observation, some by roadside interviewing and further information was collected during a follow-up telephone interview. The sample sizes are therefore greatest for those variables which were collected by observation and least for those variables collected by follow-up interview.

Table 7.1 presents the maximum sample sizes for cases and controls for the major variables used in cross-tabulations. Any missing data in other variables in the cross-tabulations would reduce the sample size from this maximum value.

Table 7.1. Maximum sample sizes as a function of the degree of completeness of the interview.

Variable	Maximum sample size	
	Cases	Controls
Age group		
under 25	76	127
25 to 34	71	263
35 and over	55	172
BACANY		
BAC=.000	110	492
BAC>.000	25	17
Type of licence		
unlicensed	11	1
learner	34	61
probationary	24	46
full	129	444

7.4 INTERPRETATION OF ODDS RATIOS

As mentioned earlier, conditional logistic regression was used to estimate the odds ratios for factors associated with crash involvement.

The odds of an event occurring is equal to the probability of the event occurring divided by the probability of it not occurring. For example, the odds of drawing a diamond from a pack of cards is one-third (commonly expressed as 3:1 against).

Case-control studies cannot estimate the odds of an event occurring but can estimate the relative odds ratio, that is the odds relative to the odds of another event. The calculated odds ratio is a measure of the risk of crashing when that variable is present, relative to when it is absent. When the odds ratio is one, the variable has no effect on crash risk. If the odds ratio is greater than one, the presence of the variable increases the risk of crashing. If the odds ratio is less than one, the presence of the variable decreases the risk of crashing. The odds ratio cannot be calculated (it is undefined) where the variable is not present in any controls (e.g. BAC>.15).

The 95% confidence interval (CI) is presented for each of the odds ratios. If the confidence interval stretches from less than one to greater than one, the calculated odds ratio is not significantly different from one. Given the small number of cases analysed, many of the odds ratios are not statistically significant.

7.4.1 Adjusted odds ratios

An odds ratio which describes the relationship of one variable to crash risk is termed an unadjusted odds ratio. If the unadjusted odds ratio is significant, then there is a significant association between the variable and crash risk. Yet the association may occur when the variable has no direct relationship with crash risk but the variable is strongly correlated with another variable which has a direct relationship with crash risk (the confounding variable).

Preliminary analyses showed that the effects of age of the driver and BAC level on risk of crashing were very strong. These effects masked or accentuated the true effects of factors which were correlated with age or BAC level. Therefore conditional logistic regression was used to calculate the odds ratios adjusted for the effects of age and BAC level (or other variables judged to affect the relationship with crash risk).

The small numbers of control riders with BAC>.05 led to constraints in the estimation of odds ratios for BAC>.05, particularly after adjustment for other factors. For this reason, where BAC was analysed with another factor, the factor BACANY - which has categories BAC=.000 and BAC>.000 was used. Given the larger proportion of controls with BAC>.000 than BAC>.050, this variable appears to behave more satisfactorily.

Where BAC is included in tables of proportions and in calculations of odds ratios, only cases and controls for which BAC data was available (i.e. not missing) were included.

8. CASE-CONTROL COMPARISONS - RIDER FACTORS

8.1 DEMOGRAPHIC CHARACTERISTICS

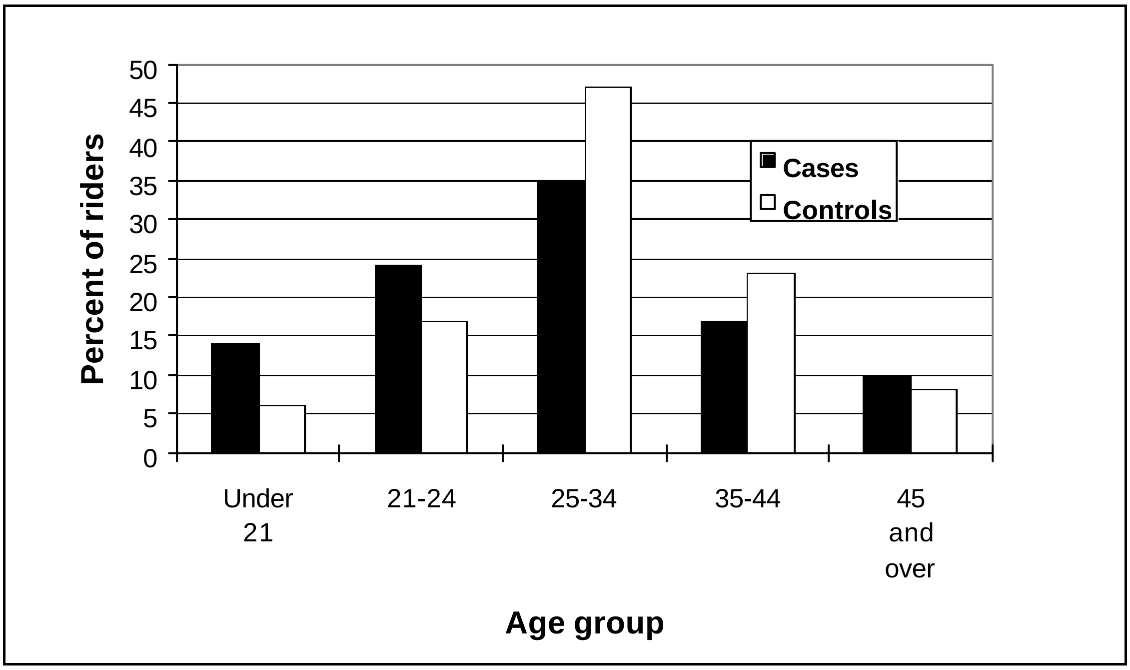
The demographic characteristics of the cases and controls are summarised in Table 8.1. The percentages of cases and controls for each variable according to age group and whether alcohol was present are presented in Tables 8.2 and 8.3. The unadjusted and adjusted odds ratios and their confidence intervals are listed in Table 8.4.

8.1.1 Rider age

The ages of riders in crashes ranged from 14 to 68, with a mean of 30.2. The ages of control riders ranged from 17 to 75, with a mean of 31.8. The difference between the mean ages of the two groups was statistically significant ($t(762)=-2.3$, $p<.05$).

The distribution of ages is shown in Figure 8.1. A larger proportion of crashed riders than control riders was found in the under 21 and 21 to 24 year old age groups. Very few riders in either group were aged 45 or over.

Figure 8.1. Percentages of case and control riders in each age group.



Compared to riders aged 35 and over, riders aged under 25 had a higher relative risk of being involved in a crash. Riders aged 25 to 34 were not significantly more likely to be involved in crashes than riders aged 35 and over (see Table 8.4).

Table 8.1. Percentages of cases and controls according to rider demographic variables. Percentages are of known.

Variable	Present in % cases	Present in % controls
Aged under 21	14	6
Aged under 25	37	22
Male rider	96	95
Never married	61	47
No tertiary education	60	51
Full-time work	68	81
Part-time work	9	7
Receiving benefit	8	3
Student	11	4
Self-employed	5	7
Physical disability	5	13
Overweight	27	37
Obese	10	8

Table 8.2. Percentages of cases and controls according to rider demographic variables for each age group. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Male rider	95	90	97	95	96	98
Never married	94	90	59	50	23	18
No tertiary education	62	56	52	52	64	46
Full-time work	61	74	75	84	72	83
Part-time work	10	14	8	4	6	6
Receiving benefit	7	3	8	3	11	2
Student	20	10	3	3	4	2
Physical disability	1	7	11	14	2	16
Overweight	12	22	36	38	39	45
Obese	4	1	9	8	17	12

Table 8.3. Percentages of cases and controls according to rider demographic variables for riders with zero BAC and riders with BAC greater than zero. Percentages are of known.

Variable	BAC=.000		BAC>.000	
	Cases	Controls	Cases	Controls
Aged under 21	36	23	42	6
Aged under 25	38	46	21	59
Male rider	95	94	100	94
Never married	64	47	57	45
No tertiary education	59	50	55	64
Full-time work	65	81	70	64
Part-time work	7	7	9	0
Receiving benefit	7	2	13	18
Student	13	4	4	0
Physical disability	3	14	5	0
Overweight	30	38	38	18
Obese	10	8	5	18

Table 8.4. Odds ratios and confidence intervals for rider demographic variables, unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

Variable	Unadjusted	Adjusted for		
		Age group	BAC	Age group and BAC
Aged under 25	**1.8** 1.1 - 2.9		**1.8** 1.0 - 3.4	
Aged 25 to 34	0.9 0.6 - 1.4		1.0 0.6 - 1.9	
Male rider	1.7 0.7 - 4.0	1.7 0.7 - 4.3	1.3 0.4 - 3.7	1.3 0.4 - 3.9
Never married	**1.9** 1.2 - 2.8	1.5 0.9 - 2.5	**2.3** 1.3 - 4.0	**2.0** 1.0 - 3.9
No tertiary education	1.3 0.8 - 1.9	1.2 0.8 - 1.8	1.2 0.7 - 2.1	1.1 0.6 - 2.0
Part-time work	1.1 0.5 - 2.3	0.9 0.4 - 2.0	0.7 0.3 - 1.9	0.7 0.3 - 1.8
Receiving benefit	**3.0** 1.3 - 7.2	**3.5** 1.4 - 8.6	2.2 0.7 - 6.8	2.6 0.8 - 8.6
Student	**2.5** 1.1 - 5.5	1.7 0.7 - 3.9	2.4 0.9 - 6.0	1.6 0.6 - 4.3
Physical disability	**0.3** 0.1 - 0.7	**0.4** 0.2 - 0.9	0.3 0.1 - 1.0	0.4 0.1 - 1.2
Overweight	0.7 0.5 - 1.1	0.9 0.6 - 1.5	0.8 0.4 - 1.4	1.0 0.5 - 1.7
Obese	1.3 0.6 - 2.5	1.8 0.9 - 3.8	1.2 0.5 - 3.1	1.6 0.6 - 4.5

8.1.2 Rider sex

For the sample as a whole, 96% of riders in crashes and 95% of control riders were male. The proportions of riders in crashes who were male varied little across the age groups. Younger control riders were more likely to be female than older riders, however (10% of under 25s were female compared with 2% of those 35 and over).

Rider sex did not significantly affect the relative risk of crashing, whether the variable was considered alone or after adjustment for rider age and alcohol.

8.1.3 Marital status

Riders in crashes were more likely to be single (never married and not in de facto relationship) than control riders. Not surprisingly, the younger riders were much more likely to be single and the percentage of riders who were single fell with increasing age (see Table 8.2). However, the proportion of riders who were single was greater among cases than controls at each age group. Being single was found to be a statistically significant risk factor after adjustment for BAC or age group and BAC.

8.1.4 Education and employment status

Overall, riders with no tertiary education appeared to be over-represented among crashed riders. This was most evident for riders aged under 25 and for those aged 35 and over. However, having no tertiary education did not significantly affect the risk ratio for being involved in an injury crash.

Receiving a benefit (unemployment benefit, pension etc) was more common among case than control riders, overall and at each age group. The unadjusted odds ratio and the odds ratio adjusted for age group were both significantly higher than 1.0. However, the odds ratios adjusted for BAC and age group and BAC were not statistically significant.

The proportion of riders who were students was almost three times greater in the crash than the control population. The over-representation was found only in riders aged under 25, where 20% of riders in crashes were students compared with 10% of control riders. While the unadjusted odds ratio for being a student was significantly greater than one, none of the adjusted odds ratios were statistically significant.

Information about employment status was available for 14 of the 24 riders in fatal crashes. None of the riders were students.

8.1.5 Health status

Crashed and control riders were asked their height and weight. From these estimates (height in metres, weight in kilograms), the Body Mass Index was calculated. Persons with BMIs of over 25 are classified as overweight and those over 30 are classified as obese.

Riders in crashes were somewhat less likely to be overweight than control riders. This difference was largest among the youngest group of riders. The proportions of both groups who were obese increased with age group, as is found for the general Australian population (National Heart Foundation and Australian Institute of Health, Risk Factor Prevalence Study, 1989).

Overall, few riders were obese and the proportion increased with age group.

Riders were also asked whether they had any physical disability. Riders in crashes were less likely to report a physical disability than control riders. This was true for each age group, but the OR was not significant after adjustment for BAC or age group and BAC.

Overall, 21% of crashed riders and 31% of control riders were not born in Australia. This significant difference ($\chi^2(1)=6.8$, $p<.05$) disappeared however after adjustment for age of the riders. The overall effect was an artefact of more younger riders in the crash sample, who were more likely to have been born in Australia.

Similar proportions of cases and controls were left-handed (17% cases, 18% controls who were followed up).

8.2 RIDER LICENSING AND EXPERIENCE

Crashed and control riders were asked a series of questions about their licence status, riding experience and crash history. The case-control comparisons for variables related to rider experience and licensing are summarised in Tables 8.5 to 8.8.

Table 8.5. Percentages of cases and controls according to rider experience and licensing variables. Percentages are of known.

Variable	Present in % cases	Present in % controls
Unlicensed	6	<1
Learner	17	11
Probationary	12	8
First rode under 16 yrs	36	34
Off-road experience first	53	45
Ridden less than 3 yrs	35	26
Ridden this bike <10,000 km	48	40
Ride <3 days/wk	33	22
Ride <300 km/wk	59	58
Inexperienced rider	55	45

Table 8.6. Percentages of cases and controls according to rider experience and licensing variables for each age group. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Unlicensed	8	0	7	0	0	1
Learner	35	29	10	9	4	1
Probationary	28	22	3	6	4	2
First rode under 16 yrs	36	34	30	41	45	24
Off-road experience first	52	47	59	47	49	38
Ridden less than 3 yrs	67	57	22	24	12	10
Ridden this bike <10,000 km	58	61	45	41	43	30
Ride <3 days/wk	29	24	28	22	42	19
Ride <300 km/wk	55	63	62	54	58	59
Inexperienced rider	72	69	41	47	50	30

Table 8.7. Percentages of cases and controls according to rider experience and licensing variables for riders with zero BAC and riders with BAC greater than zero. Percentages are of known.

Variable	BAC=.000		BAC>.000	
	Cases	Controls	Cases	Controls
Unlicensed	3	<1	16	0
Learner	20	11	16	0
Probationary	12	8	8	18
First rode under 16 yrs	33	34	38	45
Off-road experience first	56	44	76	45
Ridden less than 3 yrs	37	25	45	18
Ridden this bike <10,000 km	49	41	42	38
Ride <3 days/wk	33	21	41	9
Ride <300 km/wk	59	58	55	55
Inexperienced rider	55	45	64	36

Table 8.8. Odds ratios and confidence intervals for rider experience and licensing variables, unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

Variable	Unadjusted	Adjusted for		
		Age group	BAC	Age group and BAC
Unlicensed	**31.5** 3.7-269.2	**30.3** 3.5-260.5	**14.1** 1.3-148.8	**12.6** 1.2-133.2
Learner	**1.7** 1.0-2.8	1.5 0.9-2.7	1.6 0.8-2.9	1.4 0.7-2.7
Probationary	1.8 1.0-3.2	1.5 * 0.8-3.0	1.5 0.6-3.5	1.3 0.5-3.3
First rode under 16 yrs	1.1 0.8-1.7	1.2 0.8-1.8	0.9 0.5-1.6	1.0 0.5-1.7
Off-road experience first	**1.5** 1.0-2.2	1.5 1.0-2.2	**1.9** 1.1-3.2	**2.0** 1.1-3.5
Number of years ridden	0.98 0.96 - 1.00	1.00 0.97 - 1.03	**0.97** 0.93 - 1.00	0.99 0.95 - 1.03
Ridden less than 3 yrs	1.4 0.9-2.2	0.9 0.6-1.5	1.4 0.8-2.5	0.9 0.5-1.8
Ridden this bike <10,000 km	1.3 0.8-2.0	1.2 0.7-1.8	1.2 0.7-2.2	1.0 0.6-2.0
Ride <3 days/wk	**1.9** 1.2-3.0	**1.7** 1.1-2.8	**2.1** 1.1-3.9	**1.9** 1.0-3.5
Ride <300 km/wk	1.1 0.7-1.7	1.1 0.7-1.7	1.1 0.6-2.1	1.2 0.6-2.2
Inexperienced rider	1.4 1.0 - 2.1	1.1 0.7 - 1.6	1.4 0.9 - 2.4	1.1 0.6 - 2.0

* while age under 25 and probationary licence status were individually associated with increased crash risk, neither were significant when combined, probably because of the large overlap between these variables

8.2.1 Licence status

About 6% of riders in crashes were unlicensed (never had a licence, licence lapsed or disqualified), compared to less than 1% of control riders. All of the unlicensed riders in crashes were aged under 35. Being an unlicensed rider was associated with a significantly increased odds of crashing (compared with being a fully licensed rider).

Overall, learner riders comprised 17% of crashed riders and 11% of control riders. For both cases and controls, learner riders were mostly highly represented among under 25 year old riders (see Table 8.6). The adjusted odds ratios showed no significant increase in risk for learner riders compared with fully licensed riders.

Probationary riders were over-represented in the crash group (12% crashed, 8% controls). The difference was largely among the under 25 riders who comprised most of this group. None of the odds ratios for probationary riders were statistically significant.

Non-Victorian licences were held by 3% of crashed riders and 7% of control riders.

8.2.2 Rider experience

Information was collected about how many years the rider had been riding (experience) and how often and far the rider usually rode (exposure).

Riders were asked what age they were when they first rode on the road. Overall, similar percentages of cases and controls said that they had first ridden on the road before the age of 16 (36% cases, 34% controls). The pattern differed somewhat with age (see Table 8.6). Case and control riders aged under 25 were equally likely to have ridden on the road before age 16, cases aged 25 to 34 were less likely to have done this than controls of the same age group and crashed riders aged 35 and over were more likely to have done this than control riders of the same age group.

Riders in crashes were slightly more likely to have been an experienced off-road rider before gaining their on-road licence. This was true for each age group. There was a significant increase in crash risk associated with being an experienced off-road rider before gaining an on-road licence (after adjustment for age and BAC).

The risk associated with early off-road experience was not related to these riders having greater current exposure. Overall, 41% of both cases and controls who were experienced off-road riders before gaining an on-road licence drove 300 km per week or more compared with 43% for riders who were not experienced off-road riders.

The number of years of on-road riding experience varied from 0 to 40 for cases and from 0 to 41 for controls. After adjusting for the greater tendency of more experienced riders in crashes to have positive BAC readings, there was a statistically significant reduction in risk as a function of years of on-road riding experience. The magnitude of the reduction was small, however, equating to a rider with ten years experience having about a 25% lower risk than a rider with one year of on-road riding experience.

Overall, riders in crashes were more likely to have ridden for less than three years than control riders (35% versus 26%). Table 8.6 shows that most of this effect reflected the pattern for riders aged under 25. It is interesting to note, though, that there are sizeable numbers of novice motorcyclists even in the older age groups (24% age 25 to 34, 10% age 35 and over).

In order to examine this issue of inexperienced riders who are not novices, we defined inexperienced riders as those who had ridden on the road for less than three years or ride less than three days per week or ride less than 100 km per week. Overall, 55% of crashed riders and 45% of control riders were inexperienced. As expected, most riders aged under 25 were inexperienced, but 50% of crashed riders (and 30% of control riders) aged 35 and over were also inexperienced. The analyses showed that 40% of fully licensed riders in crashes and 37% of fully licensed control riders were inexperienced. While inexperience was widespread, none of the odds ratios for this factor were statistically significant.

8.2.3 Rider exposure

Riders were also asked about the total distance they had ridden that bike. Figure 8.2 shows that about half of the riders had ridden the bike for 10,000 km or more. A larger proportion of crashed than control riders had ridden the bike for less than 10,000 km, however (48% versus 40%).

Figure 8.3 summarises riders' estimates of how far they ride per week. Riders in crashes were more likely to ride less than three days per week than control riders (33% versus 22%). This pattern was found at each age group but was most prominent for riders aged 35 and over. Riding less than three days per week was associated with significantly increased crash risk.

Overall, case and control riders differed little in the distance that they usually rode per week. The difference between the findings for frequency and distance of riding suggests that case riders might be riding less often but for longer trips.

8.2.4 Other experience and exposure

Most riders (case and control) held another class of licence. Overall, 62% of crashed riders and 70% of control riders held a full car licence (see Table 8.9). The smaller number of full car licences and the correspondingly larger numbers of car learner permit and probationary licences held by crashed riders than control riders is consistent with the younger nature of the crash group.

Figure 8.2. Distance the rider had ridden that motorcycle.

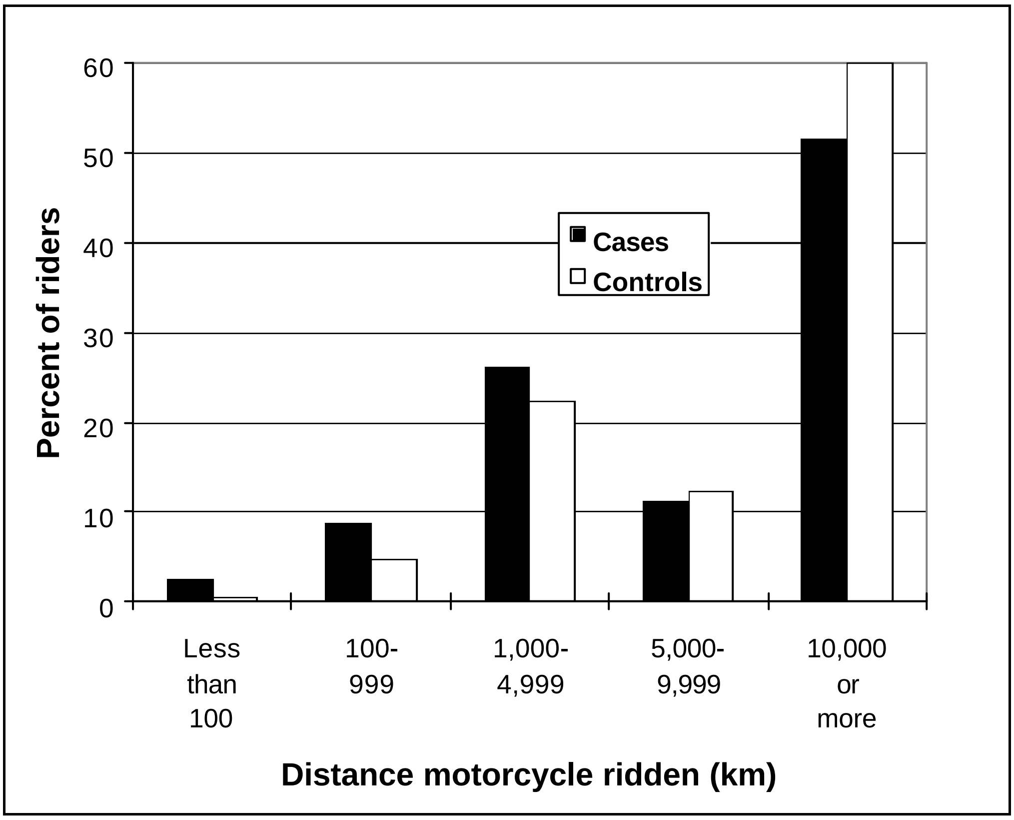


Figure 8.3. Distance the rider usually rides per week.

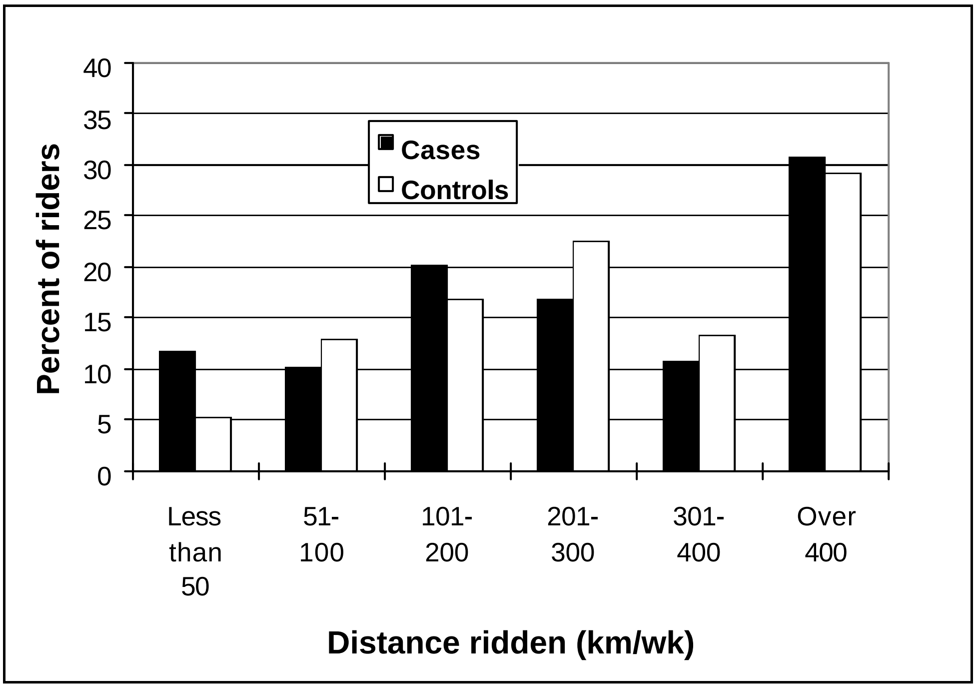


Table 8.9. Percentages of cases and controls who held another licence. Percentages are of known.

Other class of licence held	Present in % cases	Present in % controls
None	7	4
Car - learner permit	7	3
Car - probationary	9	5
Car - full	62	70
Light truck	1	2
Heavy truck/bus	7	9
Articulated truck	5	7
Other	2	1

The motorcycle was the vehicle ridden most in the last year by 50% of riders in crashes and 58% of control riders. Car and motorcycle were used equally by 5% of cases and 5% of controls, whereas a car was used more than the motorcycle by 43% of cases and 36% of controls. Table 8.10 shows that motorcycle use decreased and car use increased with age group.

Table 8.10. Percentages of cases and controls according to vehicle ridden most in the last year for each age group. Percentages are of known.

Vehicle ridden most	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Motorcycle	63	54	46	58	39	58
Car	32	41	46	37	51	32
Car and motorcycle equally	5	3	5	2	8	10
Other	0	3	3	3	2	1

8.2.5 Previous crashes

The effect on crash risk of having previous crashes in the past five years was examined for those riders who had been riding on the road for at least 5 years. Table 8.11 shows that 37% of riders in crashes and 52% of control riders reported having at least one crash in the previous five years (not including the current crash for crashed riders). Control riders appeared to be somewhat more likely to report having had two or more crashes in the past five years than crashed riders.

Table 8.12 presents crash history for each age group of rider. As would be expected, there were very few riders aged under 25 who had at least 5 years riding experience. The riders aged 35 and over appeared to be less likely to report having had any crashes, and particularly two crashes, in the past 5 years.

Table 8.11. Percentages of cases and controls according to number of crashes in the past 5 years. Only riders with at least 5 years experience. Percentages are of known.

Number of crashes in past 5 years	Present in % cases (n=95)	Present in % controls (n=231)
None	63	48
One	21	19
Two or more	16	33

Table 8.12. Percentages of cases and controls according to number of crashes in the past 5 years for each age group. Only riders with at least 5 years experience. Percentages are of known.

Number of crashes in past 5 years	Under 25		25 to 34		35 and over	
	Cases (n=10)	Controls (n=15)	Cases (n=40)	Controls (n=114)	Cases (n=44)	Controls (n=102)
None	30	27	58	45	75	55
One	30	7	20	18	20	23
Two or more	40	67	23	38	5	23

The small number of riders with at least five years experience who had BAC>.000 prevented any clear indication of the association of alcohol and past crash history (see Table 8.13).

Table 8.13. Percentages of cases and controls according to number of crashes in the past 5 years for riders with zero BAC and riders with BAC greater than zero. Only riders with at least 5 years experience. Percentages are of known.

Number of crashes in past 5 years	BAC=.000		BAC>.000	
	Cases (n=46)	Controls (n=205)	Cases (n=10)	Controls (n=8)
None	61	48	70	63
One	22	20	30	13
Two or more	17	32	0	25

One explanation of the lower involvement in crashes reported by crashed riders may be that injured riders reported only injury crashes while control riders may have reported non-injury crashes as well. Table 8.14 shows that the reduction in crash risk associated with having had two or more crashes in the past 5 years (compared with no crashes) was statistically significant when adjusted for age group but not BAC.

Table 8.14. Odds ratios and confidence intervals associated with numbers of crashes in the past 5 years, unadjusted and adjusted for age group and BAC. Only riders with at least 5 years experience. Highlighted odds ratios are statistically significant at the 95% level.

Compared with no crashes in past 5 years	Unadjusted	Adjusted for		
		Age group	BAC	Age group and BAC
One crash	0.7	0.7	0.8	0.9
	0.3-1.6	0.3-1.7	0.3-2.5	0.3-2.8
Two or more crashes	**0.4**	**0.3**	0.7	0.6
	0.2-1.0	0.1-0.9	0.2-2.2	0.2-2.3

8.3 RIDER TRAINING

Crashed riders and those control riders who completed the follow-up questionnaire were asked whether they had completed any training courses and the details of those courses.

8.3.1 Riders with training versus without

Overall, 62% of crashed riders and 51% of control riders had completed at least one rider training course (see Table 8.15). Younger riders were more likely to have completed at least one course (see Table 8.16). Table 8.17 shows that learner permit holders and probationary licence holders in crashes were more likely to state that they had completed at least one rider training course than control riders of the same licence type. The difference was not as clear for full licence holders.

