

Crash related risks in New Zealand 1989-90 and 1997-98

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Abstract

Large-scale personal interview travel surveys were carried out in New Zealand in 1989/90 and 1997/98. The surveys are unique in that self-reported details were taken of drivers' drinking behaviour to enable estimation of driving after drinking. Between the two surveys, the road toll in New Zealand fell considerably, against a background of continuing traffic growth. Using travel estimates generated by the two surveys, matched with crash data, the changing risks for various road users over the intervening eight-year period are discussed. There has been a large decrease in motorcycling since 1990, leading to a substantial reduction in overall fatalities. Changes in drinking and driving behaviour have been reflected by lower crash involvement by alcohol-affected drivers, particularly among young drivers. There are indications that long unbroken driving trips are becoming more frequent, potentially leading to impaired driving due to fatigue.

Introduction

The average number of annual New Zealand road fatalities fell from 742 to 521 over the eight years from 1989/90 and 1997/98. This 30% fall in fatalities has occurred despite an increase of approximately 35% in distance driven. When this increase in exposure to risk of road crash fatality is combined with the decrease in road deaths to estimate a fatality *rate* per km driven, a fall of 48% from 3.7 to 1.9 fatalities per 100 million km is estimated.

The exposure estimates on which this paper is based are derived from national personal interview travel surveys held in 1989/90 and in 1997/98. The travel data from these surveys can be used as the denominator of risk estimates such as risk of injury per kilometre driven. Different types of travel under different conditions present different risks to road users. The travel surveys provide invaluable insight into the changing travel patterns related to risk of road crash injury. These are discussed below.

Data sources

Exposure data

Over a period of a year – from mid-1997 to mid-1998 - approximately 14,000 people were surveyed from 7,000 randomly sampled households. Interviewed in person at their homes, people were asked to describe all of their travel by cars, motorcycles and other motor vehicles, by train or plane, by bicycle, and on foot for two particular days (called “travel days”). As these days were spread out over a whole year, information could be scaled up to represent a year's travel by all New Zealanders. There was a very high response rate for both surveys: in 1997/98, 75% of households provided full information from all household members, each of whom was personally interviewed. At least one valid interview was completed for 79% of households. The corresponding rates for the 1989/90 survey were 75% and 83%. Proxy interviews (where another member of the household supplied travel details for someone else in the household) were only permitted for children under 10 (in which case a parent or guardian supplied the information).

Each *leg* of a trip was recorded in full detail. For example, someone going to work may drive from their home to a parking building and then walk to their workplace. Each of these two legs (one by car, one on foot) was recorded in detail - including time leaving, time arriving, what sort of parking was used, and how many roads were crossed from parking building to work. Even the make, model, and other details about the car driven were recorded. The distance of the driving trip was computer-calculated by locating where the person's home was, where the parking building was, and by measuring the road distance between the two.

Respondents who drove at all on the survey days were also asked to record the times, amounts and types of alcohol they drank during the survey period. Drinking session information was recorded in both the 1989/90 and 1997/98 surveys, but the type and amount of alcohol are available for the 1997/98 survey only. The travel part of the questionnaire was completed independently of the questions on drinking, meaning that there is less likely to be underreporting of socially unacceptable driving after drinking. Driving after drinking was assessed by using a computer program to match times of drinking sessions with times of driving trips.

The survey held eight years previously was almost identical, which means that estimates of change between the two surveys can be made both easily and validly. Both surveys were designed to produce national estimates of travel and travel-related information. The main areas of difference were firstly the size of the sample: there were 8,000 respondents (6,000 fewer than the later survey); secondly, the later survey was designed to provide regional estimates whereas the earlier survey could only provide estimates for some cities individually or for rural/urban splits; thirdly, the later survey included estimates of amounts of alcohol consumed by drivers whereas the earlier survey only recorded the times of any drinking sessions. This last point of difference means that total time spent drinking must be used as a surrogate for amount consumed when comparing one survey with the other. The 1989/90 and 1997/98 surveys are described in detail in references (1) and (2) respectively.

Crash and injury data

Information about motor vehicle crashes was extracted from the Land Transport Safety Authority's database of coded information derived from Traffic Crash Reports. As each of the travel surveys began and ended in the middle of consecutive calendar years, it was appropriate to form risk estimates that combined crash data from both years spanned by the respective survey. Thus, numbers of crashes were averaged over the two calendar years 1989 and 1990 in the case of the 1989/90 risk estimates, and similarly for 1997/98, to form estimates of average annual crashes or crash involvement per annual distance travelled.

