



Motor vehicle traffic crashes involving Maori

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Abstract

Aims To provide a descriptive epidemiology of fatal and non-fatal motor vehicle traffic (MVT) crashes involving Maori (1980–1994 inclusive) and to describe factors associated with those crashes.

Methods A data set for 1980–1994 was created by linking: (1) the New Zealand Police traffic crash reports (providing crash details), and (2) the New Zealand Health Information Services (NZHIS) hospital inpatient and mortality files (providing ethnicity, other demographic and injury details).

Results The linked data set contained 8178 MVT crash events involving 8273 vehicles/drivers in which there were 9288 Maori casualties. Findings showed 82% of Maori casualties were aged less than 34 years and 70% were male. Nearly 30% were car drivers, 32% passengers, 15% motorcyclists and 12% pedestrians. Most crashes occurred in fine weather (82%), on a sealed (98%), two-way (97%) road, in or near an urban area (62%). The largest proportion (44%) of crashes occurred between 5pm and midnight and the most common days of the week on which they occurred were Saturday (21%) and Friday (19%). The most common type of crash was 'loss of control' on a corner (27%) or a straight road (13%).

Conclusions Motor vehicle traffic crashes are a major cause of mortality and morbidity for Maori. Future research, and the development of strategies to prevent traffic-related injury among Maori, would be facilitated by the inclusion of an ethnicity indicator on the traffic crash reports, and the collection of more comprehensive crash data on safety measures, such as occupant protection and driver-licence status.

Motor vehicle traffic (MVT) crashes are a leading cause of injury mortality and hospitalisation among Maori, particularly young Maori.^{1,2} Despite this, there has been little research identifying factors associated with crashes involving Maori with a subsequent paucity of information to develop effective strategies aimed at reducing Maori mortality and morbidity related to motor vehicle crashes.

An important factor contributing to this lack of information is difficulty in obtaining data by ethnicity. Police traffic crash reports incorporate details about the crash and are required for all crashes involving injury, but these reports have not included ethnicity. The New Zealand Health Information Services (NZHIS) mortality and hospitalisation databases do record ethnicity. Thus, the linking of records on the traffic crash report database (crash details), to the NZHIS fatality and hospitalisation records for those people with injuries related to motor vehicle crashes (termed 'casualties') provides one means of identifying crashes by ethnicity. Variables common to both databases are the names and some personal details (eg, date of birth) of crash victims. The feasibility of using these variables to electronically link the

NZHIS records and the police traffic crash reports has been investigated, and a satisfactory level of linkage achieved.³ This procedure has been used for creating a database for other research studies,⁴ and was used for the present study.

The aim of this research was to undertake a Maori-focused analysis of factors associated with MVT crashes involving Maori. This paper describes selected demographic characteristics of Maori injured in MVT crashes (between 1980 and 1994), details of injuries sustained, and environmental factors associated with the crashes.

Methods

The database used for this research was created by linking the New Zealand Police traffic crash reports (TCRs) to the New Zealand Health Information Services (NZHIS) hospital inpatient and mortality files for the years 1980 to 1994. MVT crash casualties were identified from the NZHIS data using the External Cause of Injury codes, E810–819.⁵ Maori were identified using the ethnicity indicator contained on this file. The NZHIS records and TCRs were linked using Automatch.⁶ A full description of the linkage procedure has been provided elsewhere.³

To examine whether the linked database was representative of the original NZHIS data, several comparisons were made. For the fatalities a comparison of the number of linked records with the number of original NZHIS fatality records showed that the linkage rate ranged from 75–100%. Linkage of the non-fatal crashes was not expected to be as high as for fatalities because of the under-reporting of non-fatal crashes to the police.³ Also, in the earlier years of this study, the names of casualties were not recorded on TCRs thus making linkage very difficult. An inspection of the linkage rate for non-fatal casualties showed that for some of the earlier years as few as 10% of the hospital records were linked to a TCR. For the later years, when full names were recorded, this increased to 56%. Despite the low linkage rates, the distributions by gender and road-user status of the cases included in the linked database were very similar to those in the original hospital database. For example: 68% of the original file and 69% on the linked file were male; 24% versus 28% were vehicle drivers; 32% versus 32% passengers; 17% versus 15% motorcycle drivers; 3% versus 2% were pillion passengers; and 11% versus 11% were pedestrians.