Table 8.15. Percentages of cases and controls according to rider training variables. Percentages are of known.

Variable	Present in % cases	Present in % controls
At least one course	62	51
Basic handling skills course	60	39
Beginner course	31	19
Intermediate course	18	14
Advanced course	10	14

Table 8.16. Percentages of cases and controls according to rider training variables for each age group. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases (n=65)	Controls (n=70)	Cases (n=61)	Controls (n=186)	Cases (n=50)	Controls (n=125)
At least one course	79	60	62	53	42	42
Basic handling skills course	72	49	64	42	42	30
Beginner course	48	29	26	19	18	14
Intermediate course	18	16	20	15	18	13
Advanced course	8	13	16	17	4	11

The training backgrounds of riders who had zero BAC and those with a positive BAC are compared in Table 8.18. Riders with a positive BAC (both cases and controls) were less likely to have completed a training course than riders with zero BAC.

Table 8.17. Percentages of cases and controls according to rider training variables and licence status. Percentages are of known.

Variable	Learner permit		Probationary		Full	
	Cases (n=30)	Controls (n=34)	Cases (n=24)	Controls (n=29)	Cases (n=117)	Controls (n=308)
At least one course	87	68	83	66	53	48
Basic handling skills course	93	56	83	59	49	36
Beginner course	77	59	33	28	21	14
Intermediate course	7	6	42	28	17	15
Advanced course	3	3	8	7	12	17

Table 8.18. Percentages of cases and controls according to rider demographic variables for riders with zero BAC and riders with BAC greater than zero. Percentages are of known.

Variable	BAC=.000		BAC>.000	
	Cases (n=95)	Controls (n=335)	Cases (n=19)	Controls (n=11)
At least one course	61	52	53	45
Basic handling skills course	57	40	47	45
Beginner course	34	20	26	20
Intermediate course	16	14	16	18
Advanced course	8	15	0	18

Having completed at least one training course had no significant effect on the odds of crashing after adjustment for age group, BAC or licence status (see Table 8.19).

Table 8.19. Odds ratios and confidence intervals associated with having completed at least one training course (compared to no courses), unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

	Odds ratio	Confidence interval
Unadjusted	**1.5**	1.0 - 2.3
Adjusted for...		
Age	1.4	0.9 - 2.2
BAC	1.6	0.9 - 2.8
Licence status	1.5	1.0 - 2.2
Age and BAC	1.5	0.8 - 2.6
Licence status and BAC	1.4	0.8 - 2.4

Crashed riders who were experienced off-road riders before gaining an on-road licence were less likely to have completed training courses than those who were not experienced off-road riders (see Table 8.20). The pattern was much weaker for controls, suggesting an increased risk associated with previous off-road experience and lack of on-road training.

Table 8.20. Percentages of case and control riders who had completed training courses as a function of whether they were an experienced off-road rider before gaining an on-road licence.

	Percent of cases	Percent of controls
Experienced off-road rider	52	47
Not experienced off-road rider	75	54

Inexperience was associated with a higher likelihood of having had training (see Table 8.21). This is likely to have occurred because basic skills training has become more widespread in recent years and so is prevalent among novice riders.

Table 8.21. Percentages of case and control riders who had completed training courses as a function of whether they were experienced or inexperienced riders.

	Percent of cases	Percent of controls
Experienced	52	44
Inexperienced	70	59

Across each age group and licence status, inexperienced riders appeared more likely to have undertaken training (see Tables 8.22 and 8.23).

Table 8.22. Percentages of cases and controls who had completed training courses as a function of whether they were experienced or inexperienced riders for each age group. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Experienced *	68	50	58	51	29	35
Inexperienced	81	65	67	55	56	60

* small numbers of riders under 25 who were experienced

Table 8.23. Percentages of cases and controls who had completed training courses as a function of whether they were experienced or inexperienced riders according to licence status. Percentages are of known.

Variable	Learner permit		Probationary		Full	
	Cases	Controls	Cases	Controls	Cases	Controls
Experienced	-	-	71	57	50	44
Inexperienced	88	69	88	67	59	55

8.3.2 Level of course completed

In general, riders were more likely to have completed only a beginner course than an intermediate or advanced course. Control riders with full licences were an exception to this pattern, however, being equally likely to have completed an advanced course, intermediate course or beginner course (see Table 8.17).

Riders in crashes were more likely to have completed a basic handling skills course than control riders (60% versus 39%). This was true across age groups (see Table 8.16) and for holders of learners permits, probationary licences and full licences (see Table 8.17). However, it was not true for riders with BACs greater than zero (see Table 8.18).

Completing an intermediate course did not significantly change the odds of crashing, compared to completing a beginners course (see Table 8.24). However, completing an advanced course, as compared to a beginners course, was associated with a significant decrease in the odds of crashing.

Table 8.24. Odds ratios and confidence intervals for rider training variables, unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

Variable	Unadjusted	Adjusted for		
		Age group	BAC	Age group and BAC
Basic handling skills course (versus no training)	**3.7** 1.4-10.0	**3.6** 1.3-9.9	2.5 0.8-8.1	2.4 0.7-8.0
Compared to beginner course only....				
Intermediate course	0.9 0.4-2.0	0.9 0.4-2.0	0.5 0.1-1.9	0.6 0.2-2.3
Advanced course	**0.4** 0.2-1.0	0.5 0.2-1.1	**0.2** 0.1-0.7	**0.2** 0.1-0.8
Compared to no training...				
Beginner course	**1.8** 1.0-3.2	1.7 0.9-3.1	1.6 0.8-3.2	1.6 0.7-3.6
Intermediate course	1.8 0.9-3.4	2.0 1.0-4.0	1.8 0.7-4.5	2.0 0.7-5.4
Advanced course	1.0 0.4-2.4	1.0 0.4-2.4	1.2 0.4-4.1	1.0 0.3-3.5

8.3.3 Recency of training

Riders who had completed at least one training course were also asked the year in which they completed their most recent course. This was to address the issue of whether the effects of training fade over time.

About half of the cases and controls had completed their most recent training course in 1995 or more recently (see Table 8.25). As expected, more of the younger riders (about 70%) and the learner and probationary riders had completed a course in 1995 or more recently than the older riders and full licence holders (see Tables 8.26 and 8.27). Recency of training appeared to have little effect on riding with positive alcohol readings (see Table 8.28).

Table 8.25. Percentages of cases and controls according to the year of the most recent training course. Percentages are of riders who had completed any training course. Percentages are of known.

Year of latest training course	Present in % cases (n=108)	Present in % controls (n=194)
1995 or later	51	55
1990 to 1994	38	29
Pre-1990	10	16

Table 8.26. Percentages of cases and controls according to the year of the most recent training course and age group. Percentages are of riders who had completed any training course. Percentages are of known.

Year of latest training course	Under 25		25 to 34		35 and over	
	Cases (n=49)	Controls (n=42)	Cases (n=38)	Controls (n=99)	Cases (n=21)	Controls (n=53)
1995 or later	73	69	31	61	38	34
1990 to 1994	27	29	51	26	42	34
Pre-1990	0	2	18	13	21	32

Table 8.27. Percentages of cases and controls according to the year of the most recent training course and licence status. Percentages are of riders who had completed any training course. Percentages are of known.

Year of latest training course	Learner permit		Probationary		Full	
	Cases (n=26)	Controls (n=23)	Cases (n=20)	Controls (n=19)	Cases (n=60)	Controls (n=147)
1995 or later	100	96	70	84	23	45
1990 to 1994	0	4	30	11	58	35
Pre-1990	0	0	0	5	19	20

Table 8.28. Percentages of cases and controls according to the year of the most recent training course and BAC level. Percentages are of riders who had completed any training course. Percentages are of known.

Year of latest training course	BAC=.000		BAC>.000 *	
	Cases (n=60)	Controls (n=174)	Cases (n=9)	Controls (n=5)
1995 or later	58	55	56	60
1990 to 1994	30	29	33	0
Pre-1990	12	16	11	40

* percentages of those who have had training, so small numbers for BAC>.000

8.3.4 Attitudes to training

Crashed riders who have had training were almost as likely as control riders to state that training had helped them to avoid accidents (see Table 8.29). Crashed riders who were learner permit holders and crashed riders aged 35 and over were less likely than controls in the same group to endorse this statement, however (see Table 8.30).

When asked whether training was important for novices only, all riders or not important, the patterns of response of case and control riders were similar.

Table 8.29. Percentages of cases and controls according to attitudes to rider training. Riders who have had training only. Percentages are of known.

Variable	Present in % cases (n=100)	Present in % controls (n=193)
Training has helped to avoid accidents	89	95
Training important for		
novices	16	18
all riders	82	81
not important	2	1

Table 8.30. Percentages of cases and controls according to attitudes to rider training for each age group. Riders who have had training only. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases (n=44)	Controls (n=42)	Cases (n=35)	Controls (n=98)	Cases (n=21)	Controls (n=53)
Training has helped to avoid accidents	89	98	97	93	78	96
Training important for						
novices	21	12	13	16	14	23
all riders	78	87	82	83	86	75
not important	2	2	5	1	0	2

Table 8.31. Percentages of cases and controls according to attitudes to rider training and licence status. Riders who have had training only. Percentages are of known.

Variable	Learner permit		Probationary		Full	
	Cases (n=22)	Controls (n=23)	Cases (n=19)	Controls (n=19)	Cases (n=57)	Controls (n=146)
Training has helped to avoid accidents	82	100	94	100	90	93
Training important for						
novices	10	3	17	11	16	19
all riders	86	94	79	89	83	79
not important	3	3	4	0	1	1

Table 8.32. Percentages of cases and controls according to attitudes to rider training for riders with zero BAC and riders with BAC greater than zero. Riders who have had training only. Percentages are of known.

Variable	BAC=.000		BAC>.000	
	Cases (n=53)	Controls (n=173)	Cases (n=7)	Controls (n=5)
Training has helped to avoid accidents	84	95	100	100
Training important for				
novices	19	18	24	18
all riders	79	81	76	82
not important	2	2	0	0

Table 8.33. Odds ratios and confidence intervals for attitudes tor rider training, unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

Variable	Unadjusted	Adjusted for		
		Age group	BAC	Age group and BAC
Training has helped to	0.4	0.4	0.5	0.4
avoid accidents	0.1-1.6	0.1-1.5	0.1-2.2	0.1-2.0
Compared with all riders, training important for				
novices only	0.9	0.9	1.3	1.3
	0.5-1.5	0.5-1.6	0.7-2.5	0.7-2.6
not important	2.2	2.5	1.3	1.3
	0.5-9.0	0.6-10.4	0.2-8.1	0.2-8.5

8.3.5 Most important thing learnt from training

Riders who had completed at least one training course were asked what was the most important thing that they had learnt from training. Table 8.34 shows that braking was the most common response, followed by machine handling and cognitive skills.

Table 8.34. Percentages of cases and controls according to the most important thing learnt from training. Percentages are of riders who have completed any training course. Percentages are of known.

Most important thing learnt	Present in % cases (n=102)	Present in % controls (n=194)
cognitive/observational skills	28	21
braking	34	35
machine handling	26	28
other	12	16

Tables 8.35 and 8.36 show that braking was generally the most common response for case and control riders in each age group and licence status. There was a trend for crashed riders to be somewhat more likely than controls to report that cognitive and observational skills were the most important thing learnt. This was most evident for riders who had completed advanced courses (see Table 8.23).

Table 8.35. Percentages of cases and controls according to the most important thing learnt from training and age group. Percentages are of riders who have completed any training course. Percentages are of known.

Most important thing learnt	Under 25		25 to 34		35 and over	
	Cases (n=44)	Controls (n=42)	Cases (n=37)	Controls (n=99)	Cases (n=21)	Controls (n=53)
cognitive/observational skills	30	17	24	26	33	17
braking	36	43	32	32	33	34
machine handling	26	24	24	27	29	34
other	9	17	21	16	4	15

Table 8.36. Percentages of cases and controls according to the most important thing learnt from training and licence status. Percentages are of riders who have completed any training course. Percentages are of known.

Most important thing learnt	Learner permit		Probationary		Full	
	Cases (n=22)	Controls (n=23)	Cases (n=20)	Controls (n=19)	Cases (n=58)	Controls (n=147)
cognitive/observational skills	28	23	40	21	24	20
braking	36	41	35	37	34	33
machine handling	24	18	15	32	29	29
other	12	18	10	11	13	17

Table 8.37. Percentages of cases and controls according to the most important thing learnt from training and level of course completed. Percentages are of riders who have completed any training course. Percentages are of known.

Most important thing learnt	Beginner		Intermediate		Advanced	
	Cases (n=51)	Controls (n=73)	Cases (n=31)	Controls (n=55)	Cases (n=16)	Controls (n=55)
cognitive/observational skills	30	26	18	18	41	18
braking	30	38	39	40	29	26
machine handling	26	17	30	38	18	33
other	13	19	12	4	12	24

Crashed riders with BAC>.000 tended to be more likely than other crashed riders to state that machine handling skills were the most important thing that they had learnt from training (see Table 8.38). However, there were only small numbers in this group.

Table 8.38. Percentages of cases and controls according to the most important thing learnt from training and BAC level. Percentages are of riders who have completed any training course. Percentages are of known.

Most important thing learnt	BAC=.000		BAC>.000	
	Cases (n=53)	Controls (n=174)	Cases (n=7)	Controls (n=5)
cognitive/observational skills	29	20	14	60
braking	34	34	29	20
machine handling	23	30	57	20
other	14	17	0	0

8.4 ALCOHOL

This section summarises the available BAC data and the riders' responses to questions about consumption of alcohol in the previous 12 hours. The riders' usual patterns of alcohol use are also reported.

8.4.1 Blood alcohol concentration

8.4.1.1 Data availability

Overall, BAC values were available for 66% of crashed riders and 90% of those control riders who stopped. There were no missing rider BACs for any of the 24 fatal crashes. For hospital admission crashes, 39% of rider BACs were missing. For crashes where the rider was treated at the Emergency Department and not admitted, 36% of rider BACs were missing. The details of the missing BACs and the processes undertaken to locate them are detailed in Appendix 2.

The characteristics of the crashes for which BAC was known or unknown are summarised in Appendix 3. There were relatively few differences between crashes for which BAC was known and those crashes which were reported to Police but BAC was unknown. Crashes which appeared not to have been reported to Police differed from these two groups, however. Crashes which were not reported to Police were more likely to be single vehicle crashes involving loss of control of the motorcycle. There was a trend for crashes which were not reported to be more likely to have unlicensed riders but this just failed to reach statistical significance (p=.08).

All control riders who stopped were asked to undertake a preliminary breath test. The BAC reading was unavailable for 54 control riders (10%) who refused to be tested. Some of these riders refused because they did not drink alcohol or had not done so recently, others because they said they disapproved of random breath testing. Riders for whom a follow-up interview was conducted were equally likely to have refused the breath test as those riders for whom only a roadside interview was conducted (9% versus 11%).

8.4.1.2 BAC values

Table 8.39 shows that 13% of crashed riders for whom BAC was known had BAC>.05, compared to less than 1% of control riders. Given the missing data, between 9% to 43% of all cases could have BAC>.05 and less than 1% to 10% of all controls could have BAC>.05. This means that the analyses of BAC values should be interpreted with considerable caution.

Crashed riders were not only more likely to have a positive BAC, but those with positive BACs tended to have higher values than those controls with positive BACs.

Table 8.39. Percentages of cases and controls according to BAC level. Percentages are of known. The possible range is given in brackets.

Variable	Present in % cases	Present in % controls
BAC>.000	19 (12 - 46)	3 (3 - 13)
BAC>.050	13 (9 - 43)	<1 (<1 - 10)
BAC level		
zero	82	97
<=.050	5	3
.051 to .149	8	<1
>=.150	5	0

Alcohol use was expected to vary according to the sex and age of the rider. Table 8.40 shows that no female riders had BAC>.05 (or BAC>.00), although the number of female riders was small.

Table 8.40. Percentages of cases and controls according to BAC level for male and female riders. Percentages are of known.

Variable	Male		Female	
	Cases (n=130)	Controls (n=478)	Cases (n=5)	Controls (n=28)
BAC>.00	19	3	0	4
BAC>.05	14	<1	0	0
BAC level				
zero	81	97	100	96
<=.050	5	3	0	4
.051 to .149	9	<1	0	0
>=.150	5	0	0	0

Crashed riders aged 25 to 34 appeared somewhat less likely than other crashed riders to have BAC>.05 (see Table 8.41).

Table 8.41. Percentages of cases and controls according to BAC level for each age group. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
BAC>.00	20	1	11	4	24	4
BAC>.05	16	0	9	<1	14	0
BAC level						
zero	80	99	89	96	76	96
<=.050	4	1	2	4	11	4
.051 to .149	10	0	7	<1	8	0
>=.150	6	0	2	0	5	0

The proportions of crashed riders with BAC>.00 or BAC>.05 were similar for learner, probationary and full licence holders (see Table 8.42). The BAC levels were somewhat lower for learner riders in crashes however - none of the learners had BAC>.15 whereas half of the crashed probationary and full licence holders with BAC>.05 had BAC>.15.

Of the six unlicensed riders in crashes, three had BAC>.05. The one unlicensed control rider had a BAC reading of zero.

Table 8.42. Percentages of cases and controls according to BAC level for each licence type. Percentages are of known.

Variable	Learner		Probationary		Full	
	Cases	Controls	Cases	Controls	Cases	Controls
BAC>.00	17	0	14	7	18	4
BAC>.05	12	0	14	0	12	<1
BAC level						
zero	84	100	86	93	82	97
<=.050	4	0	0	7	6	3
.051 to .149	12	0	7	0	6	<1
>=.150	0	0	7	0	6	0

The odds ratios and confidence intervals for the alcohol variables are presented in Table 8.43. With the exception of BACs between .000 and .050, all of the odds ratios show a statistically significant increase in risk associated with the alcohol variables, which is little affected by adjustment for age group or licence status.

Table 8.43. Odds ratios and confidence intervals for alcohol variables, unadjusted and adjusted for age group and licence status. Highlighted odds ratios are statistically significant at the 95% level.

Variable	Unadjusted	Adjusted for	
		Age group	Licence status
BAC>.000	**5.6**	**5.2**	**4.9**
	2.4 - 13.1	2.2 - 12.5	2.0 - 11.8
BAC>.050	**44.3**	**38.3**	**39.4**
	5.5 - 353.2	4.6 - 318.6	4.7 - 329.7
.000<BAC<.051	1.5	*	*
	0.5 - 4.7		
Consumed alcohol in previous 12 hours	**1.9** 1.0 - 3.3	**2.1** 1.1 - 3.8	**2.0** 1.1 - 3.8

* insufficient data to compute adjusted odds ratios

8.4.2 Recent use of alcohol

Riders in crashes and control riders who completed the follow-up interview were asked whether they had consumed any alcohol in the previous 12 hours. This information was available for 89% of cases and 99% of controls who were followed-up. Thus this information was available for a different set of riders than the BAC data reported above.

The percentages who had consumed alcohol are summarised in Table 8.44. Overall, 16% of crashed riders and 9% of control riders had consumed alcohol in the previous 12 hours. No female riders had consumed alcohol in the previous 12 hours, compared with 17% of male riders in crashes and 10% of male control riders (however the number of female riders was small).

Table 8.44. Percentages of cases and controls who had consumed alcohol in the previous 12 hours. Percentages are of known.

Alcohol consumed in previous 12 hours	Present in % cases	Present in % controls
Overall	16	9
Sex of rider		
male	17	10
female	0	0
Riders aged		
under 25	12	4
25 to 34	13	10
35 and over	27	11
BAC=.000	10	8
BAC>.000	76	82
Licence status		
learner	7	3
probationary	21	10
full	17	10

Alcohol use in the previous 12 hours was most common among the oldest group of crashed riders and least common among the youngest control riders. Learner riders (both case and control) were less likely to have consumed alcohol in the previous 12 hours than riders with probationary or full licences.

Recent use of alcohol by riders for whom there was no BAC reading recorded was examined. The data showed that 7% of crashed riders and 3% of control riders with BAC missing had consumed alcohol in the previous 12 hours. This is no greater than that found for the overall sample (16% of crashed riders and 9% of control riders), suggesting that riders with missing BACs were not more likely to have been drinking than riders with BACs available.

8.4.3 Pattern of use of alcohol

Crashed riders and control riders who were followed-up were asked how often they drink enough to feel affected by alcohol. It should be noted that this does not relate directly to drink riding, because the question did not mention riding.

Table 8.45 shows that riders in crashes reported drinking enough to feel affected by alcohol less often than control riders. The extent to which the responses of cases shows a social desirability basis is difficult to assess.

Table 8.45. Percentages of cases and controls according to how often they drink enough to feel affected by alcohol. Percentages are of known.

How often drink enough to feel affected by alcohol	Present in % cases	Present in % controls
Once per week or more	26	32
Once a month or more	28	33
Once every 6 months or more	17	18
Once a year or less	4	7
Never	25	11

The frequencies with which male and female control riders drank enough to feel affected by alcohol were similar (see Table 8.46). The small number of crashed female riders precluded comparisons of male and female crashed riders.

Table 8.46. Percentages of male and female cases and controls according to how often they drink enough to feel affected by alcohol. Percentages are of known.

How often drink enough to feel affected by alcohol	Male		Female	
	Cases (n=171)	Controls (n=359)	Cases (n=7)	Controls (n=20)
Once per week or more	28	31	0	35
Once a month or more	27	33	43	30
Once every 6 months or more	17	18	29	20
Once a year or less	4	7	0	5
Never	25	11	29	10

The pattern of use of alcohol according to rider age is summarised in Table 8.47. At all age groups, crashed riders more commonly reported "never" drinking enough to feel affected by alcohol than did controls. There are no clear age-related patterns.

Table 8.47. Percentages of cases and controls of each age group according to how often they drink enough to feel affected by alcohol. Percentages are of known.

Variable	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Once per week or more	29	33	18	30	34	34
Once a month or more	32	41	31	37	18	22
Once every 6 months or more	15	13	19	17	16	22
Once a year or less	3	0	5	7	4	11
Never	20	13	27	10	28	12

Among learner riders, cases generally reported drinking enough to feel affected by alcohol less often than controls (see Table 8.48). The pattern was similar for full licence holders but not for holders of probationary licences.

Table 8.48. Percentages of cases and controls according to how often they drink enough to feel affected by alcohol for each licence type. Percentages are of known.

Variable	Learner		Probationary		Full	
	Cases	Controls	Cases	Controls	Cases	Controls
Once per week or more	21	41	30	21	29	32
Once a month or more	35	32	30	50	25	31
Once every 6 months or more	17	9	13	11	20	20
Once a year or less	0	3	9	0	4	8
Never	28	15	17	18	23	9

The frequencies that riders with BAC available and those with BAC missing drank enough to feel affected by alcohol were generally similar (see Table 8.49).

Table 8.49. Percentages of cases and controls with BAC data available and missing according to how often they drink enough to feel affected by alcohol. Percentages are of known.

How often drink enough to feel affected by alcohol	BAC available		BAC missing	
	Cases (n=110)	Controls (n=345)	Cases (n=68)	Controls (n=35)
Once per week or more	30	31	21	37
Once a month or more	25	33	31	29
Once every 6 months or more	18	18	16	14
Once a year or less	3	7	6	6
Never	24	11	27	14

8.5 ILLICIT DRUGS

Injured riders and those controls who completed the follow-up interview were asked whether they had used marijuana or any other illicit drugs in the previous 12 hours. It is possible that some riders deliberately under-reported their use of illicit drugs. For two fatally injured riders, illicit drug use was identified from the toxicology reports.

Table 8.50 shows that 6% of crashed riders and 3% of control riders had used illicit drugs in the previous 12 hours. For more than three-quarters of both cases and controls the drug used was marijuana. None of the small number of female riders had used illicit drugs. Usage of illicit drugs appeared to decrease with age in both case and control riders.

Crashed riders with BAC>.000 were about three times as likely to have used illicit drugs in the previous 12 hours than crashed riders with zero BAC. While illicit drug use was less in control riders, the pattern of increased use by those riders who had consumed alcohol was found for control riders as well.

Table 8.50. Percentages of cases and controls who had used illicit drugs in the previous 12 hours. Percentages are of known.

Used drugs in previous 12 hours	Present in % cases	Present in % controls
Overall	6	3
Sex of rider		
male	6	3
female	0	0
Riders aged		
under 25	9	4
25 to 34	6	3
35 and over	2	1
BAC=.000	5	3
BAC>.000	18	9
Licence status		
learner	14	3
probationary	8	7
full	3	2

Learner riders in crashes were more likely to have used illicit drugs in the previous 12 hours than probationary or fully licensed riders. The same trend was not apparent for control riders, however. One unlicensed rider in a crash had used illicit drugs (9% of unlicensed riders).

None of the unadjusted or adjusted odds ratios for having used illicit drugs in the previous 12 hours were statistically significant (see Table 8.51).

Table 8.51. Odds ratios and confidence intervals for having used illicit drugs in the previous 12 hours, unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

	Odds ratio	Confidence interval
Unadjusted	2.0	0.8 - 5.0
Adjusted for...		
Age	1.7	0.7 - 4.3
BAC	1.1	0.3 - 3.6
Licence status	1.6	0.6 - 4.1
Age and BAC	0.9	0.2 - 3.2
Licence status and BAC	0.7	0.2 - 2.7

8.6 PRESCRIPTION AND NON-PRESCRIPTION DRUGS

Riders in crashes and those control riders who completed the follow-up interview were asked if they had taken any prescription drugs or non-prescription drugs in the last 12 hours (prior to the crash, or prior to being stopped). Non-prescription drugs were described as "medications that you can buy only from the chemist, but without a prescription from a doctor". The availability of information about prescription and non-prescription drugs is summarised in Table 8.52.

Table 8.52. Availability of information about use of prescription and non-prescription drugs in the previous 12 hours for case and control riders.

Information available	Cases		Controls	
	Number	Percent	Number	Percent
Prescription drugs	184	90	381	99
Non-prescription drugs	181	88	381	99

The data regarding taking prescription drugs are summarised in Table 8.53. Overall, 11% of cases and 8% of controls had taken prescription drugs in the previous 12 hours. The most common prescription drugs reported were asthma and antidepressant medications and anti-hypertensives. Usage of antidepressants was reported by six crashed riders and two control riders.

Crashed female riders were less likely to have taken prescription drugs than crashed male riders but the pattern was reversed for control riders. The number of female riders was small, however, and so these results must be treated with caution.

Table 8.53. Percentages of cases and controls who had taken prescription drugs in the previous 12 hours. Percentages are of known.

Taken prescription drugs in previous 12 hours	Present in % cases	Present in % controls
Overall	11	8
Sex of rider		
male	11	8
female	0	25
Riders aged		
under 25	3	7
25 to 34	13	7
35 and over	17	12
BAC=.000	5	8
BAC>.000	14	9
Licence status		
learner	7	9
probationary	4	10
full	13	8

Crashed riders aged under 25 were somewhat less likely to have taken prescription drugs than control riders but the reverse pattern was found for the two older age groups.

Crashed riders with zero BAC were no more likely to have taken prescription drugs than control riders with zero BAC. However, crashed riders with alcohol in their system were more likely to have taken prescription drugs than control riders who had consumed alcohol (or crashed riders who had not consumed alcohol).

For controls, the percentage of riders who had taken prescription drugs did not appear to vary with licence status. For crashed riders, full licence holders were more likely to have taken prescription drugs.

None of the unadjusted or adjusted odds ratios for having taken prescription drugs in the previous 12 hours were statistically significant (see Table 8.54).

Table 8.54. Odds ratios and confidence intervals for having taken prescription drugs in the previous 12 hours, unadjusted and adjusted for age group and BAC. Highlighted odds ratios are statistically significant at the 95% level.

	Odds ratio	Confidence interval
Unadjusted	1.4	0.7 - 2.8
Adjusted for...		
Age	1.6	0.8 - 3.1
BAC	0.6	0.2 - 1.7
Age and BAC	0.6	0.2 - 1.9

The data regarding taking non-prescription drugs in the previous 12 hours are summarised in Table 8.55. Overall, only 2% of crashed riders and 3% of control riders had taken non-prescription drugs in the previous 12 hours. Taking non-prescription drugs therefore appears to be less common than taking prescription drugs.

Cough and cold and hay fever medications were the most common non-prescription drugs reported.

The small number of female cases (7) were more likely to have taken non-prescription drugs than female controls or male cases or controls.

The percentages of cases and controls who had taken non-prescription drugs did not appear to differ markedly according to rider age, alcohol consumption or licence status. Given the small numbers involved, the estimated odds ratios had very large confidence intervals and are not reported here.

Table 8.55. Percentages of cases and controls who had taken non-prescription drugs in the previous 12 hours. Percentages are of known.

Taken non-prescription drugs in previous 12 hours	Present in % cases	Present in % controls
Overall	2	3
Sex of rider		
male	1	3
female	29	0
Riders aged		
under 25	3	7
25 to 34	0	2
35 and over	2	2
BAC=.000	1	3
BAC>.000	0	0
Licence status		
learner	0	6
probationary	0	3
full	2	3

8.7 PROTECTIVE GEAR

This section examines helmet wearing (and the type and age of the helmet) and appropriate protective clothing and footwear among crashed and control riders.

8.7.1 Helmets

8.7.1.1 Helmet wearing

Injured riders were asked whether they were wearing the helmet at the time of the crash. Information about fatally injured riders was obtained from the Victoria Police. Roadside interview staff recorded whether the control riders were wearing helmets. Whether the rider was wearing a helmet was known for 99% of crashed riders and almost 100% of control riders.