Results

Relative risks

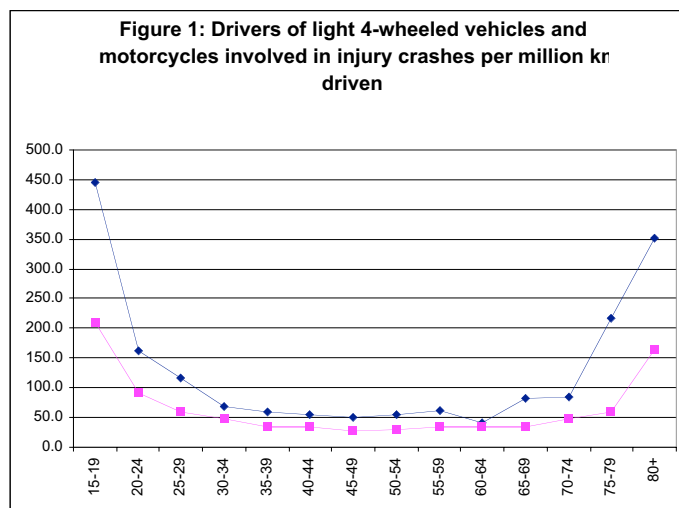


Figure 1 shows how risks (of involvement in an injury crash per 100 million km driven) for drivers of light vehicles (cars, vans, utes and motorcycles) have changed quite dramatically over the eight years separating the two travel surveys. The risk by age graphs for both 1989/90 and 1997/98 show the classic U-shaped curve with higher risk for both younger and older drivers and relatively low risk for those in the middle of the graph. Of course, the high risk of injury crash involvement estimated for older drivers is exaggerated by the fragility of the older drivers and their passengers (see Evans (3)). Figure 1 shows that risks have fallen consistently across all age groups over the intervening eight years. Overall (all age groups combined) the risk of injury crash involvement for drivers of light vehicles per distance driven is estimated to have fallen by 47%. The risk of fatal crash involvement is also estimated

to have fallen by 47%. In terms of fatal crash involvement, risk has fallen most for younger drivers and for the oldest age group.

Figure 2 shows the estimated 1997/98 risks of injury per time travelled for the six travel modes (in descending order of risk): motorcycle riding; bicycle riding; car driver; car passenger; pedestrian; bus passenger. Time travelled was used as the common exposure measure as it was available for all these travel modes.

The high risk of motorcycle riding

As shown in Figure 2, travel by motorcycle is vastly more dangerous (in terms of risk of injury per time travelled) than any other travel mode. It was estimated as about 18 times as risky than travel by cars (including vans and utes) and four times as dangerous as cycling in 1997/98. Of course, a mode of transport may appear more dangerous if it is used in more risky circumstances - or by more risky drivers. Traditionally, motorcycle riding has been dominated by the most risky driving group - young males. However, the inherent danger of this mode of transport is indicated by the high risk for riders aged 40 and over, one of the safest groups as drivers of cars¹. For every million hours riding a motorcycle, they have approximately 190 injuries, almost 30 times the risk they have as car drivers.

A major change that has occurred between 1989/90 and 1997/98 is the substantial reduction in motorcycle riding. Motorcycle ownership fell by 40% over this period and distance ridden fell by 37%.

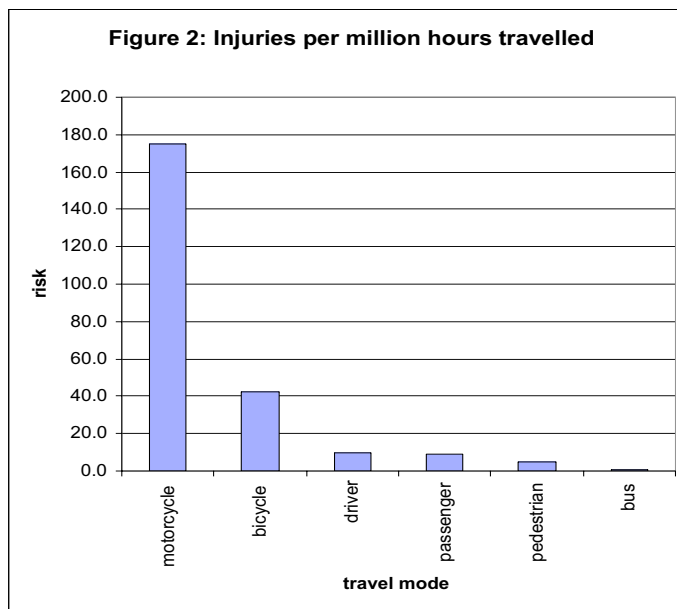
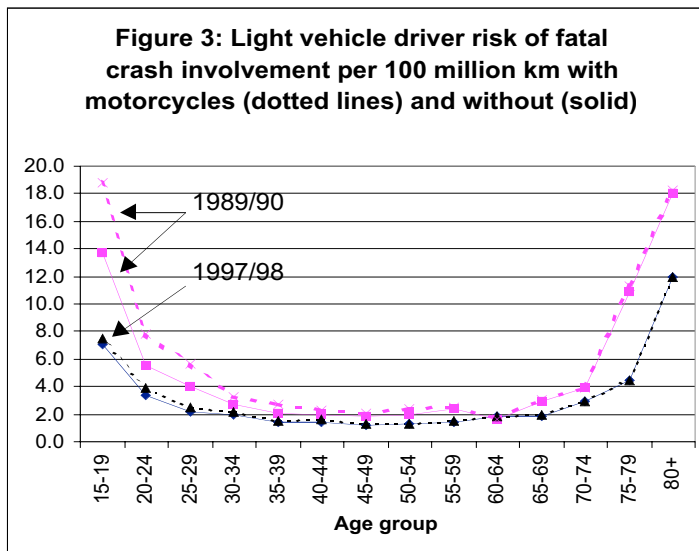