The NZHIS data included an ethnicity indicator, other demographic data (age, gender, domicile) and information on the nature and type of injury sustained by non-fatal casualties. The severity of the primary injury was scored according to the Abbreviated Injury Scale (AIS),⁷ which is a six-point scale of anatomical threat to life ranging from minor (1) to virtually unsurvivable (6). Scores were derived for the period 1988–1994 using ICDMAP-90.⁸ Prior to 1988 injury diagnosis coding was not in a format that allowed mapping to AIS.

Information on occupant protection (eg, child restraints, seatbelts, and helmets) was available for the years 1980–87 only, because the recording of these data on the TCRs was discontinued after 1987. Deprivation scores were calculated from the domicile information (place of residence) contained on the NZHIS file, which was matched to the NZDep91.⁹ The NZDep91 is an index of deprivation calculated by combining census data including income, transport, living space, home ownership and employment. Deprivation scores were calculated for casualties between 1989 and 1993 only (two years either side of the index year of 1991).

In this study 'casualties' refers to both fatal and non-fatal injury outcomes, and the casualty factors examined were considered separately for fatal and non-fatal crash victims.

Results

From 1980 to 1994, there were 8178 crash events involving 9288 Maori casualties, 1240 (13%) of whom were fatally injured. The distribution of the casualties by age and gender, by crash outcome, is given in Table 1, and shows the highest proportion of casualties (both fatal and non-fatal) were aged 15–24 years and almost 70% were male.

Table 1. Demographic characteristics of fatal and non-fatal Maori casualties in motor vehicle traffic crashes, 1980–94

	Fatal		Non-fatal		Both	
	n	%	n	%	n	%
Age						
0–14	1315	16.3	139	11.2	1454	15.7
15–24	3633	45.1	477	38.5	4110	44.3
25–34	1784	22.2	288	23.2	2072	22.3
35–44	669	8.3	140	11.3	809	8.7
45–54	347	4.3	83	6.7	430	4.6
55–64	206	2.6	64	5.2	270	2.9
65–74	76	1.0	31	2.5	107	1.2
75+	18	0.2	18	1.5	36	0.4
Total	8048	100.0	1240	100.0	9288	100.0
Gender						
Female	2462	30.6	353	28.5	2815	30.3
Male	5586	69.4	887	71.5	6473	69.7
Total	8048	100.0	1240	100.0	9288	100.0

The relative deprivation distribution (the deprivation scores (deciles) based on the NZDep91 for the casualties in the years 1989–1993) is shown in Table 2. There was a higher proportion of casualties living in areas of higher relative deprivation, with 44% of the non-fatal and 40% of the fatal casualties in the group having a decile score of 9–10.

Table 2. Distribution of deprivation scores (NZDep91) for fatal and non-fatal Maori casualties in motor vehicle traffic crashes, 1989–1993*

NZDep91 decile score	Fatal		Non-fatal		Both	
	n	%	n	%	n	%
0 (missing)	27	0.8	2	0.5	29	0.7
1–2	130	3.7	10	2.2	140	3.4
3–4	354	9.9	42	9.4	396	9.8
5–6	570	15.9	85	19	655	16.3
7–8	937	26.2	131	29.3	1068	26.6
9–10	1559	43.6	177	39.6	1736	43.1
Total	3577	100.0	447	100.0	4024	100.0

*two years either side of the index year of 1991

The injury diagnoses for the primary injury, sustained by those with non-fatal injuries, are given in Table 3. Head injuries were the most common injury (35%). The severity of the injuries assessed using the Abbreviated Injury Scale (AIS) showed that 46% were serious/moderate and, in the acute phase of treatment, 28% of casualties with non-fatal injuries spent more than a week in hospital.

Table 3. Primary injury diagnosis, injury severity and length of stay in hospital for Maori casualties in motor vehicle traffic crashes, non-fatal injuries only

Diagnosis	n	%
Intracranial injury	2187	27.2
Skull fracture	620	7.7
Fracture – lower limb	1328	16.5
Fracture – neck/trunk	735	9.1
Fracture – upper limb	494	6.1
Open wound – neck, head, trunk	756	9.4
Open wound – lower/upper limb	376	4.7
Internal – chest, abdomen, pelvis	505	6.3
Contusions	464	5.8
Other	583	7.2
Total	8048	100.0
Injury severity (AIS scores)	n	%
1 Minor	1200	24.4
2 Moderate	1687	34.3
3 Serious	570	11.6
4 Severe	90	1.8
5 Critical	20	0.4
6 Maximum	5	0.1
9 Unknown	1346	27.4
Total	*4918	100.0
Number of days in hospital	Frequency	%
0	656	8.2
1–2	3054	37.9
3–4	1165	14.4
5–7	917	11.4
8–14	999	12.4
15–21	402	5.0
22+	855	10.6
Total	8048	99.9

*includes injuries from 1988–1994

An examination of the distribution of casualties by road-user status (Table 4) shows that of the fatal casualties 31% were passengers, 37% drivers, 12% motorcycle drivers, and 14% pedestrians. The distribution was similar for non-fatal casualties.