Overall, five crashed riders (2% of known) and seven control riders (1% of known) were not wearing helmets. Four of the five crashed riders were aged under 25 and had never held a licence (i.e. 33% of unlicensed crashed riders). The other crashed rider was aged under 25 and held a learners permit. None of these crashes were fatal and none involved alcohol.

Of the seven control riders not wearing helmets, five did not stop, one completed the roadside interview only and one completed the follow-up interview. Both riders who stopped were male full licence holders aged over 25 with zero BAC.

The unadjusted odds ratio associated with not wearing a helmet was 4.3 (CI 1.2 to 16.3). The lack of additional information about many of these riders precluded the estimation of adjusted odds ratios.

8.7.1.2 Type of helmet

Overall, 17% of crashed riders and 13% of control riders were wearing an open-face helmet (see Table 8.56). Open-face helmets were more commonly associated with riders aged 35 and over and full licence holders. All eight unlicensed riders who were wearing a helmet were wearing a full-face helmet.

Control riders with BAC>.000 were more likely to be wearing an open-face helmet than control riders with zero BAC. The difference was in the same direction, but smaller, for crashed riders.

Open-face helmets were somewhat more likely to be associated with nonwork-related trips (for both cases and controls).

As expected, open-face helmets were most common among riders of motorcycles of engine capacity 750 cc and above.

Table 8.56. Percentages of cases and controls who were wearing open-face helmets. Percentages are of known.

	Present in % cases	Present in % controls
Overall	17	13
Sex of rider		
male	16	14
female	43	3
Riders aged		
under 25	6	3
25 to 34	9	12
35 and over	43	24
BAC=.000	18	12
BAC>.000	22	41
Licence status		
learner	0	10
probationary	4	2
full	25	16
Work-related trip	15	9
Nonwork-related trip	18	14
Engine capacity (cc)		
less than 260	9	8
260-749	3	4

750 and above	29	20

Adjustment for BAC led to a nonsignificant odds ratio for wearing an open face helmet compared to a full face helmet (see Table 8.57). In summary, open-face helmets are associated with older, more experienced riders which lowers crash risk but with more alcohol consumption which increases crash risk.

Table 8.57. Odds ratios and confidence intervals for wearing an open-faced helmet, unadjusted and adjusted for age group, BAC and licence status. Highlighted odds ratios are statistically significant at the 95% level.

	Odds ratio	Confidence interval
Unadjusted	**1.6**	1.2 - 16.3
Adjusted for...		
Age	**1.8**	1.1 - 3.1
BAC	1.2	0.6 - 2.3
Licence status	**1.9**	1.1 - 3.2
Age and BAC	1.4	0.7 - 2.8

8.7.1.3 Visors

Visors were much more commonly used by riders with full face helmets than those with open face helmets (see Table 8.58). Among riders with open face helmets there was a trend for controls to be more likely to be using a visor.

Table 8.58. Percentages of case and control riders using a visor according to the type of helmet worn.

Type of helmet	Present in % cases	Present in % controls
Full face	86	80
Open face	9	24

The analysis showed that 22% of crashed riders and 27% of control riders with full face helmets who were using a visor were using a tinted visor.

8.7.1.4 Age of helmet

Overall, the age of helmets did not seem to differ markedly between crashed and control riders (see Table 8.59). Older riders (and fully licensed riders) had older helmets (Tables 8.60 and 8.61). Open-face helmets were older on average than full-face helmets but this reflected that older riders (who have older helmets) are more likely to wear open-face helmets. Table 8.62 shows that crashed riders with positive BACs were somewhat more likely to be wearing older helmets but this may reflect the finding that riders with positive BACs are more commonly older riders.

Table 8.59. Percentages of cases and controls according to age of helmet. Percentages are of known.

Age of helmet	Present in % cases	Present in % controls
Less than 5 years	85	82
5 to 10 years	12	14
More than 10 years	3	5

Table 8.60. Percentages of cases and controls according to age of helmet for each age group. Percentages are of known.

Age of helmet	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Less than 5 years	93	94	88	85	77	71
5 to 10 years	7	5	12	13	14	20
More than 10 years	0	2	0	2	10	9

Table 8.61. Percentages of cases and controls for which rider training variables were present for each age group. Percentages are of known.

Age of helmet	Learner permit		Probationary		Full	
	Cases	Controls	Cases	Controls	Cases	Controls
Less than 5 years	93	94	100	96	81	80
5 to 10 years	7	6	0	4	15	15
More than 10 years	0	0	0	0	5	6

Table 8.62. Percentages of cases and controls according to age of helmet and BAC level. Percentages are of known.

Age of helmet	BAC=.000		BAC>.000	
	Cases	Controls	Cases	Controls
Less than 5 years	91	81	65	82
5 to 10 years	7	15	29	9
More than 10 years	2	4	6	9

Compared to helmets aged less than five years old, there was no significant increase in risk associated with helmets which were 5 to 10 years old or more than 10 years old (see Table 8.63).

Overall, 8% of helmets worn by crashed riders and 6% of helmets worn by control riders were bought second-hand.

Table 8.63. Odds ratios and confidence intervals for age of helmet, unadjusted and adjusted for age group and BAC. The reference level is helmets aged less than five years old. Highlighted odds ratios are statistically significant at the 95% level.

Age of helmet	Unadjusted	Adjusted for		
		Age group	BAC	Age group and BAC
5 to 10 years	0.9 0.5 - 1.6	0.9 0.5 - 1.6	0.5 0.2 - 1.2	0.5 0.2 - 1.3
More than 10 years	0.6 0.2 - 1.9	0.6 0.2 - 1.9	0.6 0.1 - 2.3	0.6 0.1 - 2.7

8.7.1.5 Ownership of helmet

Overall, 7% of riders in crashes and 2% of control riders were wearing helmets that did not belong to them (see Table 8.64). Among the cases, wearing a helmet that did not belong to the rider was most common for young riders, riders with positive BACs and riders who did not own the motorcycle they were riding. The latter was true also for control riders.

Table 8.65 shows that the increased risk associated with wearing a helmet that did not belong to the rider was not significant after adjustment for age and BAC.

Table 8.64. Percentages of cases and controls who were wearing helmets that did not belong to them. Percentages are of known.

	Present in % cases	Present in % controls
Overall	7	2
Riders aged		
under 25	8	4
25 to 34	9	1
35 and over	2	1
BAC=.000	4	1
BAC>.000	14	0
Licence status		
learner	3	6
probationary	8	0
full	5	1
Owner of the motorcycle	3	<1
Not the owner	36	17
Engine capacity (cc)		
less than 260	13	4
260-749	6	0
750 and above	2	1

Table 8.65. Odds ratios and confidence intervals for wearing a helmet that did not belong to the rider, unadjusted and adjusted for age group, BAC and ownership of the motorcycle. Highlighted odds ratios are statistically significant at the 95% level.

	Odds ratio	Confidence interval
Unadjusted	**5.0**	1.5 - 16.4
Adjusted for...		
Age	**4.9**	1.5 - 16.6
BAC	6.8	0.8 - 61.0
Ownership of motorcycle	**4.7**	1.3 - 16.7
Age and BAC	7.7	0.8 - 77.4

8.7.2 Adequacy of protective gear

Clothing and footwear were observed for controls but self-reported for cases. Riders were coded as wearing adequate protective gear if they were wearing clothing made of leather or heavy-weight or waterproof material both below and above the waist.

The percentages of crash and control riders wearing inadequate protective gear are summarised in Table 8.66. Overall, 25% of crashed riders and 21% of control riders were wearing inadequate protective clothing. Younger riders in crashes were most likely to be wearing inadequate protective clothing.

Crashed riders with BACs greater than zero were somewhat more likely to be wearing inadequate protective gear than other riders.

One-third of the unlicensed motorcyclists were wearing inadequate protective gear.

None of the unadjusted or adjusted odds ratios for wearing inadequate protective gear were statistically significant (see Table 8.67).

Riders in crashes were less likely to have been wearing motorcycle boots than control riders (33% versus 51%). Crashed riders were somewhat more likely than control riders to have been wearing laced heavy boots (35% versus 29%) or other footwear (32% versus 20%).

Table 8.66. Percentages of cases and controls wearing inadequate protective gear. Percentages are of known.

	Present in % cases	Present in % controls
Overall	25	21
Sex of rider		
male	24	22
female	38	13
Riders aged		
under 25	34	24
25 to 34	17	21
35 and over	20	19
BAC=.000	25	23
BAC>.000	32	18
Licence status		
learner	17	19
probationary	21	26
full	25	21
Riders with training	24	22
Riders without training	26	21
Level of training		
beginner	26	21
intermediate	9	22
advanced	47	26

Table 8.67. Odds ratios and confidence intervals for wearing inadequate protective gear, unadjusted and adjusted for age group, BAC, motorcycle ownership and training. Highlighted odds ratios are statistically significant at the 95% level.

	Odds ratio	Confidence interval
Unadjusted	1.4	0.9 - 2.2
Adjusted for...		
Age	1.3	0.8 - 2.0
BAC	1.4	0.8 - 2.6
Ownership of motorcycle	1.3	0.8 - 2.2
Age and BAC	1.3	0.7 - 2.3
Ownership and BAC	1.2	0.6 - 2.4
Training	1.4	0.8 - 2.2
Training and age group	1.2	0.7 - 2.0

9. CASE-CONTROL COMPARISONS - PILLION FACTORS

The presence of pillion passengers could possibly contribute to either crash causation (e.g. by behaving inappropriately or simply by producing a higher centre of gravity) or increased crash severity (because they are another person who may be killed or injured). Almost all of the riders with pillions reached the threshold injury level for admission to the study regardless of the extent of injury to the pillion passenger.

9.1 CHARACTERISTICS OF RIDERS WITH PILLIONS

There were pillions present in 10% of crashes while 7% of control motorcycles had pillions (see Table 9.1). Crashed riders aged 35 and over were more likely than younger crashed riders or controls to have pillions. None of the small number of female riders had pillions. Riders who had been drinking were more likely to be carrying pillions. Full licence holders were more likely to be carrying pillions than riders with learner permits or probationary licences. In Victoria, riders with learner permits and those with restricted licences (first year of riding after obtaining the licence unless full car licence held) are prohibited from carrying pillion passengers.

Not surprisingly, pillion carriage was much more common for nonwork-related trips than work-related trips.

Table 9.1. Percentages of case and control riders who had pillion passengers. Percentages are of known.

Presence of pillion	Present in % cases	Present in % controls
Overall	10	7
Riders aged		
under 25	8	6
25 to 34	7	9
35 and over	15	8
Sex of rider		
male	10	8
female *	0	0
Rider BAC=.000	9	8
Rider BAC>.000	24	12
Licence status		
learner	3	2
probationary	0	2
full	14	9
Work-related trip	3	1
Nonwork-related trip	14	15

* percentages are based on small numbers and may not be reliable

Whether a pillion was carried was known for all cases and controls and calculation of the odds ratio for the entire sample showed no statistically significant increase in crash risk with pillion carriage. The adjusted odds ratios, based on the subset of the data for which the adjustment factors were recorded, showed that pillion carriage increased crash risk after adjusting for alcohol. Yet the unadjusted odds ratio when calculated for this subsample showed a significant increase in crash risk with pillion carriage. Therefore the adjustments did not strengthen the odds ratios for pillion carriage within the subsample analysed.

Table 9.2. Unadjusted and adjusted odds ratios and confidence intervals for pillion carriage. Highlighted odds ratios are statistically significant.

Presence of pillion	Odds ratio	Confidence interval
Unadjusted	1.4	0.8-2.4
Adjusted for..		
Rider age	1.6	0.8-3.1
Presence of alcohol	**2.4**	1.1-5.4
Licence status	1.8	0.9-3.5
Age and alcohol	**2.5**	1.1-5.8
Licence status and alcohol	**2.8**	1.2-6.3

9.2 CHARACTERISTICS OF PILLIONS

In general, less information was able to be collected about the pillions than the riders. Information about the pillions was only available for some of the pillions in crashes. Thus, while there were 20 crashes involving pillions, pillion details are available for only 11 of these crashes. While there were 84 control pillions, only observational information was available for 61 of these pillions. To improve this situation, the photographs of all the riders with pillions were viewed and the sex of rider and pillion and the size of the pillion (child size or adult size) were coded.

Details of the pillion passenger's experience as a rider (including licence status) and experience as a pillion were recorded where a follow-up interview was conducted. However the numbers were too small to analyse.

9.2.1 Sex of rider and pillion

As noted earlier in this report, almost all riders were male. This was true also of the subset of riders who had pillions. Only one control rider with a pillion was female and no crashed riders with pillions were female. In contrast, 70% of pillions in crashes were female and 57% of control pillions were female.

9.2.2 Size of pillion

Size of pillion was coded to avoid the problem of small numbers of pillions for which age was available. All of the pillions in crashes were "adult size". For controls, 9% of pillions were "child size".

10. CASE-CONTROL COMPARISONS - MOTORCYCLE FACTORS

A number of characteristics of the case and control motorcycles were recorded and the analyses are reported here. It should be noted that many of the motorcycle characteristics may not have contributed directly to the occurrence or severity of the crashes, but rather may reflect characteristics of the riders.

10.1 REGISTRATION

Information about the motorcycle's registration and ownership were collected for cases and those controls who completed the follow-up interview. Overall, 5% of crashed motorcycles and 1% of control motorcycles were unregistered.

Of the nine unregistered motorcycles in crashes, five were ridden by riders who had never held a motorcycle licence, one was ridden by a learner and one by a full licence holder. The four unregistered control motorcycles were ridden by full licence holders. There was no evidence of a relationship between alcohol consumption and riding an unregistered motorcycle.

While the data do not permit statistical testing, it is likely that the presence of a higher percentage of unregistered vehicles in the cases than in the controls reflects the relationship of unregistered driving with being unlicensed or rider attitudes, rather than an inherent riskiness of unregistered vehicles.

10.2 OWNERSHIP

Information was gathered about whether the motorcycle was owned by the rider or someone else. This information was available for cases and those control riders who completed the follow-up interview.

Table 10.1 shows that riders in crashes were more likely to be riding a motorcycle that they did not own than control riders.

For both cases and controls, the percentages of riders who owned the motorcycle was greater for those aged 35 or over.

Full licence holders were somewhat more likely to be riding a bike they did not own than learner and probationary riders. However, 50% of the unlicensed riders in crashes did not own the motorcycle they were riding.

Crashed riders were more likely to be riding a bike they did not own on nonwork-related trips than on work-related trips. This was not found for control riders.

Table 10.1. Percentages of cases and controls who did not own the motorcycle they were riding. Percentages are of known.

	Present in % cases	Present in % controls
Overall	14	8
Sex of rider		
male	13	8
female *	25	5
Riders aged		
under 25	17	11
25 to 34	16	9
35 and over	7	5
BAC=.000	14	7
BAC>.000	17	0
Licence status		
unlicensed	50	-
learner	9	12
probationary	4	7
full	13	8
Work-related trip	7	9
Nonwork-related trip	18	6

* percentages are based on small numbers and may not be reliable

There was a significantly increased odds ratio associated with not being the owner of the motorcycle once the factors of rider age, alcohol and licence status were controlled for (see Table 10.2).

Table 10.2. Unadjusted and adjusted odds ratios and confidence intervals for not being the owner of the motorcycle. Highlighted odds ratios are statistically significant.

Variable	Odds ratio	Confidence interval
Unadjusted	1.6	0.9 - 2.9
Adjusted for..		
Rider age	1.5	0.8 - 2.8
Presence of alcohol	**3.0**	1.3 - 7.2
Licence status	1.4	0.8 - 2.8
Age and alcohol	**2.9**	1.2 - 7.3
Licence status and alcohol	**3.0**	1.2 - 7.7

10.3 YEAR OF MANUFACTURE

The year of manufacture was available for 97% of crashed motorcycles and those controls for which a follow-up interview was conducted. The median years of manufacture of case and control motorcycles are summarised in Table 10.3.

Table 10.3. Median year of manufacture of case and control motorcycles.

	Cases	Controls
Overall	1991	1990
BAC=.000	1992	1990
BAC>.000	1988	1990
Rider sex		
male	1991	1990
female *	1995	1990
Rider age		
under 25	1991	1991
25 to 34	1991	1990
35 and over	1992	1986
Licence		
learner	1990	1991
probationary	1992	1991
full	1992	1989
Work-related trip	1990	1990
Nonwork-related trip	1991	1990

* percentages based on small numbers and so may be unreliable

The median year of manufacture for crashed motorcycles was 1991 while the median year of manufacture for control motorcycles was 1990. The Mann-Whitney U Test showed that case motorcycles were statistically significantly younger than control motorcycles (U=33422, p<.05).

Crashed riders with BAC>.00 were riding older motorcycles than crashed riders with BAC=.00.

Learner riders in crashes were riding somewhat older bikes than other riders in crashes and full licence holders in crashes were riding newer bikes than control full licence holders.

10.4 ENGINE CAPACITY

The engine capacity was available for most case and control motorcycles and is summarised in Table 10.4. The data show that the distributions of engine capacities for cases and controls were very similar.

Table 10.4. Engine capacity of crash and control motorcycles.

Engine capacity (cc)	Percent of cases	Percent of controls
Less than 260	35	31
260-749	20	19
750 and above	45	50

The engine capacities of motorcycles are summarised according to the licence category of the rider in Table 10.5. For both cases and controls, riders were more likely to ride larger bikes if they held a full licence compared with a probationary licence, compared with a learner permit. Among the learner motorcyclists, crashed riders were somewhat more likely to be riding bikes of 260 cc and above than were control motorcyclists (9% versus 3%). This was not true for riders with probationary licences (29% versus 39%). For the full licence holders, crashed riders were less likely to have been riding bikes of less than 260 cc than control riders and more likely to have been riding bikes of larger than 750 cc.

Table 10.5. Percentages of cases and controls according to engine capacity for each licence category. Percentages are of known.

Engine capacity (cc)	Learner permit		Probationary		Full	
	Cases (n=34)	Controls (n=61)	Cases (n=24)	Controls (n=46)	Cases (n=129)	Controls (n=439)
Less than 260	91	97	71	61	11	20
260-749	6	0	21	11	23	26
750 and above	3	3	8	28	66	54

In Victoria, riders with learner permits and riders with restricted licences (first year of licence unless full car licence held) are restricted to riding a motorcycle of capacity less than 260 cc. All of the learner riders interviewed stated that they were subject to the 260 cc restriction. About three-quarters of the probationary riders interviewed stated that they were subject to the restriction. Some of the learner and probationary riders who stated that they were subject to the restriction were riding a bike with a capacity greater than 260 cc (8% of cases, 8% of controls).

The analyses by age group showed little differences between cases and controls in terms of distribution of engine capacity (see Table 10.6).

Table 10.6. Percentages of cases and controls according to engine capacity for each age group. Percentages are of known.

Engine capacity (cc)	Under 25		25 to 34		35 and over	
	Cases	Controls	Cases	Controls	Cases	Controls
Less than 260	59	55	26	33	16	16
260-749	20	21	20	22	16	22
750 and above	21	25	54	45	67	62

Within each BAC group, case and control riders had similar distributions of motorcycle engine capacity (see Table 10.7). Positive BACs were associated with fewer motorcycles of less than 260 cc for both cases and controls.

Table 10.7. Percentages of cases and controls according to engine capacity and BAC level. Percentages are of known.

Engine capacity (cc)	BAC=.000		BAC>.000	
	Cases	Controls	Cases	Controls
Less than 260	37	33	24	24
260-749	15	21	32	29
750 and above	49	46	44	47

Compared to riding a motorcycle of less than 260 cc, there was no significant increase in crash risk associated with riding a motorcycle of 260 to 749 cc (see Table 10.8). However, there was a significant increase in crash risk associated with riding a motorcycle of 750 cc and above when adjusted for licence status and BAC.

Table 10.8. Odds ratios and confidence intervals for engine capacity, unadjusted and adjusted for age group and BAC. The reference level is less than 260 cc. Highlighted odds ratios are statistically significant at the 95% level.

Engine capacity (cc)	Unadjusted	Adjusted for				
		Age group	BAC	Age group and BAC	Licence status	Licence status and BAC
260 to 749	0.9	0.9	0.7	0.7	1.4	1.3
	0.6 - 1.5	0.5 - 1.4	0.4 - 1.3	0.4 - 1.4	0.8 - 2.6	0.6 - 3.0
750 and above	0.9	1.3	1.1	1.4	**1.9**	**2.4**
	0.6 - 1.3	0.8 - 2.0	0.7 - 1.8	0.8 - 2.5	1.1 - 3.2	1.2 - 4.9

10.5 TWO-STROKE RACE REPLICA MOTORCYCLES

In the past, concern has been expressed about the safety of two-stroke race replica motorcycles. These are high performance motorcycles which are known for having a very sharp increase in power with increases in throttle pressure. While four-stroke race replicas are produced, they do not share this performance characteristic and so have not been considered such a risk.

Much of the concern has focused on the use of this type of motorcycle by inexperienced riders. The New South Wales Roads and Traffic Authority has banned the use of four models of 250 cc race replica motorcycles by learner motorcyclists. These motorcycles are the Honda NSR250, Kawasaki KR1S, Suzuki RGV250 and Yamaha TZR250.

Table 10.9 summarises the prevalence of these four models of motorcycles (and the predecessor of the RGV250, the RG250) in the crash and control populations in the study.

Table 10.9. Percentages of 250 cc case and control motorcycles which were two-stroke race replicas.

	Cases	Controls
Overall	24	9
BAC=.000	18	10
BAC>.000 *	67	0
Rider age		
under 25	28	15
25 to 34	18	7
35 and over	17	0
Licence		
unlicensed *	75	0
learner	20	16
probationary	25	4
full	20	6
Inexperienced	22	6
Experienced	38	10
Ownership		
own the bike	20	7
not the owner	46	9
Work-related trip	20	5
Nonwork-related trip	26	9

* percentages based on small numbers and so may be unreliable

Table 10.9 shows that two-stroke race replicas were almost three times as common among the crashed 250 cc motorcycles than among the control 250 cc motorcycles. Four of the six riders with BAC>.000 who crashed riding a 250 cc motorcycle were riding a two-stroke race replica. Race replicas were more common among cases than controls for each age group and licence category. Five of the 11 250 cc motorcycles in crashes which were not owned by the rider were two-stroke race replicas.

Matched analyses proved inefficient for this variable, since these analyses considered only those cases where the engine capacity was 250 cc and where there were controls with engine capacity of 250 cc. Nonsignificant results were obtained with this small sample. For these reasons, unmatched analyses were performed. Table 10.10 shows that, for the unmatched analyses, there was a statistically significant increase in risk associated with riding a two-stroke race replica motorcycle compared to other 250 cc motorcycles but this was a result of the association with alcohol.

Table 10.10. Unadjusted and adjusted odds ratios and confidence intervals for riding a two-stroke race replica motorcycle compared to other 250 cc motorcycles - UNMATCHED ANALYSIS. Highlighted odds ratios are statistically significant.

Variable	Odds ratio	Confidence interval
Unadjusted	**3.2**	1.6 - 6.4
Adjusted for..		
Rider age	**2.9**	1.3 - 6.7
Presence of alcohol	2.7	1.0 - 7.3
Age and alcohol	2.5	1.0 - 6.6

10.6 HEADLIGHTS ON

Crashed riders were asked whether their headlight was turned on at the time of the crash. Headlight status was recorded by observation for controls. Given that controls were collected at the same time of day and within several weeks of the crash, the matched analysis controls also for lighting conditions.

Table 10.11 summarises the percentage of case and control motorcyclists who had headlights on. The percentages are generally very high and this is likely to be influenced by the number of relatively new motorcycles in the study. Hard-wiring of headlights was mandated for motorcycles produced from March 1992 to October 1996 and these motorcycles comprise a considerable proportion of the motorcycles in the study. To examine the "voluntary" use of headlights, Table 10.12 presents the data for motorcycles manufactured before 1992 only. Year of manufacture was only known for those controls where a follow-up interview was conducted.

Table 10.13 shows that none of the unadjusted or adjusted odds ratios associated with not having headlights on for motorcycles manufactured before 1992 were statistically significant.

Table 10.11. Percentages of case and control motorcycles with headlights on.

	Cases	Controls
Overall	90	89
Daytime (6 am - 6 pm)	86	88
Night-time (6 pm - 6 am)	97	92
BAC=.000	89	87
BAC>.000 *	100	75
Rider age		
under 25	93	92
25 to 34	94	89
35 and over	81	80
Licence		
unlicensed *	67	0
learner	90	95
probationary	96	98
full	90	85
Year of manufacture		
before 1992	85	79
1992 and later	97	97
Training		
yes	90	89
no	87	82
Work-related trip	90	84
Nonwork-related trip	90	88

* percentages based on small numbers and so may be unreliable

Table 10.12. Percentages of case and control motorcycles with headlights on - motorcycles manufactured before 1992 only.

	Cases (n=102)	Controls (n=227)
Overall	85	79
Daytime (6 am - 6 pm)	77	78
Night-time (6 pm - 6 am)	95	80
BAC=.000	81	79
BAC>.000 *	100	67
Rider age		
under 25	91	88
25 to 34	91	85
35 and over	67	68
Licence		
learner	90	95
probationary	91	94
full	84	76
Training		
yes	73	75
no	89	83
Work-related trip	88	78
Nonwork-related trip	83	80

* percentages based on small numbers and so may be unreliable

Table 10.13. Unadjusted and adjusted odds ratios and confidence intervals for having headlights off for motorcycles manufactured before 1992 only. Highlighted odds ratios are statistically significant.

Variable	Odds ratio	Confidence interval
Unadjusted	0.9	0.3 - 2.3
Adjusted for..		
Rider age	2.8	0.7 - 10.8
Presence of alcohol	0.9	0.2 - 4.1
Licence status	1.2	0.4 - 4.0
Age and alcohol	1.6	0.3 - 9.5
Work-related trip	0.8	0.3 - 2.2

11. CASE-CONTROL COMPARISONS - TRIP FACTORS

11.1 REASON FOR THE TRIP

Information about the reason for the trip was collected for cases and those controls who completed the follow-up interview. The reasons were recorded within a number of categories and the proportions of work-related and other trips compared. Work-related trips include travel to and from work and other travel associated with work. Table 11.1 shows the percentages of cases and controls for which the travel was work-related. Overall, 35% of crash trips and 56% of control trips were work-related.

Table 11.1. Percentages of cases and controls for which the trip was work-related. Percentages are of known.

	Percent of cases	Percent of controls
Overall	35	56
BAC=.000	34	57
BAC>.000 *	8	27
Rider age		
under 25	29	51
25 to 34	41	57
35 and over	33	58
Engine capacity (cc)		
less than 260	27	61
260-749	42	63
750 and over	38	50

* percentages based on small numbers and so may be unreliable

From the Table, the lower risk of work-related trips seems to be related to the lower prevalence of alcohol in work-related trips.

The percentage of control trips which were work-related increased with rider age but the pattern for crash trips differed. Crash trips of riders aged 25 to 34 were more likely to be work-related than crash trips of younger or older riders.

For motorcycles of each engine capacity, crash trips were less likely to be work-related than control trips. The size of the difference decreased with increasing engine capacity, however.

All of the odds ratios show a significant increase in crash risk associated with the trip being nonwork-related (see Table 11.2).

Table 11.2. Unadjusted and adjusted odds ratios and confidence intervals for the trip being nonwork-related. Highlighted odds ratios are statistically significant.

Variable	Odds ratio	Confidence interval
Unadjusted	**3.0**	1.8 - 4.8
Adjusted for..		
Rider age	**2.9**	1.8 - 4.8
Presence of alcohol	**2.5**	1.3 - 4.8
Licence status	**2.6**	1.6 - 4.2
Engine capacity	**3.0**	1.9 - 4.9
Age and alcohol	**2.6**	1.3 - 5.2
Licence status and alcohol	**2.2**	1.1 - 4.3

The interpretation of the increased risk associated with nonwork-related travel is confounded, however, by the relationship between the work-related travel and employment status. As shown in Table 8.1, riders in crashes were less likely to be in full-time work and more likely to be receiving a benefit or a student than control riders. Therefore the riding of crashed riders could be expected to involve less work-related travel. The issue which arises is whether increased risk is associated with nonwork-related travel per se or the increased risk is related to another factor (or factors) linked to employment status.

To address this issue, the analyses of trip reason were repeated for riders in full-time employment only. Table 11.3 shows a similar pattern to that of Table 11.1, less work-related travel by crashed riders than control riders. Table 11.4 confirms the findings of Table 11.2, showing that there is a significant association between nonwork-related travel and crash risk, even for riders in full-time work.

Table 11.3. Percentages of cases and controls for which the trip was work-related. RIDERS IN FULL-TIME EMPLOYMENT ONLY. Percentages are of known.

	Percent of cases	Percent of controls
Overall	43	61
BAC=.000	43	62
BAC>.000 *	13	29
Rider age		
under 25	38	58
25 to 34	51	60
35 and over	37	63
Engine capacity (cc)		
less than 260	35	69
260-749	48	66
750 and over	46	53

* percentages based on small numbers (16 cases and 7 controls) and so may be unreliable

Table 11.4. Unadjusted and adjusted odds ratios and confidence intervals for the trip being nonwork-related. Highlighted odds ratios are statistically significant.