Figure 3 shows that the 1989/90 estimates of risk of fatal crash involvement fall by about a quarter for the younger age groups when motorcycle crashes and exposure are removed. The 1997/98 risk estimates are reduced by only a fraction, meaning that a large proportion of the gains in risk reduction for the younger age groups has been due to the replacement of motorcycle travel with car travel, which is substantially less risky.

The 1997 US risk of injury crash involvement per distance driven for motorcyclists compared to car drivers was estimated as three times as high and 11 times as high for injury and fatal crashes respectively (NHTSA (5)). This compares to 10 and 13 times for New Zealand injury and fatal crash involvement. It is likely that the greater demands placed on motorcyclists by New Zealand's generally undivided single lane road network together with the many curves and undulations made necessary by the hilly topography could account for some of the difference in injury crash involvement rates.

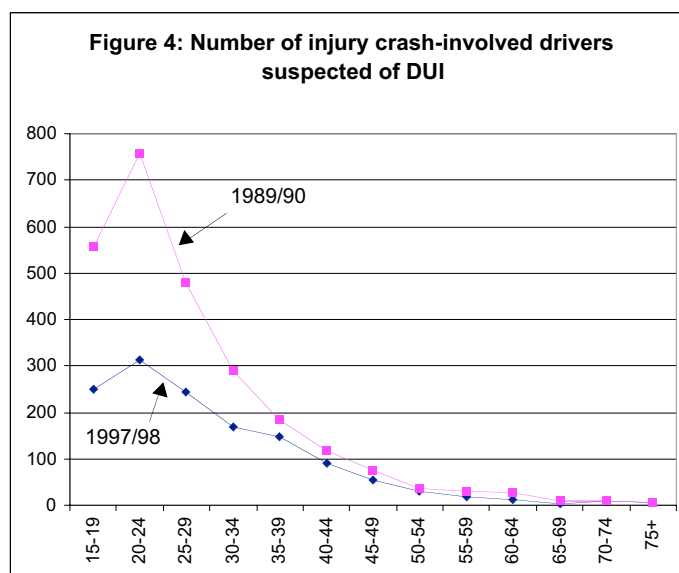
¹ It is also possible that risk-seeking individuals from all age groups may elect to ride motorcycles in preference to safer cars (Rothe and Cooper (4)).



Alcohol

If the Police attending the crash consider that the driver is driving under the influence of alcohol (DUI) then this is noted on the crash report. This judgement is a reasonable proxy for determining DUI as a large proportion of drivers suspected are later found to be over the legal limit². Between 1989/90 and 1997/98 there was a 48% reduction in the number of injury crash-involved drivers who were suspected of DUI. Figure 4 shows the number of these drivers in 1989/90 and 1997/98 disaggregated by age group. There has been a substantial fall, particularly among the younger drivers (under 35). The peak is the same for both years: 20-24-year-old drivers.

Respondents who drove at all on the survey days were also asked to record the times of any sessions when alcohol was consumed. Figure 5 shows the annual estimates of the numbers of driver trips made within four hours of a drinking session for 1989/90 and 1997/98. For drivers under 35, there was a large fall in driving after drinking. However, there appears to have been a consistent increase in driving after drinking for drivers 35 and over.



² For example, 90% of dead drivers who were suspected of DUI were later found to be over the legal limit in 1999.