Table 4. Road-user status of Maori casualties in motor vehicle traffic crashes, 1980–94, by crash severity

Road-user status	Non-fatal		Fatal		Both	
	n	%	n	%	n	%
Passenger in motor vehicle*	2547	31.6	386	31.1	2933	31.6
Driver of motor vehicle*	2273	28.2	463	37.3	2736	29.5
Motorcyclist (driver)	1240	15.4	148	11.9	1388	14.9
Motorcyclist (pillion)	188	2.3	19	1.5	207	2.2
Pedestrian	904	11.2	173	14.0	1077	11.6
Bicyclist	252	3.1	35	2.8	287	3.1
Unspecified/other	644	8.0	16	1.3	660	7.0
Total	8048	100.0	1240	100.0	9288	100.0

*other than a motorcycle

Safety protection data for the period 1980–87 showed that protection (a seatbelt or crash helmet) was used by 17% of the fatally injured and 35% of the non-fatally injured casualties, but these data were missing for 45% and 37% of the fatal and non-fatal casualties, respectively.

The environmental conditions associated with the crash events are summarised in Table 5, and show that 82% occurred in fine weather, 98% on a sealed road, and 62% in or near an urban area.

Table 5. Environmental conditions associated with motor vehicle traffic crash events involving at least one Maori casualty, 1980–94

	*n	%
Weather conditions		
Fine	6684	81.7
Heavy rain	267	3.3
Light rain	1072	13.1
Other (eg, mist, snow)	155	1.9
Light conditions		
Bright sun	2249	27.5
Dark	3793	46.4
Overcast	1742	21.3
Twilight	369	4.5
Missing	25	0.3
Road surface		
Sealed	7975	97.5
Unsealed	203	2.5
Road lanes		
One way	169	2.1
Two way	7903	96.6
Other	106	1.3
Road characteristics		
Flat road	6003	73.4
Hill road	1767	21.6
Bridge/bridge approach	270	3.3
Railway crossing	31	0.4
Other	107	1.3
Road markings		
Centre line	5370	65.7
Centre island	734	9.0
No passing line	514	6.3
Pedestrian crossing	100	1.2
None	1427	17.5
Other	33	0.4
Speed limit		
Urban (50–60 kph)	4051	49.5
Open road (100 kph)	3064	37.5
City outskirts (70–80 kph)	986	12.1
Road works (30 kph)	73	0.9
Other	4	0.1

*total n = 8178

The distribution of crash events by month of the year was relatively even, ranging from 7.3% crashes occurring in February to 9.7% in December. This suggests very little seasonal influence on crash occurrence. Table 6 presents the distribution of crashes by day of the week and time of day. Most crashes occurred between Thursday and Sunday, and the most common times of day in which crashes occurred were between 5pm and midnight (44%), and midday and 5pm (25%).

Table 6. Time of day and day of week for motor vehicle traffic crash events involving Maori, 1980–94

	n	%
Day of week		
Sunday	1247	15
Monday	711	9
Tuesday	821	10
Wednesday	867	11
Thursday	1305	16
Friday	1519	19
Saturday	1682	21
Total	*8152	100
Time of day		
12.00–4.59am	1131	14
5.00–11.59am	1382	17
12.00–4.59pm	2031	25
5.00–11.59pm	3608	44
Total	*8152	100

*data missing for 26 crash events

Table 7 shows that 40% of crashes were due to loss of control; 27% occurred while cornering and 13% on a straight road. Approximately 11% were head-on collisions and nearly 12% involved a pedestrian.