Variable	Odds ratio	Confidence interval
Unadjusted	**3.1**	1.6 - 5.9
Adjusted for..		
Rider age	**3.0**	1.5 - 5.9
Presence of alcohol	**3.0**	1.2 - 7.8
Licence status	**2.8**	1.4 - 5.5
Engine capacity	**3.1**	1.6 - 6.1
Age and alcohol	**3.3**	1.2 - 9.0
Licence status and alcohol	**3.0**	1.1 - 8.1

11.2 UNFAMILIARITY WITH THE ROAD

It is possible that unfamiliarity with the road may have played some role in crashes. Information about how many times the rider had ridden that road was collected for cases and those controls who completed a follow-up interview. Unfamiliarity with the road was defined as having ridden that road fewer than four times.

Table 11.5 shows that 18% of cases and 14% of controls had ridden on that road fewer than four times. Learner riders in crashes were somewhat less likely to be riding on an unfamiliar road than control riders, although the reverse was true for probationary riders.

None of the odds ratios associated with rider unfamiliarity with the road were statistically significant (see Table 11.6).

Table 11.5. Percentages of cases and controls for which the rider was unfamiliar with the road. Percentages are of known.

	Percent of cases	Percent of controls
Overall	18	14
BAC=.000	17	14
BAC>.000 *	13	27
Rider age		
under 25	20	13
25 to 34	14	13
35 and over	22	15
Licence type		
learner	16	24
probationary	17	7
full	16	13

* percentages based on small numbers and so may be unreliable

Table 11.6. Unadjusted and adjusted odds ratios and confidence intervals for the rider being unfamiliar with the road. Highlighted odds ratios are statistically significant.

Presence of pillion	Odds ratio	Confidence interval
Unadjusted	1.7	0.9 - 3.0
Adjusted for..		
Rider age	1.7	0.9 - 3.1
Presence of alcohol	1.2	0.5 - 2.7
Licence status	1.5	0.8 - 2.7
Age and alcohol	1.2	0.5 - 2.8
Licence status and alcohol	1.2	0.5 - 2.7

11.3 TRAVEL SPEED

The rider's estimate of the travel speed was available for 157 crashes (77% -all of these were non-fatal crashes). Those control riders who were followed-up were also asked to estimate their travel speed prior to being stopped. This information was available for 358 riders (93% of those riders who were followed-up). The posted speed limit was available for 198 crashes (97%).

Table 11.7 summarises the travel speeds estimated by case and control riders. Median estimated travel speeds varied little across speed zones for control riders. The median estimated speeds did not differ overall (Mann-Whitney U test, p>.05) or for 70 and 80 km/h sites. However, for 60 km/h sites, the estimated speed of cases showed a trend to being lower than that of controls (Mann-Whitney U test, p=.05). The median estimated speed of cases was significantly greater than that of controls for 100 km/h sites (Mann-Whitney U test, p<.05).

Table 11.7. Travel speeds estimated by case and control riders according to the posted speed limit at the site.

Posted speed	Cases		Controls	
limit (km/h)	Median	Range	Median	Range
60	50	5 - 110	60	5 - 103
70 *	67	2 - 80	50	20 - 80
80	60	0 - 80	60	10 - 90
100	80	15 - 105	60	15 - 120
Overall	55	0 - 110	60	5 - 120

* percentage based on small sample size for cases so may not be reliable

The rider's estimate of the travel speed was compared with the posted speed limit to assess the percentage of riders who estimated that they were travelling above the speed limit. These percentages are summarised in Table 11.8.

The percentage of riders who estimated that they were travelling above the speed limit was less at the higher speed limits. Both cases and controls who had BAC>.000 were more than twice as likely to estimate that they were travelling at over the speed limit. The interpretation of some of the other apparent differences in the table is complicated by the inter-relationships of variables. Crashed riders aged over 35 (mostly full licence holders) were less likely to estimate that they were travelling at over the speed limit but the riders in this age group were more likely to have crashed in 100 km/h speed zone than younger riders.

Table 11.8. Percentages of cases and controls for which the rider's estimate of the travel speed was greater than the posted speed limit at that location. Percentages are of known.

	Percent of cases	Percent of controls
Overall	16	19
Posted speed limit (km/h)		
60	19	27
70	38	19
80	0	4
100	5	2
BAC=.000	11	17
BAC>.000 *	31	44
Rider age		
under 25	21	22
25 to 34	18	15
35 and over	7	22
Licence type		
unlicensed *	38	0
learner	13	16
probationary	33	23
full	10	19
Inexperienced rider	16	18
Experienced rider	16	19
Engine capacity (cc)		
less than 260	19	13
260 to 749	12	23
750 and above	15	20
Work-related	11	19
Nonwork-related	19	19

* percentages based on small numbers and so may be unreliable

Riders in crashes where speed had been judged to be a contributory factor (see Section 4.6) were almost three times as likely to have estimated their speed as above the speed limit as riders in crashes where speed was not a contributory factor (35% vs 13%, $\chi^2(1)=7.0$, $p<.05$).

The interpretation of the estimated travel speeds and any differences in these estimates between groups is not completely clear. For controls, the information was collected some days later during the follow-up interview (to minimise length of roadside interview and thus encourage participation). It is possible that cases may have consciously or unconsciously underestimated travel speeds.

12. CASE-CONTROL COMPARISONS - ANALYSIS OF GROUPS

The case-control comparisons presented in the previous chapters show that a number of variables were strongly inter-related. Rider age and licence status were correlated, albeit not to the same extent as is found for car drivers. Licence status and engine capacity were related and engine capacity was related to nonwork-related travel.

The previous chapters have taken the approach of analysing these factors separately. An alternative approach is taken here. Clusters of motorcyclist characteristics were identified from multi-way tables. It was found that 73% of crashed motorcyclists and 79% of control motorcyclists fell into the four groups listed in Table 12.1. The group most over-represented in crashes was riders aged under 25 with a learner or probationary licence, riding a motorcycle of capacity less than 260 cc. The group least represented in crashes comprises riders aged 25 and over with a full licence, riding a motorcycle of less than 250 cc.

Table 12.1. Percentages of cases and controls falling into the four groups. Percentages are based on the sample for which the age, licence and engine capacity are known.

Group	Percent of cases (n=195)	Percent of controls (n=546)
Under 25 with learner or probationary licence, less than 260 cc	19	9
25 and over with full licence, less than 260 cc	6	13
25 and over with full licence, 260-749 cc	11	17
25 and over with full licence, 750 cc and over	37	40
Not belonging to any of the above groups	27	21

Table 12.2 shows that the proportion of riders belonging to each group was similar among riders with BAC=.000 and those with BAC>.000. Riders aged under 25 with a learner or probationary licence, riding a motorcycle of less than 260 cc comprised more of the nonwork-related trips than work-related trips for cases but not controls (see Table 12.3).

Table 12.2. Percentages of cases and controls in each group for riders with zero BAC and riders with BAC greater than zero. Percentages are of known.

Group	BAC=.000		BAC>.000	
	Cases	Controls	Cases	Controls
Under 25 with learner or probationary licence, less than 260 cc	26	11	27	0
25 and over with full licence, less than 260 cc	7	16	0	8
25 and over with full licence, 260-749 cc	12	22	20	38
25 and over with full licence, 750 cc and over	55	51	53	54

Table 12.3. Percentages of cases and controls in each group for work-related trips and nonwork-related trips. Percentages are of known.

Group	Work-related		Nonwork-related	
	Cases	Controls	Cases	Controls
Under 25 with learner or probationary licence, less than 260 cc	19	9	31	8
25 and over with full licence, less than 260 cc	9	17	7	14
25 and over with full licence, 260-749 cc	20	27	13	20
25 and over with full licence, 750 cc and over	52	46	49	59

The odds ratios were calculated by comparing the odds for the first three groups with that of the fourth group, riders aged 25 and over with a full licence, riding a motorcycle of a capacity of 750 cc and over and are summarised in Table 12.4. Group 1 had a significantly higher unadjusted risk but this was not significant after adjustment for BAC. None of the unadjusted or adjusted comparisons between Group 2 and Group 4 were statistically significant. However, the odds ratios were all less than one and their lack of statistical significance may relate to the small size of this group. Group 3 riders (aged 25 and over with full licence, engine capacity 260-749 cc) had a significantly lower risk of crashing than Group 4 riders when the odds ratio was adjusted for BAC but not when it was adjusted for work-related trip.

Table 12.4. Odds ratios and confidence intervals for membership of groups compared with Group 4: Riders 25 and over with full licence riding motorcycle of 750 cc and over. Highlighted odds ratios are statistically significant at the 95% level.

Group	Unadjusted	Adjusted for		
		BAC	Work-related trip	BAC and work-related trip
Under 25 with learner or probationary licence, less than 260 cc	**1.9** 1.0 - 3.6	1.5 0.7 - 3.5	**2.4** 1.2 - 4.8	1.9 0.8 - 4.8
25 and over with full licence, less than 260 cc	0.5 0.2 - 1.1	0.5 0.2 - 1.4	0.5 0.2 - 1.1	0.5 0.1 - 1.4
25 and over with full licence, 260-749 cc	0.6 0.3 - 1.2	**0.3** 0.1 - 0.9	0.6 0.3 - 1.2	0.4 0.1 - 1.0

13. SUMMARY OF RESULTS

The cases comprised 222 motorcycle crashes occurring on public roads in the Melbourne metropolitan area between late November 1995 and 30 January 1997 in which the rider or pillion was taken to one of the participating hospitals or died. The controls were 1195 motorcyclist trips which passed the crash site at the same time of day and week as the crash occurred.

13.1 CHARACTERISTICS OF CASES

Of the 222 crashes, 22 involved pillions. Twenty-two riders and three pillions were killed in the crashes, which had the following characteristics:

- most commonly occurred on Fridays
- generally highest frequencies from noon to 8 pm
- almost 20% occurred near the centre of Melbourne
- 80% in urban areas
- almost half were on major arterials
- 65% occurred in 60 km/h zones
- more than two-thirds on curves
- equally divided between intersection and non-intersection locations
- mostly on two-way undivided roads
- very few local area traffic management devices at crash sites
- the road was not clean at almost one-quarter of the sites and there was deformed pavement or a sudden change in road surface at many sites
- about half occurred on two-lane roads
- poles, kerbs and trees were present at most sites
- there was no evidence of braking at 85% of sites
- 9% occurred when it was raining
- about one-quarter occurred under difficult lighting conditions (glare, dusk or dawn, night-time)
- sun glare could have reduced visibility at 13% of sites
- glare from oncoming headlights was a potential problem at 8% of sites

13.1.1 Type of crash

- one-third were single vehicle crashes
- two-thirds of all crashes involved impact with an object or vehicle, in half of all crashes this was a moving car
- single vehicle crashes were more likely than multi-vehicle crashes to involve alcohol, to occur at night and to involve excessive speed
- 23% of crashes were judged to have involved excessive speed for the conditions
- the rider was judged to have contributed to about two-thirds of the multi-vehicle crashes, mainly by inappropriate positioning or failure to respond

- most riders did not consider themselves to be at fault in multi-vehicle crashes to which failure to respond was judged to contribute

13.1.2 Motorcycles

- 167 motorcycles were inspected
- 15% had travelled less than 5,000 kms
- more than 20% were judged to be not well cared for (dirt and mud etc)
- almost 40% were judged to have been in a poor to fair mechanical condition (compression, bearings etc.) prior to the crash
- clean motorcycles were mostly in good or excellent mechanical condition, whereas most of the motorcycles in poor mechanical condition were dirty
- about a quarter had under-inflated front or rear tyres
- a quarter had a worn or loose chain
- 15% had brakes in a poor condition, typically insufficient pad thickness
- 19% of rear tyres and 7% of front tyres were badly worn or bald

13.1.3 Helmets

- 145 helmets worn by riders and pillions were inspected
- over 50% were black or "dark"
- 20% of visors were tinted
- the average age was four years, with 16% more than 5 years old and so may no longer have been performing optimally
- more than 80% had obvious signs of damage, mostly scratches but some fractures
- in 43% the interior padding was visibly worn or compressed

13.2 INJURIES TO MOTORCYCLISTS IN NON-FATAL CRASHES

- the median Injury Severity Score (ISS) was greater for admitted motorcyclists than presentations (10 versus 5)
- 4% of all injured motorcyclists had severe head injuries
- 3 of the 5 motorcyclists not wearing helmets sustained head injuries
- facial injuries were uncommon and not significantly more common among those wearing open face helmets than full face helmets (8% versus 4%)
- chest injuries were uncommon but relatively severe when they occurred
- 44% of motorcyclists had upper limb injuries and 57% had lower limb injuries
- most common injuries overall were fracture of the knee or lower leg (28%) and fracture of the forearm (17%)
- external injuries (abrasions, contusions or lacerations) occurred to 88% of motorcyclists but were generally not severe
- there was no clear indication of differences in injury severity for riders and pillions in the same, non-fatal crashes
- single and multi-vehicle crashes did not differ in their injury severity
- injury severity and patterns of injury did not vary significantly as a function of speed zone
- wearing appropriate clothing did not significantly decrease the likelihood or severity of external injuries

13.3 CASE-CONTROL COMPARISONS

The data from 205 cases for which controls could be recruited and 1195 controls were compared. Where odds ratios are cited in this section, they are statistically significant.

13.3.1 Rider factors

The factors which were found to significantly increase crash risk after adjustment for potential confounding factors were:

- age under 25 (compared with age 35 or over)
- never married
- unlicensed
- experienced off-road rider before gaining on-road licence
- having fewer years of on-road riding experience (after adjustment for BAC>.00)
- ride less than 3 days per week - this may be an artefact of the study design
- having completed a beginner course compared with an advanced course
- BAC>.05 (odds ratio of 38) - 13% of crashed riders for whom BAC was known had BAC>.05 compared with less than 1% of control riders
- BAC>.00 (odds ratio of 5)
- consumed alcohol in the previous 12 hours (odds ratio of 2)
- not wearing a helmet (2% of crashed riders and 1% of controls - unadjusted odds ratio)

Other results included:

- 6% of crashed riders and 3% of control riders had used illicit drugs (mainly marijuana) in the previous 12 hours but the unadjusted and adjusted odds ratios were not statistically significant
- 11% of crashed riders and 8% of control riders had taken prescription drugs in the previous 12 hours but none of the odds ratios were statistically significant
- 2% of crashed riders and 3% of control riders had taken nonprescription drugs in the previous 12 hours but the numbers were too small to analyse
- after adjustment for BAC, there was no significant increase in risk associated with wearing an open face helmet compared to a full face helmet
- no significant increase in risk associated with wearing a helmet 5 to 10 years old or over 10 years old (compared with one less than 5 years old)
- no significant increase in risk associated with wearing a helmet that did not belong to the rider after adjustment for age and BAC
- none of the odds ratios associated with wearing protective gear were significantly different from one. However, these analyses were based on self-report data for cases and observation for controls and so may have been affected by a social desirability bias for cases.

13.3.2 Pillion factors

The presence of pillions could possibly contribute to either crash causation (e.g. by behaving inappropriately or by producing a higher centre of gravity) or increased crash severity (because they are another person who may be killed or injured).

- pillions were present in 10% of crashes and 7% of controls
- significant increase in crash risk associated with pillion carriage
- 70% of pillions in crashes were female, 57% of control pillions

13.3.3 Motorcycle factors

The factors which were found to significantly increase crash risk after adjustment for potential confounding factors were:

- riding a motorcycle with engine capacity of 750 cc and above compared to one of 260 cc or below (adjusted for licence status)
- the rider not being the owner of the motorcycle

Other results included:

- 5% of crashed motorcycles and 1% of control motorcycles were unregistered
- most motorcycles were manufactured in 1990 or later and so age of the motorcycle varied little between cases and controls
- two-stroke race replicas comprised 24% of the crashed 250 cc motorcycles compared with 9% of the control 250 cc motorcycles. The increased risk associated with riding these bikes was not significant after adjusting for the effect of alcohol but the adjusted odds ratio was still relatively high (2.7).
- headlights were on for most of the crashed and control motorcycles (both pre- and post-1992) - the odds ratios associated with pre-1992 motorcycles having headlights off were not statistically significant

13.3.4 Trip factors

- a significant increase in risk was associated with nonwork-related trips compared with work-related trips
- no significant increase in risk was associated with the rider being unfamiliar with the road
- the percentage of riders who estimated that they were travelling at above the speed limit was less at higher speed limits
- riders with BAC>.000 were more than twice as likely to state that they were travelling at over the speed limit

13.3.5 Magnitude of the contribution of the risk factors

This section presents a summary of the risk factors identified and the extent of the motorcycle crash problem with which they were associated.

Table 13.1 presents the risk factors, their prevalence in the crashes and controls and the reduction in crashes that would occur if the prevalence in crashes was reduced to that in controls. The percentages given relate to all crashes within the sample of 205 crashes analysed unless otherwise specified. These percentages are not always those which the odds ratios are based on but provide an indication of the extent of the problem associated with each risk factor.

The risk factors for which the maximum potential reduction in crashes is greatest are:

- rider aged under 25
- BAC>.05
- BAC>.00
- unlicensed or unregistered or not ridden by the owner
- nonwork-related riding

It should be noted, however, that the analyses might have overestimated the risk associated with unlicensed or unregistered or not ridden by the owner if these riders were less likely to stop at the control sites than other riders.

Table 13.1. Matrix of risk factors and their magnitude. The maximum reduction is assumed to be a reduction to the level in the control sample.

Risk factor	% crashes	% controls	Maximum reduction %	Number of the 205 crashes reduced
Rider aged under 25	37	22	15	31
BAC>.05	13	<1	12	24
BAC>.00	19	3	16	33
Unlicensed or unregistered or did not own motorcycle - all crashes	17	6	11	23
- crashes with BAC=.000 only	11	5	6	10
Pillion carriage - all crashes	10	7	3	6
- crashes with BAC>.000 only	24	12	12	4
Two-stroke 250 cc race replica **	24	9	15	9
Nonwork-related riding *	66	43	23	39
Off-road experience first	53	45	8	16

* riders with BAC=.000
** 250 cc motorcycles only

14. DISCUSSION OF THE RESULTS OF THE CASE-CONTROL STUDY

14.1 RIDER FACTORS

14.1.1 Rider age

Riders aged under 25 were found to have significantly higher odds of being involved in a crash than riders aged 35 and over. The odds of crashing for riders aged from 25 to 34 were not different from those of riders aged 35 and over. This section discusses some factors that may contribute to the increased risk for riders aged under 25.

The prevalence of riding with a positive BAC was no greater for riders aged under 25 than for riders aged 35 and over. Therefore, greater use of alcohol and other drugs does not appear to account for the increased risk for younger riders. The younger riders were more likely to report taking illicit drugs in the previous 12 hours, but this difference is insufficient to account for the magnitude of the overall increase in crash risk.

While the percentage of crashes to which the rider was judged to have contributed was similar for the younger and older riders (28% and 24% of known, respectively), there appeared to be a greater contribution of risk taking in terms of excessive speed for the younger riders. Excessive speed was judged to have contributed to 25% of the crashes of riders aged under 25 but only 15% of the crashes of riders aged 35 and over. In addition, the rider's estimate of travel speed was more commonly above the posted speed limit for riders aged under 25 than for riders aged 35 and over.

Younger riders had more of their crashes in 60 km/h speed zones than older riders (82% versus 49%). This difference is not accounted for by differences in the riding patterns of the age groups (as indexed by the percentages of control riders of each age group recruited in each speed zone). Perhaps the road environment and the behaviours of other road users are more unpredictable in 60 km/h speed zones (for example: greater frequency of uncontrolled intersections and vehicles entering and leaving the roadway, more pedestrians and bicyclists) and this poses more difficulties for younger, less experienced riders.

14.1.2 Licence status

Overall, 6% of the crashes in the study involved unlicensed riding. This may be a conservative value because information about licence status was self-reported (for both cases and controls) and some riders may not have stated that they were unlicensed.

There was a large increase in crash risk associated with unlicensed riding (never had a licence, licence lapsed or disqualified). The odds ratio may be inflated, however, if unlicensed riders were less likely to stop at the control sites.

Of the 11 unlicensed riders in crashes, 5 were riding unregistered motorcycles and 7 did not own the motorcycle. Four unlicensed riders were not wearing a helmet and three of the remaining seven unlicensed riders did not own the helmet. All the trips by unlicensed riders were nonwork-related travel.

The unlicensed riders appear to comprise two separate groups. Four of the unlicensed riders were riding off-road bikes to or from an off-road site when they crashed. None of these riders had ever held a licence and none of them had a positive BAC. The remaining seven unlicensed riders were older and on road bikes. Of the five riders for which data was available, four had a positive BAC reading.

14.1.2.1 Learners and probationary riders

The odds ratios found in the study suggested about a 50% increase in risk asociated with being a learner rider or probationary rider compared to being a fully licensed rider. However, this increase was not statistically significant, possibly because of the relatively small number of riders for which licence status was known (200 cases and 560 controls).

The analysis of rider experience showed that the difference in experience between learner and probationary riders and riders holding full licences may not be as great as occurs, for instance, with car drivers. A small number of learner riders and about one-quarter of probationary riders were classified as experienced riders while more than one-third of the fully-licensed riders were classified as inexperienced. In summary, licence status may not be as good a proxy for experience for riders as it is for drivers.

14.1.3 Experience

Consistent with the findings in the previous section, there was no significant increase in risk associated with having ridden for less than three years, compared with having ridden for three years or more.

After adjusting for the greater tendency of more experienced riders in crashes to have positive BAC readings, there was a statistically significant reduction in risk as a function of years of on-road riding experience. The magnitude of the reduction was small, however, equating to a rider with 10 years experience having about a 25% lower risk than a rider with 1 year of on-road riding experience.

Being an experienced off-road rider before gaining an on-road licence was associated with increased crash risk. There were no differences in current levels of exposure between experienced off-road riders and other riders which could explain this finding. One of the few differences between the two groups identified was the lesser propensity for the experienced off-road riders to complete on-road training courses.

The crash history results are somewhat puzzling. Among riders with at least five years experience, reporting being involved in two or more crashes in the past five years was associated with a significantly lower crash risk (before adjustment for BAC). The riders who had been involved in two or more crashes tended to ride further and more often. It could be speculated that these riders had now accumulated sufficient experience and skills that they had begun operating at lower risk.

14.1.4 Training

The more widespread availability of basic skills training in recent years has complicated the analyses of the effects of training on relative risk of crashing. This has occurred because many more novices have completed training than did older, more experienced motorcyclists.

The analyses showed a reduction in crash risk associated with having completed an advanced rider training course compared with a beginners course. The riders (both case and control) who had completed advanced rider training were more likely to ride 300 or more km per week than riders who had completed only beginner or intermediate courses.

In general, riders thought that braking was the most important thing that they had learnt from training, followed by machine handling and cognitive skills. However, crashed riders with BAC>.000 tended to be more likely to say that machine handling skills were the most important thing that they had learnt from training.

14.1.5 Marital status

Never having been married (or in a de facto relationship) was associated with a higher crash risk at each age group. This was also found in the Fatal Single Vehicle Crashes Study (Haworth and Vulcan, in preparation). Drink riding (or driving) was not found to be more common among those who had never been married, so that is not the explanation. Exposure did not appear to be greater for riders who had never been married.

14.2 ALCOHOL AND OTHER DRUGS

14.2.1 Alcohol

BAC data was missing for almost 40% of the riders in non-fatal crashes. This level of missing data remained despite a thorough examination of both hospital and police records.

Having a BAC greater than zero was associated with a five-fold increase in the odds of crashing compared to having a BAC of zero. The increase in risk associated with a BAC of greater than .05 was about forty-fold.

If riders with positive BACs were less likely to stop at the control sites, then the odds ratios associated with alcohol would be somewhat inflated.

There are several issues to be considered in interpreting the odds ratios. The first is the effect on the odds ratios of matching on time of day and day of week. Alcohol use, for car drivers at least, has a distinctive time of day and day of week pattern. A consequence of having matched cases and controls on these variables is that the controls recruited would have been more likely to be of the same alcohol status as the cases than would have occurred if the set of controls was a random sample of motorcycle riding. Therefore, the calculated odds ratios in this study are likely to underestimate the true odds ratios to some extent. The same underestimation of the odds ratios would be expected for any other factor that varies as a function of time of day or day of week.

The second issue relating to the interpretation of the odds ratios for BAC>.05 and BAC>.00 is that the range of BAC values in cases was greater than that in controls. This would have reduced the odds ratios, leading to the calculated odds ratios underestimating the true odds ratios.

More than 70% of the crashes in which alcohol was involved occurred between 6 pm and 6 am (compared with about 25% of the crashes not involving alcohol). The number of controls per night-time crash was about half that for daytime crashes. Therefore the relative lack of night-time riding may tend to reduce the involvement of alcohol in motorcycle crashes, compared to if night-time riding was more common.

Having a positive BAC was associated with a number of other risk factors including: unlicensed riding, riding a borrowed motorcycle, pillion carriage, illicit drug use, excessive speed and single vehicle crashes.

14.2.2 Other drugs

Illicit drug use was reported by 6% of crashed riders and 3% of controls, overall. Younger riders and riders with positive BAC readings were more likely to have taken illicit drugs (mainly marijuana) in the previous 12 hours. The odds ratios were not statistically significant but this may have resulted from the relatively small sample size.

In contrast, older riders were more likely than younger riders to have used prescription drugs. Taking prescription drugs was also more common in those who had consumed alcohol. While the odds ratios were not statistically significant, the apparently greater use of antidepressant medications by crashed riders merits further investigation.

Few riders and controls had taken nonprescription drugs in the 12 hours prior to riding.

14.3 PROTECTIVE GEAR

There was a high rate of helmet wearing for both crashed and control riders. Much of the nonuse of helmets in crashes appeared to be related to unlicensed riding.

Wearing open-face helmets was more common among crashed riders but this appeared to be a consequence of the association between BAC>.000 and wearing open face helmets.

None of the odds ratios related to wearing inadequate protective gear were statistically significant. However, protective gear was self-reported for cases (but observed for controls) and crashed riders may have stated that they were wearing adequate protective gear as a socially desirable response.

14.4 PILLION FACTORS

The analyses of pillion factors were restricted by the small number of pillions in crashes. Overall, pillion carriage was associated with significantly increased crash risk. Riders with pillions tended to be older, on nonwork-related trips and were more likely to have consumed alcohol.

Riders and their pillions seemed to be injured to a similar extent in non-fatal crashes but there was some indication of more severe injuries to pillions than riders in fatal crashes. The numbers, however, were very small.

14.5 MOTORCYCLE FACTORS

A number of the motorcycle factors identified might better be interpreted as rider factors since they probably reflect characteristics of the riders, rather than the performance or other characteristics of the motorcycles.

Overall, 5% of crashed motorcycles and 1% of control motorcycles were unregistered. Riding an unregistered motorcycle was associated with positive rider BAC and/or being unlicensed, however.

There was also an increased risk associated with the rider not being the owner of the motorcycle. While inexperience with the particular motorcycle probably contributes to this risk, there was also an association with alcohol use.

Overall, the distribution of engine capacities was similar for cases and controls. After adjusting for licence status, however, riding a motorcycle with engine capacity of 750 cc and above was found to be associated with a significant increased in risk compared to riding a motorcycle of 260 cc or below.

The over-involvement of two-stroke race replica 250 cc motorcycles in crashes (compared with other 250 cc motorcycles) occurred because of the association between riding the race replicas and presence of alcohol. The increased risk associated with riding these bikes was not significant after adjusting for the effect of alcohol but the adjusted odds ratio was still relatively high (2.7) and on the margin of statistical significance (confidence interval 1.0 - 7.3).

Most motorcycles were manufactured in 1990 or later and so the age of the motorcycle varied little between cases and controls. However, mechanical faults were judged to have contributed to about 12% of crashes and the mechanical inspections of crashed motorcycles identified under-inflation of tyres and insufficient brake pad thickness as problems. Control motorcycles were not inspected and so the increase in crash risk associated with mechanical defects could not be established in this study. A follow-on study has commenced which will examine the mechanical condition of a sample of motorcycles not involved in crashes.

The headlights were on for most of the crashed and control motorcycles (both pre- and post-1992). The odds ratios associated with pre-1992 motorcycles having headlights off were not statistically significant.

14.6 TRIP FACTORS

There was a significant increase in risk associated with nonwork-related trips compared with work-related trips, even after controlling for the higher involvement of alcohol in nonwork-related trips.

There was no significant increase in risk associated with the rider being unfamiliar with the road.

Similar percentages of case and control riders gave travel speed estimates which were below the posted speed limit. The percentage of riders who estimated that they were travelling at above the speed limit was less at higher speed limits. Riders with BAC>.000 were more than twice as likely to state that they were travelling at over the speed limit.

15. CONCLUSIONS

The aims of the study were to identify and assess the contribution of modifiable risk factors for severe motorcycle crashes resulting in death or serious injury. These factors will then be targeted for countermeasure development for the purposes of reducing the motorcycle specific component of the road toll.

The risk factors for which the maximum reduction in crashes is greatest are:

- rider aged under 25
- BAC>.05
- BAC>.00
- unlicensed or unregistered or not ridden by the owner
- nonwork-related riding

The tendency for some crash-involved riders to give socially desirable responses to questionnaire items unfortunately prevented meaningful case-control comparisons of riding strategies.

In general, the case-control comparisons showed the inter-relatedness of the variables affecting motorcycle safety. The characteristics of the rider, where and when they ride, why they ride and what they ride are strongly related. Thus any simple analyses which do not take these relationships into consideration fail to give an adequate understanding of the complexity of factors affecting motorcycle safety.