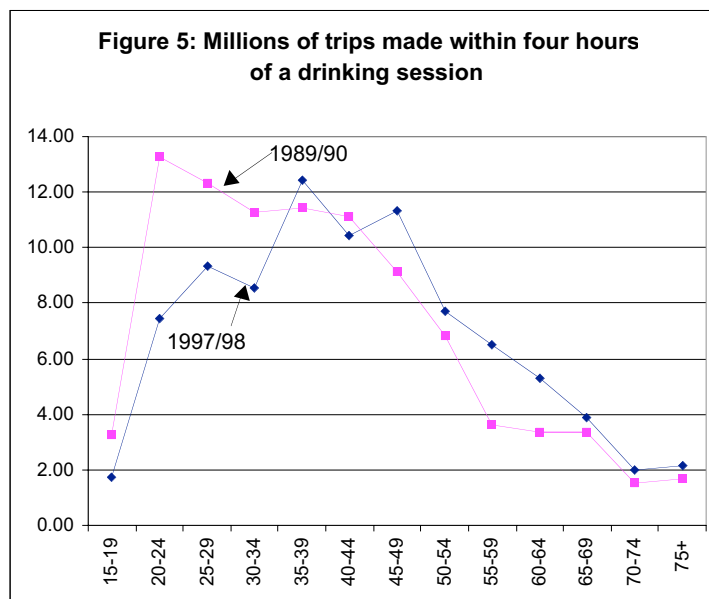
Figures 4 and 5 show that the substantial fall in drinking and driving behaviour by drivers under the age of 35 has been reflected by similarly large falls in injury crash involvement while suspected of DUI. The relationship between the Figures 4 and 5 for drivers over 35 is consistent with the same cohorts of drivers³ maintaining similar drinking and driving behaviour. As other factors will also influence the frequency of injury crashes involving alcohol, the lower curve for drivers over 35 in Figure 4 is not inconsistent with the increase in driving after drinking indicated by Figure 5. As the amount and type of drinks consumed were not recorded in 1989/90 (despite being available in 1997/98), we cannot investigate any changes in amounts of alcohol ingested during drinking sessions which would lead to changes in levels of impairment and resultant crash rates.

In the 1997/98 survey, people were also asked what type of drinks and the amount they had consumed. Drivers were assumed to be driving while over the legal blood alcohol limit if they exceed safe drinking guidelines (6) and drove at a time when they would have been over the limit given normal rates of absorption and elimination of alcohol from the blood. “High alcohol hours” are defined as those between 10pm and 4am daily, plus 4am-6am on Fridays, Saturdays and Sundays.

Table 1: Percent of trips while drivers had exceeded safe drink-driving guidelines (DUI trips) 1997/98

Time of day and week	% of trips that were DUI trips	
	Males	Females
Trips at all times	0.25%	0.08%
Trips during high alcohol hours	2.70%	0.90%

Table 1 shows that the rate of DUI during high alcohol hours was more than ten times the overall rate and the male rate was approximately three times the female rate.



Fatigue

Measures of fatigued driving suitable for use as exposure measures are difficult to collect, however the travel surveys did record details of the duration and distance driven of each trip leg (ie a period of driving without a break). If the long duration unbroken trips are assumed to be associated with fatigue, then there are indications that the situation may have worsened over the eight years between the two surveys for drivers and riders of light four-wheeled vehicles and motorcycles. In 1989/90, there were

³ For example, drivers who were 35-39 in 1989/90 will have moved to the 40-44 or the 45-49 age groups in 1997/98.

approximately 1.3 billion km driven in unbroken trips exceeding two hours' duration⁴, 7% of the total distance driven by light vehicles. In 1997/98, the corresponding figure was 2.1 billion km, constituting more than 8% of distance driven by light vehicles. There was more than twice the distance driven while making unbroken trips of more than four hours' duration in 1997/98 compared to 1989/90 (0.5 billion km and 0.2 billion km respectively). If we consider the distances driven while driving more than eight hours in a single day, again the 1997/98 survey's estimate is about twice that of 1989/90 (0.4 billion km compared to 0.2 billion km). Such driving is almost certainly associated with high levels of fatigue.

Summary

The two travel surveys provide information on driving behaviour that shed light on changes in New Zealand crash rates over the eight years between 1989/90 and 1997/98. In particular:

- Motorcycle riding was shown to be considerably more risky than car driving. Since 1990, a large proportion of younger drivers have chosen to drive cars rather than motorcycles, leading to considerable reduction in overall risk for this age group.
- The largest change in driving after drinking has also occurred for younger drivers, also reflected in much lower crash involvement by alcohol-affected drivers. Drivers over 35 years old have apparently not changed their behaviour in terms of driving following a drinking session. However, these drivers may be drinking less in drinking sessions prior to driving, leading to lower crash involvement, as indicated by the crash data.
- In 1997/98, the proportion of trips made while DUI for males was three times that of females. During high alcohol hours, the DUI rate was ten times the overall DUI rate.
- The substantial increase in mobility from 1989/90 to 1997/98 also appears to have brought an increase in driving for long periods without a break by light vehicle drivers. Attention may need to be paid to this area to avoid corresponding increases in fatigue-related crashes.

References

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⁴ Some research on professional drivers' crash risk in relation to driving hours has found a local maximum between two and four hours on duty (Folkard (7)).