Table 7. Crash classification based on the movement of the vehicles involved in the crash event, for motor vehicle traffic crashes involving Maori, 1980–94

Movement classification	n	%
Loss of control – cornering	2214	27.1
Loss of control – straight road	1051	12.9
Pedestrian	949	11.6
Head on	933	11.4
Right turn against traffic	443	5.4
Straight ahead, other vehicle turning	379	4.6
Vehicles crossing – no turns	433	5.3
Vehicles crossing – vehicle turning	376	4.6
Collision with an obstruction	388	4.7
Overtaking and lane change	341	4.2
Rear end	216	2.6
Merging or manoeuvring	341	4.2
Other	114	1.4
Total	8178	100.0

Discussion

This research provides a profile of Maori casualties (ie, Maori who were hospitalised or who died) as a result of motor vehicle injury, as drivers, passengers, bicyclists, or pedestrians. Until recently much of the available information on traffic crashes involving Maori has been based on anecdotal evidence or unpublished data¹⁰ because it has not been possible to identify Maori in the official New Zealand traffic crash database. This research aimed to fill some gaps in our knowledge about motor vehicle crashes involving Maori.

Young age was an important risk factor with two thirds of Maori casualties aged between 15 and 34 years. Rangatahi (young adults) in the 15–24 age group were particularly over-represented (45% of the non-fatal casualties and 39% of the fatalities). Given this age group makes up approximately 21% of the Maori population,¹¹ the results of this study emphasise the significant burden to the health of young Maori created by death and injury due to motor vehicle crashes.

This research showed that head injuries were incurred by around 35% of the Maori casualties admitted to hospital, followed by fractures of the lower limb, neck and trunk. Long-term disability resulting from injuries not only impacts on the individual but also on carers and whanau, and the short- and long-term consequences of injury for those who survive provide further important motivation for prevention. Durie has commented that the effect of injury to rangatahi is accentuated by the loss of the benefits that can flow from competent, healthy and skilled whanau members.¹² Thus, the provision of appropriate and accessible rehabilitation services, and the ongoing monitoring and evaluation of their effectiveness, is an important part of achieving Maori health gains in injury, alongside effective preventive measures.

Demographically, the over-representation of males is consistent with other research.¹³ Alongside being young and male, a high proportion (70%) of Maori casualties were from areas with high levels of deprivation (deciles 7–10). This finding is consistent with international research,^{14,15} and highlights the need to further explore the association between the social and economic determinants of health in relation to injury and motor vehicle traffic crashes.

The use of seatbelts in cars and helmets by motorcyclists has been shown to be associated with decreased levels of injury.¹⁶ This was not fully described in the present research as from 1987 onwards these data were no longer recorded in the traffic crash reports. The monitoring of restraint use is undertaken by way of observational surveys. These surveys are limited as certain characteristics of the occupants, including ethnicity, can not be determined by observation alone. This has left an important gap in information about safety protection that would be helpful for setting road safety targets relevant for Maori.

Analysis of the environmental issues highlights the fact that the majority of crashes involving Maori occurred on two-way, sealed roads that were either in a city or on the outskirts of a city. Given that by 1996 more than 80% of Maori lived in urban settings,¹¹ it would be expected that much of the driving done by Maori would be in or near a city and these results support this. The finding that many of the crashes occurred at night-time during the weekend is consistent with crashes involving young

people. Also, many of the crashes occurred because the driver lost control of the vehicle, 27% on a corner and 13% on a straight road. This too is consistent with crashes involving young, male drivers. Without further investigation of the factors associated with crashes involving rangatahi it is possible only to speculate about the likely relationship between many of these factors.

Limitations must be considered. First, limitations in this study relate to the accuracy of the ethnicity data within the NZHIS data set. There is the potential to underestimate Maori casualties due to under-reporting of Maori ethnicity on the hospital and mortality databases in the years for which these data were collected. Previous research has shown that Maori ethnicity has been underestimated in hospital inpatients by around 30%.¹⁷ Similarly, under-reporting of Maori in the mortality database has led to underestimation of Maori deaths.¹⁸ The issue of recording ethnicity data on the traffic crash reports has been raised in the 2010 Road Safety Strategy consultation document, with the proposal that guidelines would be developed to standardise the collection of these data.¹⁹

A further limitation of using the linked data set was that trends in crash rates over time could not be examined. In this study the variation in linkage rates from the earlier to the later years meant that the number of cases per year varied greatly over time and this may have been due solely to the linkage process and not fluctuations in the incidence of traffic crashes.

Despite these limitations, this research provides useful information for developing strategies for prevention of road traffic injury among Maori. It reinforces a need for research into rehabilitation and support services for Maori injured as the result of motor vehicle crashes. This paper also highlights the importance of road traffic crashes as a health issue for young Maori males, and reinforces the need for consistent and accurate ethnicity data across all relevant databases.

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