Comparisons with car drivers are not straightforward but it appears that helmet wearing rates are higher than seat belt wearing rates (certainly in crashes) and that alcohol involvement in motorcycle crashes is probably no worse than that of car drivers. The involvement of alcohol in motorcycle crashes is reduced by the largely daytime pattern of motorcycle riding.

But, on the other hand, there remain the unriders: underage, unlicensed, unregistered. This group comprises about 6% of the riding population but 17% of crashes. Not only are they at greater risk of crashing but they are also more likely to be not wearing helmets and so more likely to be severely injured. It is perhaps worth noting, they do not contribute to payment for the cost of their injuries by TAC Insurance payments or for their use of the road system by registration and licensing fees.

16. MOTORCYCLE EXPOSURE DATA

The lack of adequate motorcycle exposure data has hindered past efforts to understand motorcycle travel and to quantify the benefits and costs of measures to improve motorcycle safety. For this reason, the total number of motorcycles passing control sites was recorded and analysed in this study. This chapter begins with presentation of data relating to exposure in terms of the numbers of motorcycles observed under various conditions. The later part of the chapter discusses characteristics which influence the distance travelled by motorcyclists.

16.1 MOTORCYCLE VOLUMES

During the recruitment of controls, fifteen-minute traffic counts were made in the direction in which motorcyclists were being stopped. These counts and the calculated hourly volumes of all traffic and motorcycles are summarised in Table 16.1 (more detail is provided in Appendix 4). For repeat sites, the calculations relate to the first visit only. Data for three control sites at which traffic counts were not taken are excluded from the analyses.

Table 16.1. Motorcycle and general traffic volumes at control sites.

	Number of sites	Mean no. motorcycles per hour	Mean no. other vehicles per hour	Proportion motorcycles
ROAD TYPE				
local	6	2.2	294	0.0075
collector	19	1.2	288	0.0043
secondary arterial	64	3.0	561	0.0053
primary arterial	128	4.1	855	0.0047
TIME PERIOD				
Weekday day	98	4.4	883	0.0050
Weekend day	45	3.6	599	0.0059
Weekday night	34	1.5	416	0.0036
Weekend night	40	2.5	623	0.0040
OVERALL	217	3.4	703	0.0049

Notes:

1. Weekday day=6am to 6pm Monday-Friday, Weekend day=6am to 6pm Saturday-Sunday, Weekday night=6pm to 6am Sun-Mon, Mon-Tue, Tue-Wed, Wed-Thur), Weekend night=6pm to 6am Thur-Fri, Fri-Sat, Sat-Sun).
2. Two local roads were in an inner-city commercial district and therefore had higher traffic volumes than might be expected for local roads in residential areas, for example.
3. The time period corresponds to the time of occurrence of the crash which was the mid-point of the 90 minutes of sampling of motorcycles. Therefore, if the crash occurred at 5.50 pm on a Monday, the time period would be classed as Weekday day, even though 35 minutes of sampling would have occurred after 6 pm.
4. Other vehicles were counted for 15 minutes and the value multiplied by four to give an hourly value.

The most striking point of Table 16.1 is the small number of motorcycles per hour and the low proportion of traffic that they comprise, about 0.005 overall. The data are based on observations of 1121 motorcycles during 325 hours of sampling at or near the crash sites.

16.1.1 Motorcycle volumes by road type

The mean number of motorcycles per hour was greatest on primary arterials (4.1), with the smallest number being found on collector roads (1.2). The motorcycle volume on primary arterials was statistically significantly greater than that on collectors but no other differences were significant ($F(3,216)=3.77$, $p<.05$, Bonferroni test $p<.05$).

The proportion of vehicles that were motorcycles did not differ significantly across road types ($F(3,216)=0.1$, $p>.10$). The data for local roads may not be reliable because only six sites were local roads and some of these were relatively high-volume local roads.

16.1.2 Motorcycle volumes by time period

The mean number of motorcycles per hour was greatest during weekday and weekend days (see Table 16.1). Weekday day motorcycle volumes were significantly greater than weekend day or weekend night volumes ($F(3,216)=6.4$, $p<.01$, Bonferroni tests $p<.05$).

The proportion of vehicles that were motorcycles was higher on weekend days than any of the other time periods ($F(3,216)=6.7$, $p<.01$, Bonferroni tests $p<.05$).

16.1.3 Motorcycle volumes by road type and time period

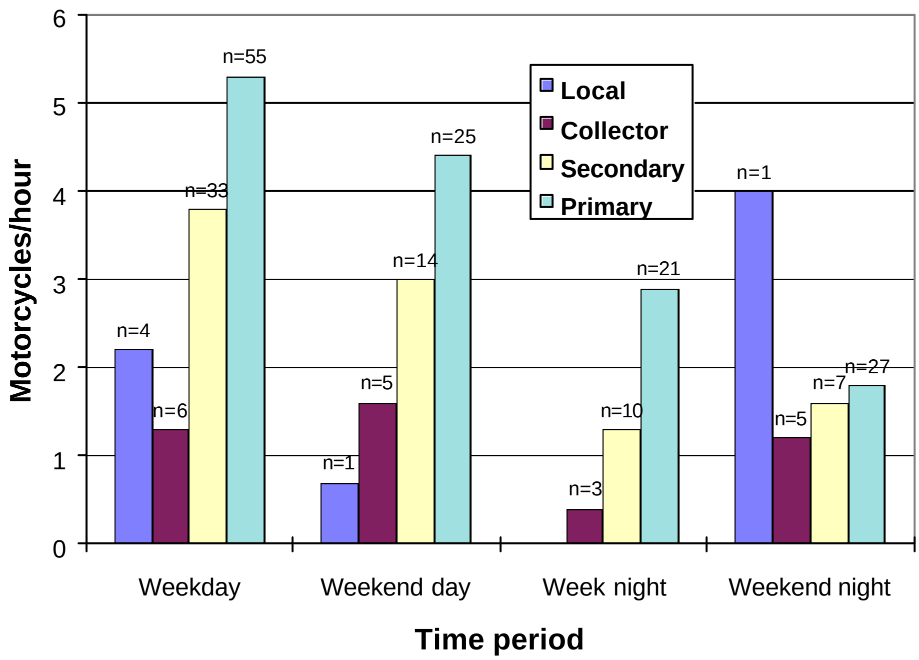
The effects on motorcycle volumes of road type and time period were found to be independent ($\chi^2(9)=6.6$, $p>.10$ for all road types, $\chi^2(6)=5.0$, $p>.10$ when local roads deleted because of the small sample size).

Figure 16.1 shows the number of motorcycles per hour as a function of road type and time period. The number of control sites contributing data is labelled on each column. The data for local roads are not likely to be reliable because of the small number of control sites on local roads. The remaining data shows that the number of motorcycles per hour was higher when the number of control sites was higher. This finding reflects the dependence of motorcycle crashes on motorcycle volumes.

To test the strength of the relationship between motorcycle volumes and crash frequency, a multiple linear regression was conducted. The crashes were restricted to those for which controls were collected on the same road. Given the small sample size, crashes on local roads were excluded. The dependent variable for the regression was the number of crashes which occurred at each combination of road type and time period (12 values). The two independent variables (entered stepwise) were mean number of motorcycles per hour and mean number of other vehicles per hour. The number of motorcycles per hour was the only variable which was statistically significant and accounted for 79% of the variance in the number of crashes (R square=.79, adjusted R square=.77, multiple R=.89). The regression equation is:

Number of crashes = 6.50 x mean no. of motorcycles/hour.

Figure 16.1. Number of motorcycles per hour as a function of road type and time period.



16.1.4 Seasonal trends in motorcycle volumes

The following analyses are based on data from February 1996 to January 1997 to avoid the early months of the study where numbers of cases were small.

Figure 16.2 shows that the mean number of motorcycles per hour was somewhat higher in February than in the other months but that there was no clear seasonal effect on motorcycle volumes. Motorcycle volumes on the weekend showed a more marked seasonal effect than those on weekdays (see Figure 16.3). In general, weekend volumes were higher than weekday volumes during January to March but lower during the cooler months. This suggests that recreational riding is much more seasonal than commuter riding.

Figure 16.2. Mean number of motorcycles per hour for control sites in each month of the year.

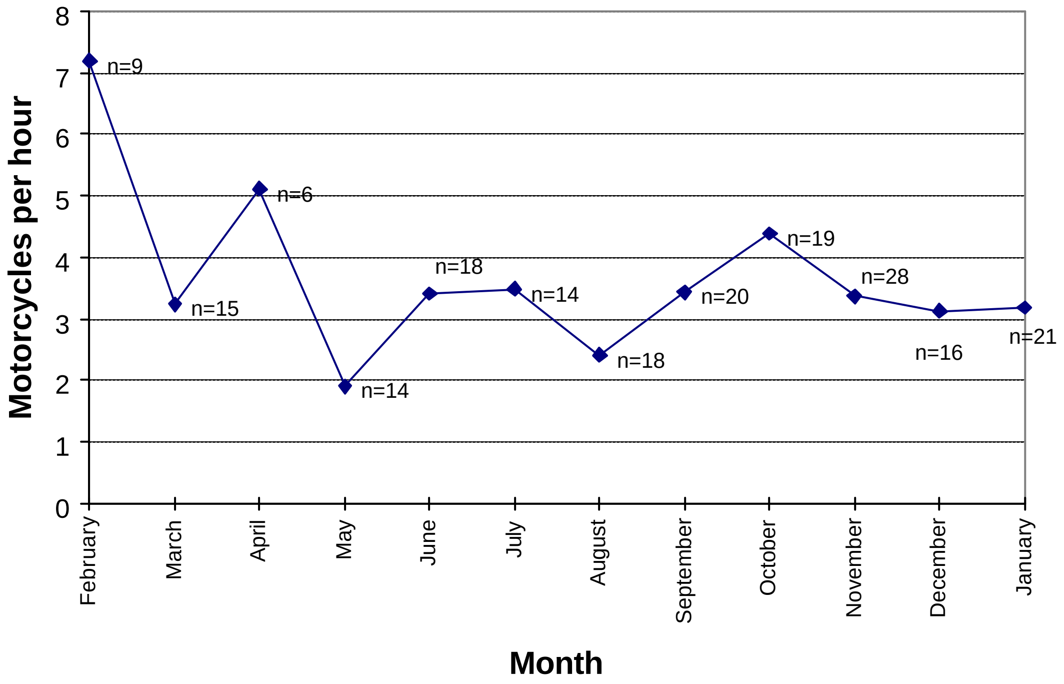
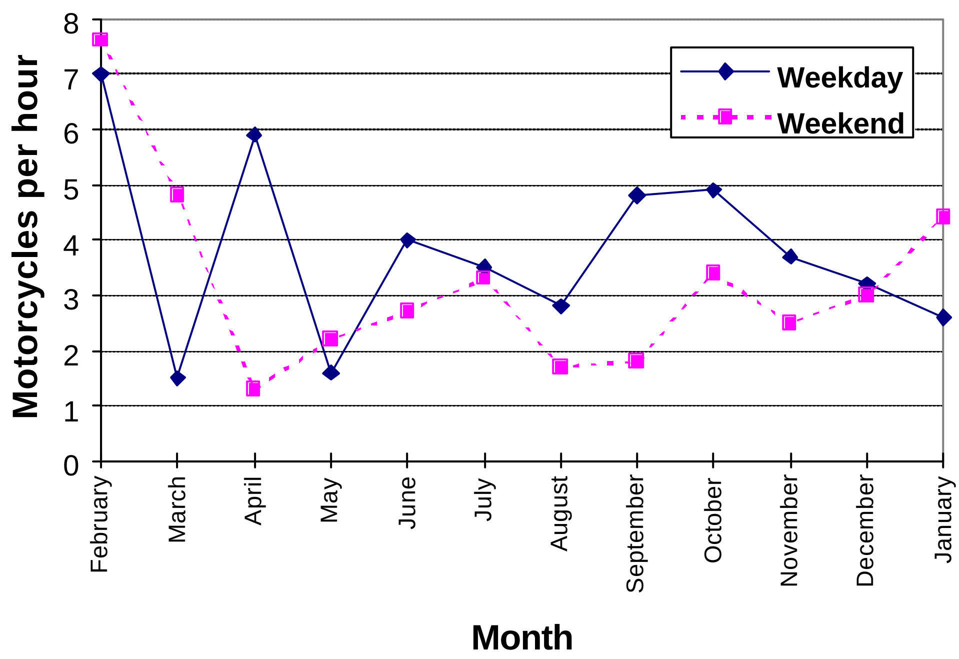


Figure 16.3. Mean number of motorcycles per hour on weekdays and weekends for control sites in each month of the year.



16.1.5 Influences of weather on motorcycle exposure

The weather conditions during each control session were recorded. Table 16.2 summarises the weather conditions during the first control session for each case. Repeat sessions are excluded to avoid bias from more commonly repeating rainy controls than dry controls. While the means suggest that volumes were less when it was cloudy or overcast than when it was dry, a one-way analysis of variance showed that the volumes for each type of weather did not differ significantly, $F(4, 216)=1.6$, $p>.10$.

Table 16.2. Motorcycle volumes as a function of weather conditions.

Weather	Mean no. of motorcycles per hour	Standard deviation	No. of cases
Fine	3.8	3.8	126
Cloudy or overcast	2.8	3.4	62
Light rain or drizzle	3.9	5.1	19
Heavy rain	1.1	1.0	7
Fog	5.3	5.7	3

16.2 DISTANCE RIDDEN

Those riders who completed the follow-up interview were asked "Over the last year, on average, how many kilometres would you usually do on a motorcycle on the road each week?". The question had multiple-choice responses, ranging from "less than 50 kms" to "over 400 kms". While the multiple-choice responses made it easier for the riders to answer the question, they prevented calculation of simple average values.

Given that the riders had to be riding on a public road to be recruited into the study, riders who ride further would have been more likely to be recruited. Therefore the estimates presented here may be biased upwards. They reflect the distances ridden by the population of active riders, rather than by the population of holders of motorcycle licences or the population of owners of registered motorcycles.

Table 16.3 shows that the median distance travelled per week was between 201 and 300 kilometres. Data analysis showed no significant differences in the pattern of distance ridden according to age group ($\chi^2(10)=5.6$, $p>.05$).

Table 16.3. Weekly distance ridden according to age group. Percentages are of known.

Weekly distance ridden (km)	Under 25 (n=67)	25 to 34 (n=182)	35 and over (n=123)	All ages
Less than 50	6	6	3	5
51-100	18	13	11	13
101-200	16	16	18	17
201-300	22	19	27	22
301-400	12	14	12	13
over 400	25	31	28	30

Generally, learner permit holders did not ride as far per week as riders with probationary or full licences ($\chi^2(10)=20.1$, $p<.05$, see Table 16.4).

Table 16.4. Weekly distance ridden according to licence category. Percentages are of known.

Weekly distance ridden (km)	Learner (n=31)	Probationary (n=29)	Full (n=300)
Less than 50	16	10	4
51-100	19	7	13
101-200	26	21	15
201-300	19	14	24
301-400	3	17	14
over 400	16	31	31

Table 16.5 examines weekly distance ridden as a function of engine capacity. The pattern of distance ridden differed significantly between the three levels of engine capacity ($\chi^2(10)=19.6$, $p<.05$). The proportion of riders who rode more than 400 km per week was similar for each engine capacity. However, riders of motorcycles of under 260 cc were more likely to ride less than 50 km per week.

Table 16.5. Weekly distance ridden according to engine capacity. Percentages are of known.

Weekly distance ridden (km)	Under 260 cc (n=111)	260 to 749 cc (n=87)	750 cc and over (n=172)
Less than 50	11	3	2
51-100	14	13	13
101-200	21	17	14
201-300	21	22	24
301-400	5	16	16
over 400	28	29	31

Clearly, licence status and engine capacity are not independent factors. Table 16.6 presents the proportions of riders who rode 300 or more km per week according to licence status and engine capacity. Riding shorter distances per week appears to be associated with being a learner rider, rather than riding a motorcycle of less than 260 cc. The proportions of fully licensed riders who rode 300 or more km per week did not differ significantly according to the engine capacity of the motorcycle ($\chi^2(2)=1.7$, $p>.05$). Licence status, rather than engine capacity, appears to be the stronger determinant of distance ridden.

Table 16.6. Proportions of riders who rode 300 or more km per week according to licence status and engine capacity. Percentages are of known.

Licence status	Under 260 cc	260 to 749 cc	750 cc and over
Learner	19	-	-
Probationary	44	75 *	43 *
Full	38	43	48

* percentages based on small numbers and so may be unreliable

16.3 SUMMARY OF FINDINGS: MOTORCYCLE EXPOSURE DATA

Exposure estimates were calculated based on observations of 1121 motorcycles during 325 hours of sampling at or near the crash sites. The overall proportion of the traffic comprised by motorcycles was very low, about 0.5%.

The highest average number of motorcycles per hour was found on primary arterials (4.05), with the smallest number being found on collector roads (1.23). The proportion of the traffic which motorcycles comprised appears to be similar across road types.

Average motorcycles per hour was greatest during weekday and weekend days and the proportion of traffic that motorcycles comprised was highest on weekend days. Both the average number of motorcycles per hour and the proportion of traffic which motorcycles comprised were lower at night than during the day.

The mean number of motorcycles per hour accounted for 79% of the variance in the number of crashes (per time period or per road type). The regression equation describing the relationship in this particular study is:

Number of crashes=6.50 x mean number of motorcycles per hour

The median distance travelled per week was between 201 and 300 kilometres. Riders holding probationary and full licences rode further per week, on average, than holders of learner permits. Engine capacity per se showed little effect on distance ridden.

16.4 DISCUSSION OF MOTORCYCLE EXPOSURE DATA

As noted in the Introduction to this report, there has been little detailed motorcycle exposure data collected in the past. This section compares the exposure data collected in the current study with that in previous studies.

16.4.1 Earlier studies

The populations of interest for the motorcycle exposure studies comprise registered owners or licensed riders or riders who are recruited in the act of riding. It would be expected that exposure estimates would be higher for the last of these populations since it excludes inactive riders.

A measure of motorcycle travel was obtained in June 1988 using a three-day diary mailed out to 2,400 riders with a learners permit or a probationary licence and another 2,000 registered owners of motorcycles in Victoria. There was a response rate of 30% (unpublished report by Research International commissioned by Road Traffic Authority - now VicRoads).

The survey of motorised vehicle travel conducted for VicRoads in 1994 (Arup Transportation Planning, 1995), for example, provided data on only 46 riders on metropolitan arterial roads, 53 riders in rural towns and 52 riders on rural highways.

The Australian Bureau of Statistics Survey of Motor Vehicle Usage in May 1995 included data from 138 motorcycle owners (171 surveyed, response rate 81%) from Victoria.

Galambos and Haworth (1994) analysed the responses of 320 Victorian riders who completed a questionnaire designed by the Motorcycle Riders' Association of Australia. The response rate was very low, given that about 70,000 questionnaires were mailed with licence renewals.

16.4.2 Comparisons with earlier studies

Table 16.7 summarises the motorcycle exposure data from some recent Australian studies. The VicRoads 1994 Exposure Survey gave lower estimates of total distance travelled by motorcycles than the ABS Survey of Motor Vehicle Use 1995. This may have reflected that the earlier study was conducted during the cold months of July and August when motorcycle riding is anecdotally considered to be less popular. This may also have contributed to the lower percentage of travel by motorcycles observed in the VicRoads 1994 Exposure Survey than the current study.

The estimated distance travelled per rider per week was similar for the MRAA study and the current study. Both the Research International study and the current study showed that non-novices rode further per week than novices. Those studies which measured distance travelled per rider according to engine capacity reported greater distances for larger capacity motorcycles (greater than 500 cc or greater than 750 cc) than smaller capacity motorcycles.

The data presented here do not clearly indicate any changes in the exposure patterns of riders from 1988 to 1996. While the ABS Survey of Motor Vehicle Use showed that the number of registered motorcycles in Australia decreased from a level of about 350,000 in 1982 and 1985 to about 280,000 in 1988, the numbers have remained almost constant since then.

Table 16.7. Summary of motorcycle exposure data from some recent Australian studies.

Exposure variable	Research International (1988)	VicRoads 1994 Exposure Survey	MRAA (1994)	ABS Survey of Motor Vehicle Usage 1995	current study
Sample size	n=1320	n=151	n=320	n=138 in Victoria, other states unknown	n=1121
Population	learners permit or probationary licence holders or registered owners	riders during trips	licence holders or registered owners	registered owners	riders passing crash sites
Total distance travelled by all motorcycles ('000 km per week)					
Australia				29,346	
Victoria				6,365	
Melbourne		792			
rural towns		99			
rural highways		1,326			
Percentage of travel that is done by motorcycles					
Australia				0.9%	
Victoria				0.8%	
Melbourne		0.3%			0.5%
rural towns		0.5%			
rural highways		0.9%			
Distance travelled per rider per week (km)					
Australia				100	
Victoria			235	90	
all riders					median 201-300
novice riders	140				learner median 101-200 probationary median 201-300
non-novice riders	160				full licence median 201-300
Distance ridden by engine capacity	>500 cc ride further		>750 cc more likely to ride over 250 kms/wk		>750 cc ride further than other full licence holders
Frequency of riding	about 40% rode on any given day		75% rode daily or 2 to 3 times per week		78% ride 3 or more days per week

17. RIDING STYLES AND STRATEGIES

As noted earlier in the report, there was evidence of socially desirable responding by crashed riders. Given that most of the questions related to riding skills and strategies were self-reported and unable to be verified, the decision was made to report this information for control riders but not riders involved in crashes.

This chapter presents a brief summary of the results, focussing on statistically significant differences. More details are presented in Appendix 5. Experience was defined here as the same combination of experience and weekly amount of riding used in the earlier analyses (see Section 4.6.1).

17.1 OBSERVATIONAL AND MACHINE HANDLING SKILLS

17.1.1 Most important skills

When riders were asked which skill was the most important,

- 71% nominated scanning all around and a long way ahead
- 14% nominated advanced machine handling skills, and
- 16% described other skills.

There were no significant differences in the pattern of responses as a function of rider experience, licence status, age group or training courses undertaken.

17.1.2 Looking behind over one shoulder

Overall, 64% of riders stated that they looked behind over one shoulder "always", 28% reported doing this "often", 7% "rarely" and 1% "never". There were no differences between inexperienced and experienced riders, or between learner, probationary and full licence holders.

The pattern of responses varied significantly according to the age group of the rider ($\chi^2(6)=21.7$, $p<.05$). Table 17.1 shows that the reported frequency of looking behind over one shoulder appeared to decrease with age group.

Table 17.1. Percentages of riders of each age group according to how often they look behind over one shoulder.

Look behind over one shoulder	Under 25	25 to 34	35 and over
always	70	67	57
often	29	29	27
rarely	1	3	15
never	0	1	1

Riders with training looked behind over one shoulder more often than riders without training ($\chi^2(3)=10.1$, $p<.05$, see Table 17.2).

Table 17.2. Percentages of riders with and without training according to how often they look behind over one shoulder.

Look behind over one shoulder	With training	Without training
always	69	59
often	27	29
rarely	3	11
never	1	1

17.1.3 Approaching curves

Riders were asked if they changed their position on the road to maximise the view when approaching curves. The responses of the group as a whole were:

- always - 59%
- often - 32%
- rarely - 7%
- never - 2%

There were no differences according to the experience, license status, age or training of the riders.

17.1.4 Approaching intersections

Riders were asked to indicate which of a number of behaviours they undertook when approaching intersections. Table 17.3 shows that the most common behaviours of all riders when approaching intersections were: scan all around and consider road surface and available space for braking. Inexperienced riders were more likely to nominate decreasing speed than experienced riders ($\chi^2(1)=5.2$, $p<.05$).

Table 17.3. Percentages of inexperienced and experienced riders who take each of the following measures when approaching intersections.

When approaching intersections...	Inexperienced	Experienced	All riders
scan all around	99	98	98
scan behind	77	77	77
cover brake	86	88	87
decrease speed	**90**	**81**	85
change down a gear	69	70	69
change position for increased visibility	80	82	81
establish eye contact with other drivers	74	76	75
consider road surface and available space for braking and swerving	97	97	97

Table 17.4 shows that riders who had undertaken a training course were more likely than untrained riders to state that they would change position for increased visibility ($\chi^2(1)=18.6$, $p<.05$).

Table 17.4. Percentages of riders with and without training who take each of the following measures when approaching intersections.

When approaching intersections...	With training	Without training
scan all around	100	97
scan behind	78	76
cover brake	84	89
decrease speed	87	83
change down a gear	66	72
change position for increased visibility	**90**	**72**
establish eye contact with other drivers	76	75
consider road surface and available space for braking and swerving	97	97

17.2 POSITIONING ON THE ROADWAY

17.2.1 Normal position in the travelling lane

Motorcycle trainers consider that the right hand wheel track is the safest position in the travelling lane. When asked what position in the travelling lane would you normally occupy, 7% of riders nominated the left hand wheel track, 75% the right hand wheel track and 18%, the centre of the lane. The responses varied significantly according to age group of the rider ($\chi^2(4)=9.8$, $p<.05$). Younger riders appeared to be less likely to travel in the left hand wheel track and more likely to travel in the right hand wheel track than older riders (see Table 17.5). Riders aged 35 and over appeared to be more likely to travel in the centre of the lane.

Table 17.5. Percentages of riders of each age group according to which position in the travelling lane normally occupied.

Position	Under 25	25 to 34	35 and over
Left hand wheel track	3	9	8
Right hand wheel track	82	77	66
Centre of the lane	15	14	26

Riders with training were more likely to travel in the right hand wheel track and less likely to travel in the centre of the lane ($\chi^2(2)=9.4$, $p<.05$ - see Table 17.6).

Table 17.6. Percentages of riders with and without training according to which position in the travelling lane normally occupied.

Position	With training	Without training
Left hand wheel track	6	9
Right hand wheel track	81	67
Centre of the lane	13	24

17.2.2 Lane choice on a freeway

Riders were asked "When riding on a freeway, which lane do you normally occupy?". Overall, the responses were:

- left - 34%
- centre - 27%
- right - 15%
- mixture - 24%

There were no effects of rider experience, licence status, age or training.

17.3 INTERACTIONS WITH OTHER VEHICLES

17.3.1 Following distance

Riders were asked "How far beyond other vehicles do you usually travel?" with the possible responses being "less than 2 seconds", "more than 2 seconds" and "maintaining a 2 second gap". Approximately 3% of riders were unable to answer this question and this percentage did not differ according to age, experience, licence status and training. The results which follow are for those riders who were able to respond.

Overall, 20% of riders stated that they maintained a gap of less than 2 second, 36% more than 2 seconds and 44% responded that they maintained a gap of 2 seconds (see Table 17.7). The patterns of responses of inexperienced and experienced riders differed significantly ($\chi^2(2)=6.2$, $p<.05$). Table 17.7 shows that inexperienced riders were more likely to respond that they maintained a gap of more than 2 seconds, while experienced riders were more likely to state that they maintained a gap of less than 2 seconds.

Table 17.7. Percentages of inexperienced and experienced riders according to how far behind other vehicles they usually travel.

Usual gap	Inexperienced	Experienced	All riders
Less than 2 seconds	16	24	20
More than 2 seconds	42	31	36
Maintaining 2 second gap	42	45	44

The responses of riders differed according to age group ($\chi^2(4)=13.5$, $p<.05$). The riders aged 25 to 34 appeared to be more likely than others to maintain a gap of less than 2 seconds. The riders aged under 25 were more likely to maintain a 2 second gap, while the riders aged 35 and over were more likely to allow a gap of more than 2 seconds (see Table 17.8).

Table 17.8. Percentages of riders of each age group according to how far behind other vehicles they usually travel.

Usual gap	Under 25	25 to 34	35 and over
Less than 2 seconds	16	27	13
More than 2 seconds	30	32	44
Maintaining 2 second gap	54	40	43

17.3.2 Response to tailgating

Riders were asked to nominate which of a list of responses to tailgating they made. The most common response to tailgating was "move out of the way" which was nominated by 54% of respondents - see Table 17.9.

Table 17.9. Percentages of riders according to their response to tailgating.

Response to tailgating	All riders
speed up	28
slow down	23
maintain speed	28
flash brake light	29
move out of the way	54
do nothing	4
other	12

There were few differences in the patterns of responding according to rider characteristics. However, learner riders were less likely than probationary or full licence holders to state that they would "speed up" ($\chi^2(2)=7.5$, $p<.05$ - see Table 17.10).

Table 17.10. Percentages of learner, probationary and fully-licensed riders according to their response to tailgating.

Response to tailgating	Learner	Probationary	Full
speed up	**9**	**24**	**31**
slow down	35	31	21
maintain speed	32	24	28
flash brake light	24	21	31
move out of the way	50	55	54
do nothing	0	0	5
other	9	17	12

Similarly, riders who had undertaken training were less likely to nominate that they would “speed up” ($\chi^2(1)=7.4$, $p<.05$ - see Table 17.11).

Table 17.11. Percentages of riders with and without training according to their response to tailgating.

Response to tailgating	With training	Without training
speed up	**22**	**34**
slow down	24	22
maintain speed	32	24
flash brake light	27	31
move out of the way	56	52
do nothing	3	6
other	13	11

17.3.3 Flashing the headlight

Almost half of the riders interviewed stated that they “never” flashed their headlight to warn others of their presence (see Table 17.12). The most common reason given by riders for not flashing their headlight was that their headlight was hard-wired and therefore already on. Other common responses included that it was not necessary, flashing the headlight confused or distracted other drivers and that they used the horn instead.

Table 17.12. Percentages of riders according to how often they flash their headlight to warn others of their presence.

How often flash headlight....	All riders
always	1
often	11
rarely	41
never	46

17.3.4 Using the horn

Using the horn to warn others of their presence was a more common strategy, with more than one-quarter of riders “always” or “often” doing this (see Table 17.13). Experienced riders tended to use the horn more often than inexperienced riders ($\chi^2(3)=16.5$, $p<.05$ - see Table 17.13).

Table 17.13. Percentages of inexperienced and experienced riders according to how often they use the horn to warn others of their presence.

How often use horn....	Inexperienced	Experienced	All riders
always	3	12	8
often	22	21	21
rarely	39	44	42
never	37	23	29

17.4 DEALING WITH EMERGENCY SITUATIONS

Riders were asked a number of questions about their experiences of, and strategies for dealing with, emergency situations.

17.4.1 Near misses in the last month

About three-quarters of the riders interviewed usually experienced at least one near miss per month. Experienced riders reported significantly more near misses per month ($\chi^2(3)=13.2$, $p<.05$ - see Table 17.14) but the amount of riding was greater for experienced than inexperienced riders.

Table 17.14. Percentages of inexperienced and experienced riders according to the number of near misses usually experienced per month.

Usual number of near misses	Inexperienced	Experienced	All riders
None	35	19	26
One	20	26	24
Two or three	21	25	23
More than three	24	30	27

The usual number of near misses also differed significantly according to the age group of the rider ($\chi^2(6)=13.4$, $p<.05$). In general, the youngest riders reported the most near misses (see Table 17.15).

Table 17.15. Percentages of riders of each age group according to the number of near misses usually experienced per month.

Usual number of near misses	Under 25	25 to 34	35 and over
None	17	23	36
One	24	25	21
Two or three	20	26	19
More than three	39	25	24

17.4.1.1 Near misses on the last trip

Overall, 12% of riders stated they had experienced a near miss on the last trip they had made. This percentage was unaffected by rider age, experience, license status or training.

17.4.2 Practising crash avoidance skills

Riders were asked if they had practised emergency braking or counter-steering in the last six months. Overall, 58% of riders had practised emergency braking in the last six months. The proportion of riders in each sub-group are summarised in Table 17.16. Inexperienced riders and riders who had completed at least one training course were more likely to have practised emergency braking. Riders with full licences and older riders were less likely to have practised emergency braking in the last six months.

Table 17.16. Percentages of riders who practised emergency braking in the last six months.

Types of riders	Percent	Probability
All riders	58	
Inexperienced riders	68	
Experienced riders	49	$\chi^2(1)=13.9$, $p<.05$
Learner	85	
Probationary	86	
Full	52	$\chi^2(2)=24.9$, $p<.05$
Under 25	74	
25 to 34	60	
35 and over	46	$\chi^2(2)=15.7$, $p<.05$
At least one training course	68	
No training courses	47	$\chi^2(1)=17.2$, $p<.05$

Overall, 67% of riders stated that they had practised counter-steering in the last six months (see Table 17.17). Again, inexperienced riders and those who had completed at least one training course were more likely to have practised counter-steering. Full licence holders and older riders were less likely to have practised counter-steering in the last six months.

Table 17.17. Percentages of riders who practised counter-steering in the last six months.

Types of riders	Percent	Probability
All riders	67	
Inexperienced riders	75	
Experienced riders	60	$\chi^2(1)=10.0$, $p<.05$
Learner	71	
Probationary	90	
Full	64	$\chi^2(2)=8.1$, $p<.05$
Under 25	76	
25 to 34	70	
35 and over	57	$\chi^2(2)=8.9$, $p<.05$
At least one training course	74	
No training courses	59	$\chi^2(1)=10.2$, $p<.05$

17.4.3 Confidence in using crash avoidance skills

Riders were asked how confident they would feel about using the front brake hard and performing a sudden swerve in an emergency situation.

Overall, 71% of riders felt confident about using the front brake hard in an emergency situation at any time. An additional 23% would feel confident in doing this only in dry, perfect conditions. Six percent of riders stated that they would never feel confident using the front brake hard in an emergency situation. The percentages of riders giving each response was unaffected by age, experience, licence status or training history.

Overall, 68% of riders felt confident performing a sudden swerve in an emergency situation at any time. An additional 27% of riders stated that they would feel confident performing a sudden swerve only in dry, perfect conditions. Six percent stated that they would not feel confident performing a sudden swerve in an emergency situation.

The percentages of riders who felt confident performing a sudden swerve in an emergency situation differed according to licence status, however ($\chi^2(4)=17.5$, $p<.05$). Table 17.18 shows that riders with probationary licences appeared to be the most confident about performing sudden swerves in emergency situations.

Table 17.18. Percentages of learner, probationary and fully-licensed riders according to when they feel confident performing a sudden swerve in an emergency situation.

When feel confident.....	Learner	Probationary	Full
At any time	38	79	70
Only in dry, perfect conditions	47	17	25
Never	15	3	5

17.5 USEFULNESS OF TRAINING

Riders who had completed a training course were asked about the usefulness of the skills that they had learnt, specifically, braking, cornering and collision avoidance skills.

17.5.1 Use of braking skills learnt in training

Of those riders who had completed at least one training course, 73% stated that they "always" used the braking skills learnt in training, 23% used them "often", 4% "rarely" and no riders "never" used these skills.

17.5.2 Use of cornering skills learnt in training

Of those riders who had completed at least one training course, 69% stated that they "always" used the cornering skills learnt in training, 24% used them "often", 5% "rarely" and 2% "never" used these skills.

The frequency of use of cornering skills learnt in training differed significantly across the rider age groups ($\chi^2(6)=14.0$, $p<.05$). The riders aged 35 and over appeared to be more likely to use these skills "always" than the younger riders (see Table 17.19).

Table 17.19. Percentages of riders in each age group according to how often they use cornering skills learnt in training.

Use cornering skills..	Under 25	25 to 34	35 and over
always	60	67	80
often	38	20	18
rarely	2	9	0
never	0	3	2

17.5.3 Use of collision avoidance skills learnt in training

When riders were asked how often they use the collision avoidance skills learnt in training, 62% responded "always", 23% "often", 11% "rarely" and 3% "never". These proportions did not differ significantly according to rider age, experience, licence status or training history.

17.6 SUMMARY OF FINDINGS

While there were some differences identified, in general, the riding styles and strategies adopted were similar across rider age groups, experience, licence status and training history. The observed differences are summarised below. The greater likelihood that younger riders, many of whom were not fully licensed, had completed at least one training course complicates the interpretation of the observed differences somewhat.

Summary of observed differences in riding styles and strategies:

observational skills	frequency of looking behind over one shoulder decreased with age group, more common with training
approaching intersection	inexperienced riders more likely to decrease speed, trained riders more likely to change position to improve visibility
position on roadway	younger riders and riders with training less likely to travel in the left-hand wheel track and more likely to travel in the right-hand wheel track (safer)
following distance	longer gap for inexperienced riders, shorter gap for 25 to 34 year old riders
response to tailgating	learner and probationary riders and riders with training less likely to speed up
using the horn	more by experienced riders
dealing with emergency situations	more near misses usually experienced per month by experienced riders (who ride more), youngest age group report most usual number of near misses per month, inexperienced and trained riders more likely to have practised emergency braking and/or counter-steering in the last six months, riders with probationary licences were the most confident about performing sudden swerves in emergency situations
usefulness of training	riders aged 35 and over most likely to use cornering skills learnt in training “always”

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APPENDIX 1: QUESTIONNAIRES

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

MOTORCYCLE ACCIDENT QUESTIONNAIRE

1 Case No: ....

2 Date of Interview:

day *month* *year*

3 Interviewer: ....

4 Ask whether rider or pillion:

rider	1
pillion passenger	2

5 Status of subject of interview:

admitted	1
killed	2
not admitted	3
presentation	4

6 Status of other person on motorcycle:

not applicable	1
admitted	2
killed	3
not admitted	4
presentation	5

7 Place of Interview:

ward	1
face to face after discharge	2
telephone	3
other *(please describe)*	4

....

8	Hospital:	Monash Medical Centre	1	Alfred	5
		Royal Melbourne	2	Mornington	6
		Dandenong	3	Western	7
		Box Hill	4	Not applicable	8

9 First or subsequent involvement in study:

first	1
second	2
third	3

10 Alcohol reading taken (from medical record):

yes (breath)	1
yes (blood)	2
no (not done)	3
no (refused to be breathalysed)	4
no (other and please describe)	5
don’t know	6

....

11 Alcohol result (from medical record): .

12 Time of breathalyser/blood alcohol (from medical record):

. am pm

13 Injury severity score: ....

non-injured case	98
don't know	97

14 Information mainly obtained from:

hospital records only	1
hospital records and Police only	2
Coroner only	3
the appropriate person	4
the other person on the motorcycle	5
other proxy respondent *(please specify)*	6

....

SECTION 1: ACCIDENT DETAILS (RIDER ONLY. GO TO QN 1.31 FOR PILLIONS)

Now I have some questions about the accident site:

1.1 Where exactly did the accident happen?
(Please give the actual place if possible eg. the north west corner of Flinders and Swanston Street, opposite Flinders Street Station)

....

....

(At this point, interviewer needs to establish if the accident occurred on a public road in the Melbourne metropolitan area. If it definitely did not, ***do not proceed with the questionnaire****. If in doubt, continue.)*

1.2 What time of the day was the accident? ▪ am pm

1.3 What day of the week was it?

Monday	1
Tuesday	2
Wednesday	3
Thursday	4
Friday	5
Saturday	6
Sunday	7
don't know	8

1.4 What was the date?

day *month* *year*

1.5 Which of the following best describes the weather at the time of the accident?

fine	1
cloudy/overcast	2
light rain (drizzle)	3
heavy rain	4
fog	5
don't know	6
other *(please describe)*	7

....

1.6 Which of the following best describes the light conditions at the time of the accident?

sunny/bright sunlight	1
glare	2

overcast/cloudy	3
dusk or dawn	4
night time	5
don't know	6
other *(please describe)*	7

……………………………………………………………………………………………

1.7 Which of the following best describes the street lighting at the time of the accident?

no street lights	1
street lights on	2
street lights off	3
don't know about lights	4

1.8 Was the road wet at the time of the accident?

yes	1
no	2
don't know	3

1.9 Could you please tell us what exactly happened in the accident and draw a diagram if possible.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

Diagram:
(Nb: Probe about involvement of road markings, traffic management features and other road features. Indicate position of motorcycle.)

1.10 Which way were you looking immediately prior to the accident?

directly ahead 1

at oncoming traffic 2

at side roads 3

at your motorcycle 4

don't know 5

at something else *(please describe)* 6

…………………………………………………………………………………………………

1.11 Was your view of the road ahead blocked in any way?

no 1

yes, by moving vehicles in front 2

yes, by parked vehicles 3

yes, by something else *(please describe)* 4

…………………………………………………………………………………………………

1.12 Was there anything especially dangerous about the accident location?

no 1

yes, loose material (eg gravel) 2

yes, tram tracks 3

yes, poor visibility 4

yes, complicated location 5

yes, other problem *(please describe)* 6

…………………………………………………………………………………………………

1.13 Did anything happen that was unexpected?

nothing 1

unexpected movement of other vehicle 2

road surface changed 3

don't know 4

other *(please describe)* 5

…………………………………………………………………………………………………

1.14 Did anything distract your attention?

no	1
yes, movements of other vehicles	2
yes, other *(please describe)*	3

....

1.15 What type of accident was it (first event)?

impact with object/vehicle	1	
fell off - trying to avoid impact	2	
loss of control - any other reason	3	**Go to 1.17**

1.16 What type of object did you swerve to avoid or did you hit?

parked or stationary motor vehicle	1
animal	2
pedestrian	3
bicycle	4
another motorcycle	5
moving car	6
moving light commercial vehicle	7
bus or heavy truck	8
pole or tree	9
kerb	10
don't know	11
impact with another type of vehicle/object *(please describe)*	12

....

1.17 How many vehicles were directly involved in the accident? ....
(By this we mean all the vehicles involved, not only those that were damaged. For example: just you and your motorcycle would be 'one', you and another vehicle would be 'two' and so on. Do not include other vehicles in area at the time. Don't include parked vehicles)

1.18 Did you use your brakes?

no	1	**Go to 1.20**
yes, front only	2	
yes, back only	3	
yes, both	4	
yes and brakes are linked	5	
yes, don't know which ones	6	**Go to 1.20**
don't know	7	**Go to 1.20**
not applicable	8	**Go to 1.20**

1.19 If you used both brakes, which did you use first?

front	1
back	2
together	3
don't know	4

1.20 Is there anything you could have done differently to avoid the accident?

no	1
different position on the road	2
riding more slowly	3
different avoidance procedure	4
other *(please describe)*	5

....

1.21 Who was at fault in the accident?

no-one	1
self	2
other person	3
both parties	4
don't know	5

1.22 What do you think was the speed limit at the place you had the accident?

.... km/h

1.23 What speed do you think you were travelling at just prior to the accident?

.... km/h

We would like to know more about the trip that you were making when you had your accident.

1.24 Where were you when you last got onto your bike? *(This is the exact location)*

....

....

1.25 What was the next place or street you were planning to stop or get off your bike?

....

....

1.26 What was the **main** reason for your trip?

going to/from work	1
work related travel	2
going to/from shops	3
going to/from visiting home of friends/family	4
recreational riding	5
going to/from social venue	6
going to/from sport	7
don't know	8
other *(please describe)*	9

....

1.27 Were you in a hurry?	yes	1
	no	2
	don’t know	3

1.28 How many times had you ridden that road in the year leading up to the accident?

just once (i.e. at the time of the accident)	1
2-3 times	2
4-10 times	3
11-20 times	4
more than 20 times	5
don't know	6

1.29 Did you experience any near misses on the last trip you made prior to the accident?

yes	1	
no	2	
don't know	3	

ASK BOTH RIDERS AND PILLIONS:

1.30 Were you wearing a helmet?

yes	1	
no	2	**Go to 1.36**
don't know	3	**Go to 1.36**

1.31 Is the helmet yours?

yes	1	
no	2	**Go to 1.34**
don't know	3	**Go to 1.34**

1.32 How old is the helmet? .... years

1.33 Did you buy the helmet new?

yes	1
no	2
don't know	3

1.34 What type of helmet was it?

full face	1
open face	2
don't know	3
other *(please describe)*	4

....

1.35 What was the main colour of the helmet? *(If unclear, state light or dark)*

....

1.36	Were you using a visor?	yes	1	
		no	2	**Go to 1.38**
		don't know	3	**Go to 1.38**
1.37	Was the visor tinted?	yes	1	
		no	2	
		don't know	3	
1.38	Could we take a look at the helmet?	yes	1	
		no	2	**Go to 1.40**

1.39 Where is the helmet now?

....

....

1.40 Were you wearing any clothing or other articles that are reflective (not fluorescent)?

yes		1	
	no	2	**Go to 1.42**
	don't know	3	**Go to 1.42**

1.41 What was it? ....

1.42 What was the main colour of your clothing from your waist up?
(If unclear, state light or dark)

....

1.43 What material was it made of?

leather	1
heavy-weight material	2
waterproof material (inc. dri-rider)	3
light-weight material (eg shirt, T-shirt)	4
don't know	5
other *(please describe)*	6

....

1.44 What material was your clothing from the waist down made of?

leather	1

heavy-weight material 2

waterproof material 3

light-weight material 4

don't know 5

other *(please describe)* 6

1.45 What were you wearing on your feet?

nothing 1

laced heavy shoes 2

motorcycle boots 3

don't know 4

other *(please describe)* 5

....

1.46 Were you wearing motorcycle gloves? yes 1

no 2

don't know 3

1.47 Did you have your headlight turned on?

no 1

yes, on high beam 2

yes, on low beam 3

yes but not sure whether high or low beam 4

don't know 5

1.48 Did you have any physical disabilities yes 1

no 2

1.49 Please describe your disabilities: ....

....

....

ASK THE FOLLOWING OF RIDERS ONLY IF THERE WAS A PILLION PASSENGER (REFER TO QNS 4 AND 5 ON FRONT PAGE):

1.50 What sex was the pillion passenger?

male 1

female 2

1.51 About how tall are they? ....

1.52 About how heavy are they? ....

1.53 Does your pillion passenger have any type of motorcycle licence?

yes 1

no 2

don't know 3

1.54 How often had your pillion passenger ridden with you before the accident?

never 1

a few times 2

often 3

don’t know 4

other *(please describe)* 5

....

1.55 How often had your pillion passenger ridden with anybody at all (including you) before the accident?

never 1

a few times 2

often 3

don’t know 4

other *(please describe)* 5

....

ASK BOTH RIDER AND PILLION

We would also like to get some details from the other person on the motorcycle.

1.56 Can you give us their first name and a contact telephone number?

yes	1	
no	2	

Name: ....

Phone: .... AH

Phone: .... BH

SECTION 2: THE MOTORCYCLE (RIDERS ONLY. GO TO SECTION 8 FOR PILLIONS)

Now I would like to ask you some questions about the motorcycle you were riding at the time of the accident:

2.1 What is the make and model of the motorcycle you were riding?

.... *(Make)* .... *(Model)*

2.2 What year was it made? 19

2.3 How many cc's is it? ....

2.4 Was the motorcycle registered at the time of the accident?

yes	1	
no	2	
don't know	3	

2.5 Did you own the motorcycle?

yes	1	
no	2	**Go to 2.7**
don't know	3	**Go to 2.7**

2.6 What year did you buy it? 19

2.7 How many kilometres have you clocked up since you've been using this motorcycle?

never ridden this motorcycle before	1
less than 100kms	2
100-999kms	3
1000-4,999kms	4
5,000-9,999kms	5
10,000km or greater	6
don't know	7

2.8 Do you regularly ride another motorcycle? yes 1

no 2 **Go to 2.10**

2.9 How does it differ from the accident one?

....

....

For completeness in this study, we need to take a look at your bike. This would involve the engineer looking at the bike and taking photos of it with the registration plates covered. This information, of course, is confidential and only used for our study.

2.10 Could we have a look at the bike? Yes 1

No 2 **Go to Section 3**

2.11 Where is the bike now?

....

....

The engineer will make contact in the next few days to arrange a convenient time to look at the bike.

SECTION 3: RIDING EXPERIENCE (RIDERS ONLY)

I would like to ask you some questions about your motorcycle riding experience. Firstly, I would like to ask you some questions about your off-road experience.

3.1 Were you an experienced off-road rider before you gained your on- road licence?

yes	1
no	2
don't know	3

Now I would like to ask you some questions about your on-road riding experience.

3.2 How old were you when you first rode a motorcycle on the road? ....
(Even without a licence)

3.3 For how many years altogether have you ridden a motorcycle regularly *on the road*? This means at least once a week. *(If riding has not been continuous, add together the periods of regular riding)*

....

3.4 Over the last year, how often on *average* have you ridden a motorcycle *on the road*? *(For new riders, average the total out over a year)*

3 days a week or more	1
1-2 days a week	2
1-3 days a month	3
a few days a year	4
not at all	5
don't know	6
other *(please describe)*	7

....

3.5 Over the last year, on average, how many kilometres would you usually do on a motorcycle on the road each week? *(For new riders, average the total out over a year)*

less than 50kms (30 miles)	1
51-100kms (31-63 miles)	2
101-200kms (64-126 miles)	3
201-300kms (127-188 miles)	4
301-400kms (189-250 miles)	5
over 400kms (over 250 miles)	6
don't know	7
other *(please describe)*	8

……………………………………………………………………………………………………

3.6 What is the main purpose of your riding?

transport	1
recreation	2
both transport and recreation	3
don't know	4
other *(please describe)*	5

……………………………………………………………………………………………………

Now we have some questions about your motorcycle licence.

3.7 What type of **motorcycle** licence do you have at present?

never had one	1	**Go to 3.14**
licence has lapsed	2	
licence disqualified	3	
learner permit	4	
probationary licence - must display Ps on bike	5	
full licence	6	
overseas or international licence	7	
don't know	8	
other *(please specify)*	9	

……………………………………………………………………………………………………

3.8 Is it a Victorian licence?

yes	1
no	2

3.9 Are you restricted to riding motorcycles of less than 260 cc?

yes 1

no 2

3.10 Are you allowed to carry a pillion? yes 1

no 2

3.11 Are you subject to zero BAC? yes 1

no 2

3.12 What year did you get your learner permit? 19

3.13 How long ago did you get your motorcycle licence (or 'previous' licence if lapsed/disqualified)?

less than one year ago 1

1 year ago 2

2 years ago 3

3 years ago 4

4 or more years ago 5

don't know 6

3.14 How many motorcycle courses have you completed?

none 0 **Go to 3.22**

....

3.15 Have you done a basic handling skills course?

yes 1

no 2

don't know 3

For the last motorcycle course that you have completed:

3.16 What year did you do it? 19

3.17 Where was the course and who held it?

Where: ....

Who: ....

3.18 What level was it at?

advanced 1

intermediate 2

beginner	3
don't know	4
other *(please describe)*	5

3.19 What was the most useful/important thing you learnt?

……………………………………………………………………………………………

3.20 Has training helped you to avoid accidents?

yes	1
no	2
don't know	3

How often do you apply the skills learnt through training to the following:

3.21a	Braking?	always	1
		often	2
		rarely	3
		never	4
3.21b	Cornering?	always	1
		often	2
		rarely	3
		never	4
3.21c	Collision avoidance?	always	1
		often	2
		rarely	3
		never	4

3.22 Do you consider rider training important for:

novice riders only	1
all riders	2
neither, it's not important	3

I would now like to ask you some questions about any accidents that you might have had.

3.23 In the last five years, how many accidents have you been involved in as a motorcycle rider on the road (not counting the present one)?
(We do not mean accidents where you were a pillion passenger)

none 1 **Go to Section 4**

one 2

two 3

more than two 4

3.24 How many of these involved another vehicle? ....

SECTION 4: RIDING STRATEGIES (RIDERS ONLY)

4.1 Have you practised emergency braking in the last six months?

yes 1

no 2

4.2 Have you practised counter-steering (sudden swerving) in the last six months?

yes 1

no 2

4.3 Do you feel confident using the front brake hard in an emergency situation:

at any time 1

only in dry, perfect conditions 2

never 3

4.4 Do you feel confident in performing a sudden swerve in an emergency situation:

at any time 1

only in dry, perfect conditions 2

never 3

4.5 Which of the following do you consider to be of greater importance?

scanning all around and a long way ahead 1

advanced machine handling skills 2

other *(please specify below)* 3

....

4.6 How often do you change your road position to maximise your view on approaching curves?

always 1

often 2

rarely 3

never 4

When approaching intersections, do you:

4.7a regularly scan all around? yes 1
no 2

4.7b regularly scan behind? yes 1
no 2

4.7c regularly cover brakes? yes 1
no 2

4.7d regularly decrease speed? yes 1
no 2

4.7e regularly change down a gear? yes 1
no 2

4.7f regularly change position for increased visibility?
yes 1
no 2

4.7g regularly establish eye contact with other drivers?
yes 1
no 2

4.7h regularly consider road surface condition and available space for braking or swerving?
yes 1
no 2

4.8 How often do you flash your headlight to warn others of your presence?

always	1	**Go to 4.10**
often	2	**Go to 4.10**
rarely	3	
never	4	

4.9 Why don't you flash your headlight?

……………………………………………………………………………………………

……………………………………………………………………………………………

4.10 Do you regularly use the horn as a warning of your presence?

always	1
often	2
rarely	3
never	4

4.11 When you are being 'tailgated', do you? *(Tick more than one if necessary)*

speed up	1
slow down	2
maintain speed	3
flash brake light	4
move out of the way	5
nothing	6
other *(please specify)*	7

……………………………………………………………………………………………

4.12 How often do you look behind over one shoulder?

always	1
often	2
rarely	3
never	4

4.13 How far behind other vehicles do you usually travel?

less than two seconds	1
more than two seconds	2
maintaining two second gap	3
don't know	4

4.14 What position in the travelling lane would you normally occupy?

left hand wheel track	1
right hand wheel track	2
centre of the lane	3

4.15 When riding on a freeway, which lane do you normally travel in?

left lane	1
centre lane(s)	2
right lane	3
mixture of the above	4

SECTION 5: OTHER DRIVING EXPERIENCE (RIDERS ONLY)

Now I would like to ask you some questions about your experience driving cars and other vehicles.

5.1 What other types of motor vehicle licence do you hold?

none - never had one	1
none - licence has lapsed	2
none - licence disqualified	3
private motorcar - learner	4
private motorcar - probationary	5
private motorcar - full	6
light truck	7
heavy truck/bus	8
articulated truck	9
don't know	10
other *(please specify)*	11

……………………………………………………………………………………………

5.2 What year did you get your first car licence? 19

5.3 For how many years altogether have you driven a car (or other vehicle) regularly on the roads? *(This means at least once a week. If driving has not been continuous, add together periods of regular driving)*

……………………

5.4 What is the motor vehicle you have driven the most kilometres in the last year on the road? *(This includes motorcycles.)*

none (don't usually drive)	1
motorcycle	2

car	3
car and motorcycle equally	4
taxi or bus	5
light commercial vehicle (truck)	6
heavy truck	7
don't know	8
other *(please describe)*	9

....

SECTION 6: ALCOHOL (RIDERS ONLY)

Now I would like to ask you a few questions about your alcohol intake over the last year.

6.1 How often do you drink enough to feel affected by alcohol?

once per week or more	1
once a month or more	2
once every 6 months or more	3
once a year or less	4
never	5
don't know	6

6.2 Had you drunk any alcohol in the 12 hours before the accident?

yes	1	
no	2	**Go to 6.6**
don't know	3	**Go to 6.6**

6.3 How many hours before the accident did you start drinking? ....

6.4 How long before the accident did you stop drinking? ....

6.5 Please describe what you had to drink and how much:

....

....

....

6.6 Had you taken any medication prescribed by a doctor in the 12 hours before the accident?

yes	1	
no	2	**Go to 6.8**
don't know	3	**Go to 6.8**

6.7 What was it? ....

6.8 Had you taken any medication only available from the chemist in the 12 hours before the accident?

yes	1	
no	2	**Go to 6.10**
don't know	3	**Go to 6.10**

6.9 What was it? ....

6.10 Had you had any marijuana or other such drugs in the 12 hours before the accident?

yes	1	
no	2	**Go to Section 7**
don't know	3	**Go to Section 7**

6.11 What were they? ....

SECTION 7: 24 HOUR DRIVING HISTORY (RIDERS ONLY)

Now we would like to ask you some questions about when you were riding your motorcycle during the 24 hour period before you had your accident. This means from ____________________ (24 hours before the accident).

For all trips, could you please tell us the **starting** and **finishing place** and the **starting** and **finishing time**. Please indicate whether am or pm.

All trips	All trips in previous 24 hours	
Time	**Start place**	**End place**
Beginning: End:		
Beginning: End:		
Beginning: End:		
Beginning: End:		
Beginning: End:		
Beginning: End:		

SECTION 8: PERSONAL DETAILS (RIDERS AND PILLIONS)

Now I would like to ask you a few questions about yourself. Please remember that all of these details are completely confidential.

8.1 What is your date of birth?

day *month* *year*

8.2 Record sex of case?

male 1

female 2

8.3 What is your marital status?
(Please choose the one that best describes the present situation)

single (never married)	1
married/living with partner	2
separated or divorced	3
widowed	4
don't know	5

8.4 What was the highest level of education that you received?

primary school	1
secondary school	2
technical college or similar	3
university	4
don't know	5

8.5 Which of the following best describes your present job situation?
(If necessary, please choose the two boxes that best describes the situation)

full-time work	1
part-time work	2
receiving benefit	3
student	4
self employed	5
home maker	6
unemployed and no benefit	7
don't know	8
other *(please describe)*	9

8.6 How many years have you lived in Australia?

born here	1
less than 5 years	2
5-10 years	3
more than 10 years	4

8.7 About how tall are you? ....

8.8 About how heavy are you? ....

8.9 Are you:

left-handed	1
right-handed	2

For riders: **This is the end of the questionnaire. Thank you very**

much for your time.

Reminder notes for interviewer:
Do you need to inspect the helmet? Refer to question 1.39

For pillions: Continue with Section 9.

SECTION 9: PILLION MOTORCYCLING EXPERIENCE (for pillions only)

Now we would like to ask you some questions about your motorcycling experience.

9.1 Have you ever ridden a motorcycle yourself?

yes	1	
no	2	**Go to 9.7**
don't know	3	**Go to 9.7**

9.2 For how many years altogether have you ridden regularly on the roads? This means at least once a week as a driver. *(If riding hasn't been continuous, add together periods of regular riding)*

....

9.3 What type of motorcycle licence do you have at present?

never had one	1	**Go to 9.7**
licence has lapsed	2	
licence disqualified	3	
learner permit	4	
probationary licence - must display Ps on bike	5	
full licence	6	
overseas or international licence	7	
don't know	8	
other *(please specify)*	9	

....

9.4 How long ago did you get your full motorcycle licence (or 'previous' licence if lapsed/disqualified)?

less than one year ago	1
1 year ago	2
2 years ago	3
3 years ago	4
4 or more years ago	5
don't know	6

9.5 What year did you get your learner permit? 19

9.6 How often had you ridden as a pillion passenger on a motorcycle before the accident?

never	1
a few times	2
often	3
don't know	4
other *(please describe)*	5

……………………………………………………………………………………………………

9.7 How often have you ridden as a pillion passenger on a motorcycle *with that driver before*?

never	1
a few times	2
often	3
don't know	4
other *(please describe)*	5

……………………………………………………………………………………………………

This is the end of the questionnaire. Thank you very much for your time.

29/11/95

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

CASE CONTROL STUDY OF MOTORCYCLE CRASHES

SITE INSPECTION FORM

1 Identification

Type of site? case 1

control 2

1.1 Identification no.: ....

1.2 Date of inspection:

day *month* *year*

1.3 Date of crash:

day *month* *year*

1.4 Time of inspection *(24 hour clock)*:

1.5 Time of crash *(24 hour clock)*:

2 Site details

2.1 Intersection of .... and ....
or
Midblock: between .... and ....

2.2 Distance from closest km post or other identifier (if appropriate).

....

2.3 Suburb/locality: ....

2.4 Melways ref.: ....

2.5 LGA: ....

Sketch of site:

(Please include on diagram widths of (a) median, (b) outer separator, (c) pavement, (d) shoulder, (e) nature strip - including footpath if applicable, (f) rural verge, and (h) road reserve)

2.6 Road type:

freeway	1
major arterial	2
minor arterial	3
collector	4
local	5
other (eg. rural)	6

....

3 General features

3.1 Adjacent land use:

urban residential	1
urban commercial	2
urban industrial	3
urban parkland	4
rural residential	5
rural farmland	6
rural forest	7

3.2 Traffic flow:

heavy	1
medium	2
light	3

3.3 Speed limit at site: .... km/h

4 Road Geometry

4.1 Intersection type:

Not applicable *(if Location=1)*	1
X-intersection	2
Y-intersection	3
T-intersection	4
multi-intersection	5

4.2 Road configuration:

- one way 1
- two way undivided 2
- two way undivided with service roads 3
- divided road (dual carriageway) - no service roads 4
- divided road (dual carriageway) with service roads 5
- other *(please specify)* 6

....

4.3 Type of median:

- no median 1
- painted - wider than 2 lines 2
- studs - raised studs 3
- paved, gravel or low level landscape 4
- paved, gravel or low level landscape with trees 5
- physical barrier 6
- tram safety zone 7
- other *(please specify)* 8

....

4.4 Type of outer separator:

- no outer separator 1
- paved, gravel or low level landscaping 2
- paved, gravel or low level landscaping with trees 3
- physical barrier 4

4.5 Type of kerbing:

- no kerbing 1
- mountable kerb 2
- barrier kerb 3

4.6 Horizontal road alignment:

- straight 1
- curved 2

4.7 Curve rad: .... metres

4.8 Vertical road grade: .... %

4.9 Over vertical curve sight distance: ....

4.10 Under vertical curve length: ....

4.11 Pavement cross slope: ....

4.12 Shoulder cross slope: ....

4.13 Side drain:

yes 1

no 2

4.14 Side drain navigable:

yes 1

no 2

5 Traffic controls

5.1 Traffic controls:

None present 1

Stop sign 2

Give way sign 3

Roundabout 4

Double unbroken lines 5

Flashing signals 6

Traffic control signals 7

Railway crossing 8

Pedestrian crossing 9

School crossing 10

Police officer/road patrol/railway worker manual traffic control/roadwork/half road closed 11

Warning signs 12

Road closure barriers 13

5.2 Local area traffic management devices:

speed humps 1

raised pavements 2

chicanes/slow points 3

threshold treatments 4

roundabouts 5

other (specify) 6

....

6 Road surface

6.1 Surface material of road pavement:

gravel/crushed rock	1
chip seal	2
asphalt	3
slick bitumen	4
other (specify):	5

....

6.2 Surface material of shoulder:

gravel/crushed rock	1
chip seal	2
asphalt	3
slick bitumen	4
other (specify):	5

....

6.3 Surface coarseness of road pavement:

coarse	1
medium	2
fine	3

6.4 Surface cleanness of road pavement:

clean	1
muddy	2
oily	3
loose material	4

6.5 Road markings:

no road markings	0
paint	1
thermoplastics	2
raised reflective pavement markers	3

Sketch of road markings:

6.6	Potholes:	yes	1
		no	2
6.7	Pit lids/drainage grates:	yes	1
		no	2
6.8	Deformed pavement:	yes	1
		no	2
6.9	Integrity of pavement:	yes	1
		no	2
6.10	Sudden change in road surface:	yes	1
		no	2

6.11 Number of lanes: ………………………………………………………

6.12 Lane configuration:

number of lanes not changing	1
changing lane configuration - merging 2 lanes into one or divided road into undivided road	2
breakdown lane - reserved for broken down vehicles	3
climbing lane - extra lane for slow vehicles up hill	4
diverging (exit) - decelerating lane for traffic to diverge from the main stream	5
merging (entry) - accelerating lane for traffic to diverge from the main stream	6
turn slot median opening - right turn slot or free left lanes at intersection	7
bus/transit - lane reserved for buses or vehicle qualifying under 'transit' conditions, includes bicycle lanes	8
tram lines and stops/safety zones - facilities for trams along carriageway	9

7 Roadside objects

7.1 Roadside objects:

kerbs	1
poles	2
trees	3
fences	4
guard rails	5
buildings	6
rural roadside density (1 to 6)	7
railway crossing	8
bridge abutment	9
culvert end walls	10
other *(please specify)*	11

....

8 Impairment of visibility

8.1 Could glare from sun reduce visibility?

yes	1
no	2

8.2 Could pavement reflection of artificial lighting be a problem?

yes	1

	no	2

8.3 Could oncoming headlights be a problem?

	yes	1
	no	2

9 Evidence of crash (for crash sites)

9.1 Evidence of braking:

rear tyre hooked skid	1
rear tyre weaved skid (fish tailing)	2
straight skid	3
front tyre skid	4

9.2 Type of debris: ....

9.3 Location of debris: ....

9.4 Relationship to sudden change in road surface: ....

9.5 Location of evidence in relation to cross section: ....

9.6 Other comments: ....

....

....

....

....

....

....

29/11/95

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

CASE CONTROL STUDY OF MOTORCYCLE CRASHES

MOTORCYCLE INSPECTION FORM

(Note: do not ask any questions about the crash.)

1 Case No: ....

2 Date of inspection:

day *month* *year*

3 Inspected by: ....

4 Make: ....

5 Model: ....

6 CCs: ....

7 Is there a **current** registration label?

yes 1

no 2

8 Odometer reading:

less than 100kms 1

100-999kms 2

1000-4,999kms 3

5,000-9,999kms 4

10,000km or greater 5

no odometer 6

9 Condition of bike:

dirt: ....

rust: ....

dents/scratches in petrol tank: ....

tyre pressure: ....

mechanical condition: ....

lights: ....

steering: ....

drive train: ....

brakes: ....

oil leaks: ....

10 Type of tyre:

Type of tyre:	road	1
	off-road	2
	combination	3

Comments: ....

11 Condition of tyre tread:

	Front	Rear
little sign of wear	1	5
tread somewhat worn	2	6
tread badly worn	3	7
bald	4	8

12 Obvious signs of damage from crash: ....

....

....

....

....

....

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

CASE CONTROL STUDY OF MOTORCYCLE CRASHES

HELMET INSPECTION FORM

1 Case No: ....

2 Date of inspection:
day *month* *year*

3 Inspected by: ....

4 Type of helmet?
- full face 1
- open face 2
- don't know 3
- other *(please describe)* 4

....

5 Main colour of the helmet? *(If unclear, state light or dark)*

....

6 Is there a visor?
- yes 1
- no 2

7 Is the visor tinted?
- yes 1
- no 2

8 Is the helmet ASA 1698 approved?
- yes 1
- no 2

9 Brand of helmet: ....

10 Year of manufacture: ....

11 Are there any signs of obvious damage such as dents or scratches?

yes 1 ***See below***

no 2

12 If 'yes', describe as best as possible: ....

....

....

....

....

13 Are there any stickers? (other than ASA) yes 1

no 2

14 Has helmet been painted? yes 1

no 2

15 Any signs of alterations? yes 1 ***See below***

no 2

16 If yes, please describe:

....

....

17 Is interior padding visibly worn/compressed? yes 1

no 2

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

MOTORCYCLE CONTROL SITE
MASTER FORM

1 **Case No:** ....

2 **Date of inspection:**
day *month* *year*

3 **Time of inspection** *(24 hour clock)*: .

4 **Team:** (1) .... (2) .... (3) ....

5 **Melways ref.:** ....

6 **Location address:** ....

7 **Crash Direction:** downstream 1 *(e.g., going to)* upstream 2 *(e.g., coming from)* N/A 3

8 **Site Description:** uphill 1 downhill 2 flat 3

9 **Surface:** sealed 1 unsealed 2

10 **Speed limit:** .... km/h

11 **Adjacent areas:** ....

12 **Weather:** fine 1 fog 5
cloudy/overcast 2 don’t know 6
light rain (drizzle) 3 other 7
heavy rain 4 ....

13 **Comments about conditions:** ....

14 **Traffic count:** .... vehicles per .... minutes

15 **Count commenced:** . Count completed: .

16 **Film exposure number:** ....

17 **Observer:** ....

MOTORCYCLIST ROADSIDE OBSERVER QUESTIONNAIRE **29/11/95**

1 **Control No:** .... **2** **Case No:** ....

3 **Pillion passenger?** yes 1 no 2 **Go to 6**

4 **Pillion wearing helmet?** yes 1 no 2

5 **Type of helmet pillion wearing?**

full face	1	don't know	3
open face	2	other	4

....

6 **Rider wearing a helmet?** yes 1 no 2 **Go to 8**

7 **Type of helmet rider wearing?**

full face	1	don't know	3
open face	2	other	4

....

8 **Headlight turned on?**

no	1	unsure high/ low beam	4
yes, high beam	2	don't know	5
yes, low beam	3		

9 **Rider wearing any clothing or other articles that are reflective (not fluorescent)?**

yes 1 no 2 **Go to 11** don't know 3 **Go to 11**

10 **What is it?**

....

11 **Main colour of rider's clothing from the <u>waist up</u>?**

....

12 **Material from the <u>waist up</u> made of?**

leather	1	light-weight material	4
heavy-weight material	2	don't know	5
waterproof material	3	other	6

....

13 **Material from the <u>waist down</u> made of?**

leather	1	light-weight material	4
heavy-weight material	2	don't know	5
waterproof material	3	other	6

....

14 **Rider wearing on feet?**

nothing	1	don't know	4
laced heavy shoes	2	other	5

....

motorcycle boots 3

15 Date of roadside interview:

day month year

16 Record the time: . am pm

17 Observer: ……………………………………………………………………………

29/11/95

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

MOTORCYCLIST ROADSIDE INTERVIEWER QUESTIONNAIRE

1 Control No: ....

2 Case No: ....

3 Date of roadside interview:

day *month* *year*

4 Time *(24 hour clock)*: . am pm

5 Interviewer: ....

6 Interviewee: driver 1

pillion passenger 2

7 What is your date of birth?

day *month* *year*

8 Record sex of case? male 1

female 2

9 What type of **motorcycle** licence do you have at present?

never had one	1	**Go to 11**
licence has lapsed	2	
licence disqualified	3	
learner permit	4	
probationary licence - must display Ps on bike	5	
full licence	6	
overseas or international licence	7	
don't know	8	
other *(please specify)*	9	

....

10 Is it a Victorian licence?

yes	1
no	2

11 Which way were you looking immediately prior to being stopped?

directly ahead	1
at oncoming traffic	2
at side roads	3
at your motorcycle	4
don't know	5
at something else *(please describe)*	6

....

12 Was your view of the road ahead blocked in any way?

no	1
don't know	2
yes, by moving vehicles in front	3
yes, by parked vehicles	4
yes, by something else *(please describe)*	5

....

Would you mind being breathalysed. The result would be for research purposes only and would not be disclosed to the police.

yes 1

no 2

18 BAC result: .

This is the end of the questionnaire, but we would like to phone you within the next few days to ask you some more details. Could we have your first name and phone number so that we can call you?

yes 1

no 2

First name: ....

Phone: (........).. AH

(........).. BH

When is the best time to call you: .... AM

PM

Thank you for your participation.

MONASH UNIVERSITY
ACCIDENT RESEARCH CENTRE

MOTORCYCLIST FOLLOW-UP QUESTIONNAIRE

The following information can be used to prompt the interviewee's memory:

Date of roadside interview:
day *month* *year*

Time of roadside interview: . am pm

Location: ………………………………………………………

Interviewee: driver
pillion passenger

1 Control No: ……………………….

2 Case No: ……………………….

3 Date of follow-up interview:
day *month* *year*

SECTION 1: TRAVEL DETAILS

We would like to ask you some details about your travel at the time you were stopped.

1.1 Was there anything especially dangerous about the road just before you were stopped?

no	1
yes, loose material (eg gravel)	2
yes, tram tracks	3
yes, poor visibility	4
yes, complicated location	5
yes, other problem *(please describe)*	6

....

1.2 Had anything happened that was unexpected just before you were stopped?

nothing	1
unexpected movement of other vehicle	2
road surface changed	3
don't know	4
other *(please describe)*	5

....

1.3 Had anything distracted your attention just before you were stopped?

no	1
yes, movements of other vehicles	2
yes, other *(please describe)*	3

....

1.4 What do you think the speed limit was just before you were stopped?

.... km/h

1.5 What speed do you think you were travelling at just before you were stopped?

.... km/h

We would like to know more about the trip that you were making.

1.6 Where were you when you last got onto your bike?
(This is the exact location)

....

....

1.7 What was the next place or street you were planning to stop or get off your bike?

....

1.8 What is the **main** reason for your trip?

going to/from work	1
work related travel	2
going to/from shops	3
going to/from visiting home of friends/family	4
recreational riding	5
going to/from social venue	6
going to/from sport	7
don't know	8
other *(please describe)*	9

....

1.9 Were you in a hurry?

yes	1
no	2
don't know	3

1.10 How many times had you ridden that road in the past year?

just once (i.e. that time)	1
2-3 times	2
4-10 times	3
11-20 times	4
more than 20 times	5
don't know	6

1.11	Were you wearing a helmet?	yes	1	
		no	2	**Go to 1.16**
		don’t know	3	**Go to 1.16**
1.12	Is the helmet yours?	yes	1	
		no	2	**Go to 1.15**
		don’t know	3	**Go to 1.15**
1.13	How old is the helmet?	.... years		
1.14	Did you buy the helmet new?	yes	1	
		no	2	
		don’t know	3	

1.15 What is the main colour of the helmet? *(If unclear, state light or dark)*

....

1.16 Were you using a visor when you were stopped?

		yes	1	
		no	2	**Go to 1.18**
		don't know	3	**Go to 1.18**
1.17	Was the visor tinted?	yes	1	
		no	2	
		don’t know	3	
1.18	Were you wearing motorcycle gloves?	yes	1	
		no	2	
		don’t know	3	

SECTION 2: 24 HOUR DRIVING HISTORY

Now finally, we would like to ask you some questions about when you were riding your motorcycle during the 24 hour period before you had you were stopped. This means from ____________________ (24 hours before the accident).

For all trips, could you please tell us the **starting** and **finishing place** and the **starting** and **finishing time**. Please indicate whether am or pm.

All trips	All trips in previous 24 hours	
Time	**Start place**	**End place**
Beginning: End:		
Beginning: End:		
Beginning: End:		
Beginning: End:		
Beginning: End:		
Beginning: End:		

SECTION 3: RIDING STRATEGIES (RIDERS ONLY)

3.1 Have you practised emergency braking in the last six months?

yes 1

no 2

3.2 Have you practised counter-steering (sudden swerving) in the last six months?

yes 1

no 2

3.3 Do you feel confident using the front brake hard in an emergency situation:

at any time 1

only in dry, perfect conditions 2

never 3

3.4 Do you feel confident in performing a sudden swerve in an emergency situation:

at any time 1

only in dry, perfect conditions 2

never 3

3.5 Which of the following do you consider to be of greater importance?

scanning all around and a long way ahead 1

advanced machine handling skills 2

other *(please specify below)* 3

....

3.6 How often do you change your road position to maximise your view on approaching curves?

always 1

often 2

rarely 3

never 4

When approaching intersections, do you:

3.7a regularly scan all around? yes 1 no 2

3.7b regularly scan behind? yes 1 no 2

3.7c regularly cover brakes? yes 1 no 2

3.7d regularly decrease speed? yes 1 no 2

3.7e regularly change down a gear?

yes 1
no 2

3.7f regularly change position for increased visibility?

yes 1
no 2

3.7g regularly establish eye contact with other drivers?

yes 1
no 2

3.7h regularly consider road surface condition and available space for braking or swerving?

yes 1
no 2

3.8 How often do you flash your headlight to warn others of your presence?

always 1 **Go to 3.10**
often 2 **Go to 3.10**
rarely 3
never 4

3.9 Why don't you flash your headlight?

……………………………………………………………………………………………

……………………………………………………………………………………………

3.10 Do you regularly use the horn as a warning of your presence?

always 1
often 2
rarely 3
never 4

3.11 When you are being ‘tailgated’, do you? *(tick more than one if necessary)*

speed up	1
slow down	2
maintain speed	3
flash brake light	4
move out of the way	5
nothing	6
other *(please specify)*	7

....

3.12 How often do you look behind over one shoulder?

always	1
often	2
rarely	3
never	4

3.13 How far behind other vehicles do you usually travel?

less than two seconds	1
more than two seconds	2
maintaining two second gap	3
don’t know	4

3.14 What position in the travelling lane would you normally occupy?

left hand wheel track	1
right hand wheel track	2
centre of the lane	3

3.15 When riding on a freeway, which lane do you normally travel in?

left lane	1
centre lane(s)	2
right lane	3
mixture of the above	4

3.16 How many near miss situations with other traffic do you experience per month?

usually none	1
usually only one	2
usually 2 or 3	3
usually more than 3	4
don't know	5

3.17 Did you experience any near misses on the last trip you made prior to being stopped?

yes	1
no	2
don't know	3

SECTION 4: THE MOTORCYCLE (RIDERS ONLY)

We would like to know some details about the motorcycle you were riding.

4.1 What is the make and model of the motorcycle you were riding?

.... *(Make)* .... *(Model)*

4.2 What year was it made? 19

4.3 How many cc's is it? ....

4.4 Was the motorcycle registered at the time you were stopped?

yes	1
no	2
don't know	3

4.5 Did you own the motorcycle at the time you were stopped?

yes	1	
no	2	**Go to 4.8**
don't know	3	**Go to 4.8**

4.6 What year did you buy it? 19

4.7 How many kilometres have you clocked up since you've been using this motorcycle?

never ridden this motorcycle before	1
less than 100kms	2
100-999kms	3
1000-4,999kms	4
5,000-9,999kms	5
10,000km or greater	6
don't know	7

4.8 Do you regularly ride another motorcycle?

yes	1	
no	2	**Go to Section 5**

4.9 How does it differ from the one you were riding when you were stopped?

....

....

SECTION 5: RIDING EXPERIENCE (RIDERS ONLY)

We would like to know about your motorcycle riding experience. Firstly, your off-road experience:

5.1 Were you an experienced off-road rider before you gained your on- road licence?

yes	1
no	2
don't know	3

5.2 How old were you when you first rode a motorcycle on the road? .... *(Even without a licence)*

5.3 For how many years altogether have you ridden a motorcycle regularly on the road? This means at least once a week. *(If riding has not been continuous, add together the periods of regular riding)*

....

5.4 Over the last year, how often on *average* have you ridden a motorcycle on the road?

3 days a week or more	1
1-2 days a week	2
1-3 days a month	3
a few days a year	4
not at all	5
don't know	6
other *(please describe)*	7

....

5.5 Over the last year, on average, how many kilometres would you usually do on a motorcycle on the road each week? *(For new riders, average the total out over a year)*

less than 50kms (30 miles)	1
51-100kms (31-63 miles)	2
101-200kms (64-126 miles)	3
201-300kms (127-188 miles)	4
301-400kms (189-250 miles)	5
over 400kms (over 250 miles)	6
don't know	7
other *(please describe)*	8

....

5.6 What is the main purpose of your riding?

transport	1
recreation	2
both transport and recreation	3
don't know	4
other *(please describe)*	5

....

Now we have some questions about your motorcycle licence.

5.7 Are you restricted to riding motorcycles of less than 260 cc?

yes	1
no	2

5.8 Are you allowed to carry a pillion? yes 1

no 2

5.9 Are you subject to zero BAC? yes 1

no 2

5.10 What year did you get your learner licence? 19

5.11 How long ago did you get your motorcycle licence (or 'previous' licence if lapsed/disqualified)?

less than one year ago 1

1 year ago 2

2 years ago 3

3 years ago 4

4 or more years ago 5

don't know 6

5.12 How many motorcycle courses have you completed?

none 0 **Go to 5.20**

....

5.13 Have you done a basic handling skills course?

yes 1

no 2

don't know 3

For the last motorcycle course that you have completed*:*

5.14 What year did you do it? 19

5.15 Where was the course and who held it?

Where: ....

Who: ....

5.16 What level was it at?

advanced	1
intermediate	2
beginner	3
don't know	4
other *(please describe)*	5

5.17 What was the most useful/important thing you learnt?

……………………………………………………………………………………………………

5.18 Has training helped you to avoid accidents?

yes	1
no	2
don't know	3

How often do you apply the skills learnt through training to the following:

5.19a	Braking?	always	1
		often	2
		rarely	3
		never	4
5.19b	Cornering?	always	1
		often	2
		rarely	3
		never	4
5.19c	Collision avoidance?	always	1
		often	2
		rarely	3
		never	4

5.20 Do you consider rider training important for:

novice riders only	1
all riders	2
neither, it's not important	3

I would now like to ask you some questions about any accidents that you might have had.

5.21 In the last five years, how many accidents have you been involved in as a motorcycle rider on the road?
(We do not mean accidents where you were a pillion passenger)

none	1	**Go to Section 6**
one	2	
two	3	
more than two	4	

5.22 How many of these involved another vehicle? ....

SECTION 6: OTHER DRIVING EXPERIENCE (RIDERS ONLY)

Now I would like to ask you some questions about your experience driving cars and other vehicles.

6.1 What other types of motor vehicle licence do you hold?

none - never had one	1	**Go to 6.3**
none - licence has lapsed	2	
none - licence disqualified	3	
private motorcar - learner	4	
private motorcar - probationary	5	
private motorcar - full	6	
light truck	7	
heavy truck/bus	8	
articulated truck	9	
don't know	10	
other *(please specify)*	11	

....

6.2 What year did you get your first car licence? 19

6.3 For how many years altogether have you driven a car (or other vehicle) regularly on the roads? *(This means at least once a week. If driving has not been continuous, add together periods of regular driving)*

....

6.4 What is the motor vehicle you have driven the most kilometres in the last year on the road? *(This includes motorcycles.)*

none (don't usually drive)	1
motorcycle	2

car	3
car and motorcycle equally	4
taxi or bus	5
light commercial vehicle (truck)	6
heavy truck	7
don't know	8
other *(please describe)*	9

………………………………………………………………………………………………

SECTION 7: ALCOHOL (RIDERS ONLY)

Now I would like to ask you a few questions about your alcohol intake over the last year.

7.1 How often do you drink enough to feel affected by alcohol?

once per week or more	1
once a month or more	2
once every 6 months or more	3
once a year or less	4
never	5
don't know	6

I would like to ask you a few questions about your alcohol intake over the few hours before you were stopped.

7.2 Had you drunk any alcohol in the 12 hours before being stopped?

yes	1	
no	2	**Go to 7.6**
don't know	3	**Go to 7.6**

7.3 How many hours before being stopped did you start drinking?

……………

7.4 How many hours before being stopped did you stop drinking?

....

7.5 Please describe what you had to drink and how much:

....

....

....

7.6 Had you taken any medication prescribed by a doctor in the 12 hours before being stopped?

	yes	1	
	no	2	**Go to 7.8**
	don't know	3	**Go to 7.8**

7.7 What was it? ....

7.8 Had you taken any medication only available from the chemist in the 12 hours before being stopped?

	yes	1	
	no	2	**Go to 7.10**
	don't know	3	**Go to 7.10**

7.9 What was it? ....

7.10 Had you had any marijuana or other such drugs in the 12 hours before being stopped?

	yes	1	
	no	2	**Go to Section 8**
	don't know	3	**Go to Section 8**

7.11 What were they? ....

SECTION 8: PERSONAL DETAILS (RIDERS AND PILLIONS)

Now some questions about yourself. Please remember that all of these details are completely confidential.

8.1 What is your marital status?
(Please choose the one that best describes the present situation)

single (never married)	1
married/living with partner	2
separated or divorced	3
widowed	4
don't know	5

8.2 What was the highest level of education that you received?

primary school	1
secondary school	2
technical college or similar	3
university	4
don't know	5

8.3 Which of the following best describes your present job situation?
(If necessary, please choose the two boxes that best describes the situation)

full-time work	1
part-time work	2
receiving benefit	3
student	4
self employed	5
home maker	6
unemployed and no benefit	7
don't know	8
other *(please describe)*	9

8.4 How many years have you lived in Australia?

born here	1
less than 5 years	2
5-10 years	3
more than 10 years	4

8.5 About how tall are you? ....

8.6 About how heavy are you? ....

8.7	Are you:	left-handed	1
		right-handed	2

8.8	Did you have any physical disabilities	yes	1
		no	2

8.9 Please describe your disabilities: ....

....

....

FOR RIDERS:
This is the end of the questionnaire. Thank you very much for your time.

FOR PILLIONS:
Go to Section 9.

SECTION 9: PILLION MOTORCYCLING EXPERIENCE (for pillions only)

I would like to ask you some questions about *your* motorcycling experience.

9.1 Have you ever ridden a motorcycle yourself?

yes	1	
no	2	**Go to 9.6**
don't know	3	**Go to 9.6**

9.2 For how many years altogether have you ridden regularly on the roads? This means at least once a week as a driver.
(If riding hasn't been continuous, add together periods of regular riding)

....

9.3 What type of motorcycle licence do you have at present?

never had one 1

licence has lapsed 2

licence disqualified 3

learner permit 4

probationary licence - must display Ps on bike 5

full licence 6

overseas or international licence 7

don't know 8

other *(please specify)* 9

....

9.4 How long ago did you get your full motorcycle licence (or 'previous' licence if lapsed/disqualified)?

less than one year ago 1

1 year ago 2

2 years ago 3

3 years ago 4

4 or more years ago 5

don't know 6

9.5 When did you get your learner permit? ....

9.6 How often have you ridden as a pillion passenger on a motorcycle before being stopped (with any rider)?

never 1

a few times 2

often 3

don't know 4

other *(please describe)* 5

....

9.7 How often have you ridden as a pillion passenger on a *motorcycle with that driver* before being stopped?

never	1
a few times	2
often	3
don't know	4
other *(please describe)*	5

....

This is the end of the questionnaire. Thank you very much for your time.

APPENDIX 2: MISSING BAC VALUES FOR RIDERS

The availability of BAC data for the non-fatal and fatal crashes in each year is summarised in Table A2.1. The rider BAC was missing for 75 of the 222 crashes (34%). This comprised 70 crashes in 1996 and 5 crashes in 1997. There were no missing rider BACs for any of the 24 fatal crashes.

Table A2.1. Availability of BAC data for injury and fatal crashes according to year.

Year	BAC available			BAC missing			Total
	Non-fatal	Fatal	Total	Non-fatal	Fatal	Total	
1995	8	1	9	0	0	0	9
1996	101	20	121	70	0	70	191
1997	14	3	17	5	0	5	22
Total	123	24	147	75	0	75	222

Five of the 75 missing rider BACs derived from the 17 crashes for which no controls were able to be recruited. Therefore rider BAC was missing for 70 of the 205 cases (34%) which were included in the case-control comparisons.

Sources of BAC data

The rider BAC values for all fatal crashes were provided by Police, located in the State Traffic Accident Record (STAR) or located in the VicRoads Fatality Database.

The sources of BAC data for non-fatal crashes are summarised in Table A2.2. For hospital admission crashes, 65/165 (39%) of rider BACs were missing. For crashes where the rider was treated at the Emergency Department and not admitted, 12/33 (36%) of rider BACs were missing.

Table A2.2. Sources of BAC data for non-fatal crashes. Crashes classed as hospital admission or presentation crashes on the basis of the severity of injury to the rider.

Source of BAC data	Hospital admission crashes	Presentation crashes	Total
Hospital records	50	10	60
STAR	23	6	29
TAS database	29	5	34
Total BAC values located	102	21	123
Missing BAC values	63	12	75
Total crashes	165	33	198

Procedures undertaken to locate BAC values

A three-stage procedure was undertaken to locate BAC data for non-fatal crashes. First, the Emergency Department records were searched at the time of interviewing the rider. If there was no BAC recorded at that time, then the records were searched again at the time of coding the rider's injuries from the medical record (after discharge).

If there was still no BAC value found, then Police records were examined. For crashes which occurred in 1996 (the majority), an attempt was made to identify the crash and the BAC in a MUARC copy of the State Traffic Accident Record (STAR) for 1996.

The results of comparison of crashes with STAR were:

- 30 crashes were unable to be located in STAR
- 29 BAC values were available
- 66 BAC values were missing (coded 999 in STAR).

The staff of the Traffic Alcohol Section (TAS) of the Victoria Police (at Brunswick) assisted in searching for BAC values missing from STAR and BAC values for crashes which occurred in 1995 or 1997. Three separate sources of information were examined: the alcohol records database (BAS), the manual record of arrival of blood screening samples and the TAIS computer database of accident reports (ADDS database - compiled from Form 510s).

The BAS database held information relating to the type of accident, date and time, the number of vehicles and the details of the persons involved. It also showed if a blood alcohol sample had been taken and whether this had produced a positive or negative reading. This information was obtained through entering the accident report number which is assigned by the Police Traffic Accident Information Service. In some instances where there was no accident number available it was possible to locate crashes through either a name, or the date of the accident and the number of vehicles involved. The BAS database provided BAC values for 34 of the crashes and showed that in five additional crashes no blood sample result was recorded.

The name of the rider for each missing BAC crash was also compared with the manual record of arrival of blood alcohol screening samples. The hard copy is used to log the arrival of blood sample information prior to being entered on the data base. This allowed a cross check that the information in the BAS database had been entered accurately.

Where the BAS and the manual record showed no evidence of a blood sample being taken, the name of the reporting officer was used to find the crash on the ADDS database. This file stated whether a preliminary breath test (PBT) was conducted at the scene by the attending police member.

The reasons why BAC values were missing are summarised in Table A2.3.

In 48 of the missing data cases the ADDS file stated that no PBT had been taken at the accident scene (see Table A2.3). This may have been because the police member considered that it was inappropriate to take a PBT due to the injuries of the person, or because the police attended after the person had been transported to hospital.

There were 20 missing BAC crashes which were unable to be found in any of the three Police files (see Table A2.3). The study interviews showed that 13 of these 20 crashes were single vehicle incidents. It is most likely that these 20 crashes were simply not reported to Police.

The remaining two missing BAC cases appear to have involved persons who submitted false names as the names of the riders obtained in the study and on the Police databases did not correspond.

Table A2.3. Summary of characteristics of missing BAC data.

Characteristics of missing BACs	Number of crashes
Crash located on ADDS database but....	
“no PBT taken”	48
“no PBT taken and no blood sample received”	5

Crash unable to be located on any Police database - likely to be unreported crash	20
Accident number found but name of rider did not correspond	2
Total	75

Hospital attended

The percentages of BAC values that were known for riders treated at each hospital are presented in Table A2.4. The availability of BAC data appeared to be similar for admissions and presentations. It should be noted, however, that numbers of presentations were small and so percentages of BAC known for presentations at some hospitals may not be reliable.

Table A2.4. Availability of BAC information for riders who were admitted to or presented to participating hospitals. Non-fatally injured riders only.

Hospital	Admissions		Presentations		Overall	
	Number of riders	Percent BAC known	Number of riders	Percent BAC known	Number of riders	Percent BAC known
Alfred	55	71	14	71	69	71
Dandenong	33	67	2	50	35	66
Box Hill	17	53	11	73	28	61
Monash Medical Centre	15	27	3	33	18	27
Royal Melbourne	16	69	0	-	16	69
Western	17	65	0	-	17	65
Mornington Peninsula	12	50	3	33	15	47
Overall	165	62	33	64	198	62

APPENDIX 3: COMPARISON OF CHARACTERISTICS OF NON-FATAL CRASHES WITH BAC KNOWN AND UNKNOWN

As noted in Appendix 2, rider BACs were known for all of the fatal crashes in the study but were unknown for more than one-third (75) of the non-fatal crashes. The tables which follow compare the characteristics of non-fatal crashes for which BAC was known and unknown.

Tables A3.1 and A3.2 show that there were no significant differences between non-fatal crashes with BAC known and those with BAC unknown in terms of crash characteristics, temporal pattern of occurrence, rider or motorcycle characteristics.

Table A3.1. Percentages of non-fatal crashes with BAC known and unknown according to crash and rider characteristics. Variables which were recorded for all crashes.

Variable	BAC known (n=122)	BAC unknown (n=75)
Type of crash		
single vehicle	30	40
multi-vehicle	70	60
		$\chi^2(1)=2.2$, $p>.05$
impact with object/vehicle	71	65
fell off - trying to avoid impact	4	1
loss of control	25	33
		$\chi^2(2)=2.6$, $p>.05$
Day of week		
Monday-Friday	70	71
Saturday-Sunday	30	29
		$\chi^2(1)<0.1$, $p>.05$
Time of crash		
midnight-6am	8	3
6am-noon	25	25
noon-6pm	42	41
6pm-midnight	25	31
		$\chi^2(3)=3.0$, $p>.05$
Type of helmet		
full face	78	83
open face	21	17
		$\chi^2(1)=1.1$, $p>.05$

Table A3.2. Percentages of non-fatal crashes with BAC known and unknown according to crash and rider characteristics. Those variables recorded for crashes with controls only.

Variable	BAC known (n=112)	BAC unknown (n=70)
Rider age		
under 25	36	39
25 to 34	34	36
35 and over	31	26
		$\chi^2(2)=0.5$, p>.05
Licence status		
unlicensed	6	6
learner	18	13
probationary	13	14
full licence	63	66
other	1	1
		$\chi^2(4)=1.0$, p>.05
Engine capacity (cc)		
less than 260	36	37
260 to 749	18	23
750 and over	46	40
		$\chi^2(2)=1.0$, p>.05

Tables A3.3 and A3.4 divide the crashes with BAC unknown into those in which the crash was reported to Police but no BAC value was recorded and those crashes with BAC missing which appear to have not been reported to Police. Crashes which were not reported to Police were more likely to be single vehicle crashes involving loss of control of the motorcycle. There was a trend for crashes which were not reported to be more likely to have unlicensed riders but this just failed to reach statistical significance (p=.08). None of the other crash, rider or motorcycle characteristics differed significantly between crashes which were not reported to Police and those which were reported but no BAC recorded.

Table A3.3. Percentages of non-fatal crashes with BAC known and unknown (crash reported but no BAC recorded or crash not reported) according to crash and rider characteristics. Variables which were recorded for all crashes.

Variable	BAC known (n=122)	BAC unknown: Crash reported, no BAC record (n=54)	BAC unknown: Crash not reported (n=21)
Type of crash			
single vehicle	30	32	62
multi-vehicle	70	69	38
			$\chi^2(1)=5.8$, $p<.05$
impact with object/vehicle	71	76	38
fell off - trying to avoid impact	4	0	5
loss of control	25	24	57
			$\chi^2(2)=10.8$, $p<.05$
Day of week			
Monday-Friday	70	69	76
Saturday-Sunday	30	31	24
			$\chi^2(1)=0.4$, $p>.05$
Time of crash			
midnight-6am	8	4	0
6am-noon	25	30	14
noon-6pm	42	41	43
6pm-midnight	25	26	43
			$\chi^2(3)=3.6$, $p>.05$
Type of helmet			
full face	78	87	72
open face	21	13	28
			$\chi^2(1)=2.1$, $p>.05$

Table A3.4. Percentages of non-fatal crashes with BAC known and unknown (crash reported but no BAC recorded or crash not reported) according to crash and rider characteristics. Variables which were recorded for crashes with controls only.

Variable	BAC known (n=112)	BAC unknown: Crash reported, no BAC record (n=50)	BAC unknown: Crash not reported (n=20)
Rider age			
under 25	36	42	25
25 to 34	34	34	45
35 and over	31	24	30
			$\chi^2(2)=1.8$, $p>.05$
Licence status			
unlicensed	6	0	15
learner	18	14	10
probationary	13	16	10
full licence	63	68	65
other	1	2	0
			$\chi^2(4)=8.5$, $p=.08$
Engine capacity (cc)			
less than 260	36	34	50
260 to 749	18	26	15
750 and over	46	40	35
			$\chi^2(2)=1.8$, $p>.05$

APPENDIX 4: MOTORCYCLE EXPOSURE DATA

Table A4.1. Motorcycle volumes as a function of type of road.

	Local	Collector	Secondary arterial	Primary arterial	Overall
Number of control sites	6	19	64	128	217
No. mcycles/hr					
Mean	2.22	1.23	3.01	4.05	3.44
SD	2.91	1.22	3.01	4.34	3.84
No. other vehicles/hr					
Mean	294.00	288.06	560.88	854.97	703.08
SD	133.36	247.44	508.90	728.73	657.84
Mcycles/all vehicles					
Proportion	0.0075	0.0043	0.0053	0.0047	0.0049

Table A4.2. Motorcycle volumes as a function of time period.

	Weekday day	Weekend day	Weekday night	Weekend night	Overall
Number of control sites	98	45	34	40	217
No. mcycles/hr					
Mean	4.44	3.59	1.51	2.48	3.44
SD	4.60	3.52	1.82	2.36	3.84
No. other vehicles/hr					
Mean	882.99	599.38	415.88	623.10	703.08
SD	747.69	582.89	479.22	506.44	657.84
Mcycles: other vehicles					
Proportion	0.0050	0.0059	0.0036	0.0040	0.0049

Statistical advice was obtained that estimation of the errors for the proportions was not possible using available software. Derivation of new formulas was considered to be beyond the scope of this project.

APPENDIX 5. RIDING STYLES AND STRATEGIES

OBSERVATIONAL AND MACHINE HANDLING SKILLS

Most important skills

Table A5.1. Percentages of inexperienced and experienced riders according to which skill they feel to be more important.

Most important skill	Inexperienced	Experienced	All riders
Scanning all around and a long way ahead	70	71	71
Advanced machine handling skills	14	14	14
Other	16	15	16

$\chi^2(2)=0.1$, $p>.05$

Table A5.2. Percentages of learner, probationary and fully-licensed riders according to which skill they feel to be more important.

Most important skill	Learner	Probationary	Full
Scanning all around and a long way ahead	79	72	69
Advanced machine handling skills	9	17	14
Other	12	10	17

$\chi^2(4)=2.6$, $p>.05$

Table A5.3. Percentages of riders of each age group according to which skill they feel to be more important.

Most important skill	Under 25	25 to 34	35 and over
Scanning all around and a long way ahead	67	70	74
Advanced machine handling skills	17	13	12
Other	16	17	14

$\chi^2(4)=1.4$, $p>.05$

Table A5.4. Percentages of riders with and without training according to which skill they feel to be more important.

Most important skill	With training	Without training
Scanning all around and a long way ahead	70	72
Advanced machine handling skills	23	14
Other	17	14

$\chi^2(2)=0.5$, $p>.05$

Looking behind over one shoulder

Table A5.5. Percentages of inexperienced and experienced riders according to how often they look behind over one shoulder.

Look behind over one shoulder	Inexperienced	Experienced	All riders
always	63	65	64
often	32	25	28
rarely	5	9	7
never	0	1	1

$\chi^2(3)=6.4$, $p>.05$

Table A5.6. Percentages of learner, probationary and fully licensed riders according to how often they look behind over one shoulder.

Look behind over one shoulder	Learner	Probationary	Full licence
always	62	76	63
often	38	24	28
rarely	0	0	9
never	0	0	1

$\chi^2(6)=8.0$, $p>.05$

Table A5.7. Percentages of riders of each age group according to how often they look behind over one shoulder.

Look behind over one shoulder	Under 25	25 to 34	35 and over
always	70	67	57
often	29	29	27
rarely	1	3	15
never	0	1	1

$\chi^2(6)=21.7$, $p<.05$

Table A5.8. Percentages of riders with and without training according to how often they look behind over one shoulder.

Look behind over one shoulder	With training	Without training
always	69	59
often	27	29
rarely	3	11
never	1	1

$\chi^2(3)=10.1$, $p<.05$

Approaching curves

Table A5.9. Percentages of inexperienced and experienced riders according to how often they change road position to maximise view on approaching curves.

Change road position	Inexperienced	Experienced	All riders
always	55	62	59
often	37	29	32
rarely	7	7	7
never	1	2	2

$\chi^2(3)=3.2$, $p>.05$

Table A5.10. Percentages of learner, probationary and fully licensed riders according to how often they change road position to maximise view on approaching curves.

Change road position	Learner	Probationary	Full licence
always	56	68	60
often	38	29	31
rarely	6	4	7
never	0	0	2

$\chi^2(6)=2.6$, $p>.05$

Table A5.11. Percentages of riders of each age group according to how often they change road position to maximise view on approaching curves.

Change road position	Under 25	25 to 34	35 and over
always	59	63	53
often	36	27	38
rarely	3	9	7
never	1	1	2

$\chi^2(6)=7.9$, $p>.05$

Table A5.12. Percentages of riders with and without training according to how often they change road position to maximise view on approaching curves.

Change road position	With training	Without training
always	63	55
often	31	34
rarely	6	8
never	1	3

$\chi^2(3)=4.7$, $p>.05$

Approaching intersections

Table A5.13. Percentages of inexperienced and experienced riders who take each of the following measures when approaching intersections.

When approaching intersections...	Inexperienced	Experienced	All riders
scan all around	99	98	98
scan behind	77	77	77
cover brake	86	88	87
decrease speed	90	81	85
change down a gear	69	70	69
change position for increased visibility	80	82	81
establish eye contact with other drivers	74	76	75
consider road surface and available space for braking and swerving	97	97	97

decrease speed $\chi^2(1)=5.2$, $p<.05$

Table A5.14. Percentages of learner, probationary and fully licensed riders who take each of the following measures when approaching intersections.

When approaching intersections...	Learner	Probationary	Full
scan all around	100	93	99
scan behind	71	69	78
cover brake	79	86	87
decrease speed	91	79	84
change down a gear	79	59	69
change position for increased visibility	82	79	81
establish eye contact with other drivers	79	79	74
consider road surface and available space for braking and swerving	97	100	96

Table A5.15. Percentages of riders of each age group who take each of the following measures when approaching intersections.

When approaching intersections...	Under 25	25 to 34	35 and over
scan all around	97	98	99
scan behind	70	76	82
cover brake	81	89	86
decrease speed	87	84	85
change down a gear	79	65	70
change position for increased visibility	79	84	78
establish eye contact with other drivers	80	74	74
consider road surface and available space for braking and swerving	97	95	99

Table A5.16. Percentages of riders with and without training who take each of the following measures when approaching intersections.

When approaching intersections...	With training	Without training
scan all around	100	97
scan behind	78	76
cover brake	84	89
decrease speed	87	83
change down a gear	66	72
change position for increased visibility	90	72
establish eye contact with other drivers	76	75
consider road surface and available space for braking and swerving	97	97

change position for increased visibility $\chi^2(1)=18.6$, $p<.05$

POSITIONING ON THE ROADWAY

Normal position in the travelling lane

Table A5.17. Percentages of inexperienced and experienced riders according to which position in the travelling lane normally occupied.

Position	Inexperienced	Experienced	All riders
Left hand wheel track	6	9	7
Right hand wheel track	77	73	75
Centre of the lane	18	18	18

$\chi^2(2)=1.5$, $p>.05$

Table A5.18. Percentages of learner, probationary and fully-licensed riders according to which position in the travelling lane normally occupied.

Position	Learner	Probationary	Full
Left hand wheel track	3	0	8
Right hand wheel track	77	82	74
Centre of the lane	19	19	18

$\chi^2(4)=3.2$, $p>.05$

Table A5.19. Percentages of riders of each age group according to which position in the travelling lane normally occupied.

Position	Under 25	25 to 34	35 and over
Left hand wheel track	3	9	8
Right hand wheel track	82	77	66
Centre of the lane	15	14	26

$\chi^2(4)=9.8$, $p<.05$

Table A5.20. Percentages of riders with and without training according to which position in the travelling lane normally occupied.

Position	With training	Without training
Left hand wheel track	6	9
Right hand wheel track	81	67
Centre of the lane	13	24

$\chi^2(2)=9.4$, $p<.05$

Lane choice on a freeway

Table A5.21. Percentages of inexperienced and experienced riders according to lane normally occupy on freeway.

Lane	Inexperienced	Experienced	All riders
Left	39	31	34
Centre	27	27	27
Right	12	17	15
Mixture	23	26	24

$\chi^2(3)=3.6$, $p>.05$

Table A5.22. Percentages of learner, probationary and fully-licensed riders according to lane normally occupy on freeway.

Lane	Learner	Probationary	Full
Left	42	38	33
Centre	24	21	28
Right	6	24	15
Mixture	27	17	25

$\chi^2(6)=5.5$, $p>.05$

Table A5.23. Percentages of riders of each age group according to lane normally occupy on freeway.

Lane	Under 25	25 to 34	35 and over
Left	36	29	41
Centre	26	29	25
Right	13	17	12
Mixture	25	26	22

$\chi^2(6)=5.4$, $p>.05$

Table A5.24. Percentages of riders with and without training according to lane normally occupy on freeway.

Lane	With training	Without training
Left	30	38
Centre	28	26
Right	14	16
Mixture	28	20

$\chi^2(3)=4.5$, $p>.05$

INTERACTIONS WITH OTHER VEHICLES

Following distance

Table A5.25. Percentages of inexperienced and experienced riders according to how far behind other vehicles they usually travel.

Usual gap	Inexperienced	Experienced	All riders
Less than 2 seconds	16	24	20
More than 2 seconds	42	31	36
Maintaining 2 second gap	42	45	44

$\chi^2(2)=6.2$, $p<.05$

Table A5.26. Percentages of learner, probationary and fully-licensed riders according to how far behind other vehicles they usually travel.

Usual gap	Learner	Probationary	Full
Less than 2 seconds	12	32	20
More than 2 seconds	52	25	35
Maintaining 2 second gap	36	43	45

$\chi^2(4)=6.7$, $p>.05$

Table A5.27. Percentages of riders of each age group according to how far behind other vehicles they usually travel.

Usual gap	Under 25	25 to 34	35 and over
Less than 2 seconds	16	27	13
More than 2 seconds	30	32	44
Maintaining 2 second gap	54	40	43

$\chi^2(4)=13.5$, $p<.05$

Table A5.28. Percentages of riders with and without training according to how far behind other vehicles they usually travel.

Usual gap	With training	Without training
Less than 2 seconds	22	18
More than 2 seconds	32	39
Maintaining 2 second gap	45	43

$\chi^2(2)=2.0$, $p>.05$

Response to tailgating

Table A5.29. Percentages of inexperienced and experienced riders according to their response to tailgating.

Response to tailgating	Inexperienced	Experienced	All riders
speed up	24	31	28
slow down	23	22	23
maintain speed	30	26	28
flash brake light	27	31	29
move out of the way	53	55	54
do nothing	2	6	4
other	10	14	12

Table A5.30. Percentages of learner, probationary and fully-licensed riders according to their response to tailgating.

Response to tailgating	Learner	Probationary	Full
speed up	9	24	31
slow down	35	31	21
maintain speed	32	24	28
flash brake light	24	21	31
move out of the way	50	55	54
do nothing	0	0	5
other	9	17	12

speed up $\chi^2(2)=7.5$, $p<.05$

Table A5.31. Percentages of riders of each age group according to their response to tailgating.

Response to tailgating	Under 25	25 to 34	35 and over
speed up	20	27	33
slow down	28	23	20
maintain speed	22	27	33
flash brake light	33	29	27
move out of the way	49	51	59
do nothing	4	3	6
other	12	13	11

none of the above statistically significant

Table A5.32. Percentages of riders with and without training according to their response to tailgating.

Response to tailgating	With training	Without training
speed up	22	34
slow down	24	22
maintain speed	32	24
flash brake light	27	31
move out of the way	56	52
do nothing	3	6
other	13	11

speed up $\chi^2(1)=7.4$, $p<.05$

Flashing the headlight

Table A5.33. Percentages of inexperienced and experienced riders according to how often they flash their headlight to warn others of their presence.

How often flash headlight....	Inexperienced	Experienced	All riders
always	1	2	1
often	9	14	11
rarely	41	42	41
never	50	43	46

$\chi^2(3)=4.1$, $p>.05$

Table A5.34. Percentages of learner, probationary and fully-licensed riders according to how often they flash their headlight to warn others of their presence.

How often flash headlight....	Learner	Probationary	Full
always	0	0	2
often	6	0	13
rarely	32	48	41
never	62	52	44

$\chi^2(6)=9.3$, $p>.05$

Table A5.35. Percentages of riders in each age group according to how often they flash their headlight to warn others of their presence.

How often flash headlight....	Under 25	25 to 34	35 and over
always	1	2	1
often	13	10	13
rarely	40	42	42
never	46	47	45

$\chi^2(6)=1.3$, $p>.05$

Table A5.36. Percentages of riders with and without training according to how often they flash their headlight to warn others of their presence.

How often flash headlight....	With training	Without training
always	1	2
often	11	12
rarely	44	39
never	45	47

$\chi^2(3)=2.5$, $p>.05$

Using the horn

Table A5.37. Percentages of inexperienced and experienced riders according to how often they use the horn to warn others of their presence.

How often use horn....	Inexperienced	Experienced	All riders
always	3	12	8
often	22	21	21
rarely	39	44	42
never	37	23	29

$\chi^2(3)=16.5$, $p<.05$

Table A5.38. Percentages of learner, probationary and fully-licensed riders according to how often they use the horn to warn others of their presence.

How often use horn....	Learner	Probationary	Full
always	6	0	9
often	24	17	21
rarely	35	41	42
never	35	41	28

$\chi^2(6)=5.3$, $p>.05$

Table A5.39. Percentages of riders in each age group according to how often they use the horn to warn others of their presence.

How often use horn....	Under 25	25 to 34	35 and over
always	9	10	4
often	26	22	18
rarely	36	41	46
never	30	27	32

$\chi^2(6)=7.0$, $p>.05$

Table A5.40. Percentages of riders with and without training according to how often they use the horn to warn others of their presence.

How often use horn....	With training	Without training
always	8	8
often	24	18
rarely	41	43
never	28	31

$\chi^2(3)=1.8$, $p>.05$

DEALING WITH EMERGENCY SITUATIONS

Near misses in the last month

Table A5.41. Percentages of inexperienced and experienced riders according to the number of near misses usually experienced per month.

Usual number of near misses	Inexperienced	Experienced	All riders
None	35	19	26
One	20	26	24
Two or three	21	25	23
More than three	24	30	27

$\chi^2(3)=13.2$, $p<.05$

Table A5.42. Percentages of learner, probationary and fully-licensed riders according to the number of near misses usually experienced per month.

Usual number of near misses	Learner	Probationary	Full
None	29	10	27
One	29	31	22
Two or three	27	24	23
More than three	15	35	28

$\chi^2(6)=7.4$, $p>.05$

Table A5.43. Percentages of riders of each age group according to the number of near misses usually experienced per month.

Usual number of near misses	Under 25	25 to 34	35 and over
None	17	23	36
One	24	25	21
Two or three	20	26	19
More than three	39	25	24

$\chi^2(6)=13.4$, $p<.05$

Table A5.44. Percentages of riders with and without training according to the number of near misses usually experienced per month.

Usual number of near misses	With training	Without training
None	26	26
One	23	25
Two or three	26	19
More than three	25	30

$\chi^2(3)=3.2$, $p>.05$

Near misses on the last trip

Table A5.45. Percentages of riders who experienced any near misses on the last trip they made.

Types of riders	Percent	Probability
All riders	12	
Inexperienced riders	9	
Experienced riders	15	$\chi^2(1)=3.4$, $p>.05$
Learner	9	
Probationary	4	
Full	13	$\chi^2(2)=2.5$, $p>.05$
Under 25	7	
25 to 34	14	
35 and over	12	$\chi^2(2)=2.4$, $p>.05$
At least one training course	11	
No training courses	14	$\chi^2(1)=0.7$, $p>.05$

Practising crash avoidance skills

Table A5.46. Percentages of riders who practised emergency braking in the last six months.

Types of riders	Percent	Probability
All riders	58	
Inexperienced riders	68	
Experienced riders	49	$\chi^2(1)=13.9$, $p<.05$
Learner	85	
Probationary	86	
Full	52	$\chi^2(2)=24.9$, $p<.05$
Under 25	74	
25 to 34	60	
35 and over	46	$\chi^2(2)=15.7$, $p<.05$
At least one training course	68	
No training courses	47	$\chi^2(1)=17.2$, $p<.05$

Table A5.47. Percentages of riders who practised counter-steering in the last six months.

Types of riders	Percent	Probability
All riders	67	
Inexperienced riders	75	
Experienced riders	60	$\chi^2(1)=10.0$, $p<.05$
Learner	71	
Probationary	90	
Full	64	$\chi^2(2)=8.1$, $p<.05$
Under 25	76	
25 to 34	70	
35 and over	57	$\chi^2(2)=8.9$, $p<.05$
At least one training course	74	
No training courses	59	$\chi^2(1)=10.2$, $p<.05$

Table A5.48. Percentages of inexperienced and experienced riders according to when they feel confident using the front brake hard in an emergency situation.

When feel confident.....	Inexperienced	Experienced	All riders
At any time	69	73	71
Only in dry, perfect conditions	26	20	23
Never	5	7	6

$\chi^2(2)=2.1$, $p>.05$

Table A5.49. Percentages of learner, probationary and fully-licensed riders according to when they feel confident using the front brake hard in an emergency situation.

When feel confident.....	Learner	Probationary	Full
At any time	62	66	73
Only in dry, perfect conditions	27	31	21
Never	12	3	6

$\chi^2(4)=4.4$, $p>.05$

Table A5.50. Percentages of riders of each age group according to when they feel confident using the front brake hard in an emergency situation.

When feel confident.....	Under 25	25 to 34	35 and over
At any time	64	76	68
Only in dry, perfect conditions	31	19	23
Never	4	5	9

$\chi^2(4)=6.8$, $p>.05$

Table A5.51. Percentages of riders with and without training according to when they feel confident using the front brake hard in an emergency situation.

When feel confident.....	With training	Without training
At any time	70	72
Only in dry, perfect conditions	26	20
Never	4	8

$\chi^2(2)=3.9$, $p>.05$

Table A5.52. Percentages of inexperienced and experienced riders according to when they feel confident performing a sudden swerve in an emergency situation.

When feel confident.....	Inexperienced	Experienced	All riders
At any time	64	71	68
Only in dry, perfect conditions	29	25	27
Never	7	5	6

$\chi^2(2)=2.2$, $p>.05$

Table A5.53. Percentages of learner, probationary and fully-licensed riders according to when they feel confident performing a sudden swerve in an emergency situation.

When feel confident.....	Learner	Probationary	Full
At any time	38	79	70
Only in dry, perfect conditions	47	17	25
Never	15	3	5

$\chi^2(4)=17.5$, $p<.05$

Table A5.54. Percentages of riders of each age group according to when they feel confident performing a sudden swerve in an emergency situation.

When feel confident.....	Under 25	25 to 34	35 and over
At any time	63	70	65
Only in dry, perfect conditions	33	24	28
Never	4	6	7

$\chi^2(4)=2.7$, $p>.05$

Table A5.55. Percentages of riders with and without training according to when they feel confident performing a sudden swerve in an emergency situation.

When feel confident.....	With training	Without training
At any time	67	68
Only in dry, perfect conditions	27	26
Never	6	5

$\chi^2(2)=0.2$, $p>.05$

USEFULNESS OF TRAINING

How often use braking skills learnt in training

Table A5.56. Percentages of inexperienced and experienced riders according to how often they use braking skills learnt in training.

Use braking skills..	Inexperienced	Experienced	All riders
always	76	70	73
often	22	24	23
rarely	2	6	4
never	0	0	

$\chi^2(2)=1.9$, $p>.05$

Table A5.57. Percentages of learner, probationary and fully-licensed riders according to how often they use braking skills learnt in training.

Use braking skills..	Learner	Probationary	Full
always	74	79	73
often	26	21	22
rarely	0	0	5
never	0	0	0

$\chi^2(4)=2.3$, $p>.05$

Table A5.58. Percentages of riders in each age group according to how often they use braking skills learnt in training.

Use braking skills..	Under 25	25 to 34	35 and over
always	69	69	86
often	29	27	10
rarely	2	4	4
never	0	0	0

$\chi^2(4)=7.0$, $p>.05$

How often use cornering skills learnt in training

Table A5.59. Percentages of inexperienced and experienced riders according to how often they use cornering skills learnt in training.

Use cornering skills....	Inexperienced	Experienced	All riders
always	75	63	69
often	21	26	24
rarely	3	8	5
never	1	3	2

$\chi^2(3)=4.7$, $p>.05$

Table A5.60. Percentages of learner, probationary and fully-licensed riders according to how often they use cornering skills learnt in training.

Use cornering skills..	Learner	Probationary	Full
always	77	68	69
often	18	26	23
rarely	5	0	6
never	0	5	2

$\chi^2(6)=3.1$, $p>.05$

Table A5.61. Percentages of riders in each age group according to how often they use cornering skills learnt in training.

Use cornering skills..	Under 25	25 to 34	35 and over
always	60	67	80
often	38	20	18
rarely	2	9	0
never	0	3	2

$\chi^2(6)=14.0$, $p<.05$

How often use collision avoidance skills learnt in training

Table A5.62. Percentages of inexperienced and experienced riders according to how often they use collision avoidance skills learnt in training.

Use collision avoidance skills....	Inexperienced	Experienced	All riders
always	67	57	62
often	20	26	23
rarely	8	14	11
never	4	2	3

$\chi^2(3)=3.6$, $p>.05$

Table A5.63. Percentages of learner, probationary and fully-licensed riders according to how often they use collision avoidance skills learnt in training.

Use collision avoidance skills..	Learner	Probationary	Full
always	77	84	58
often	9	11	26
rarely	9	5	12
never	5	0	4

$\chi^2(6)=7.9$, $p>.05$

Table A5.64. Percentages of riders in each age group according to how often they use collision avoidance skills learnt in training.

Use collision avoidance skills..	Under 25	25 to 34	35 and over
always	61	64	61
often	15	25	28
rarely	22	7	10
never	2	4	2

$\chi^2(6)=8.3$, $p>.05$