

High-risk drivers: an exercise in crash data analysis with what was to hand

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Abstract

Safer Journeys, New Zealand's road safety strategy for 2010–2020, is based on a safe systems approach. As a follow-up to the initial strategy work and analysis, further investigation was undertaken on high-risk drivers. For the analysis, high-risk drivers were characterised as those drivers at fault in crashes who were:

- unlicensed and disqualified drivers (including drivers who were forbidden to drive or who had an expired licence or the wrong licence class for the vehicle being driven)
- drivers identified as evading enforcement or racing or showing off at the time of the crash
- drivers with a blood alcohol level of at least fifty percent over the adult legal limit (i.e. 120 mg/100 ml)
- repeat alcohol offenders, specifically drivers in alcohol-related crashes who had at least one prior alcohol conviction
- repeat speed offenders, specifically drivers in speed-related crashes who had at least two prior speeding offences with at least one involving 35 or more demerit points.

The desktop review combined crash data from the Crash Analysis System, selected data from the Driver Licence Register, post-mortem and other blood alcohol readings from the Institute of Environmental Science and Research (ESR) and alcohol offence data provided by police. An overview of crash statistics for high-risk drivers is presented here, along with a discussion of the limitations of the data available, and the challenges of matching data from diverse datasets. The techniques and data sources used are potentially useful for future yearly monitoring of the trends of high-risk drivers.

1 Introduction

New Zealand's road safety strategy for 2010–2020 (Safer Journeys) is based on a safe systems approach, with a vision of a safe road system increasingly free of death and serious injury. The system areas have four components: safe roads and roadsides, safe speeds, safe vehicles, and safe road use. Within safe road use is the issue of high-risk drivers; originally defined in Safer Journeys (Ministry of Transport, 2010a) to be:

dangerous and reckless drivers, disqualified drivers, unlicensed drivers, drivers involved in illegal street racing, repeat drink/drug drivers, high BAC level offenders, repeat speed offenders and high-level speed offenders.

This was further refined in the Safer Journeys Action Plan (Ministry of Transport, 2011a) to be:

drivers who have a history of dangerous and reckless driving, including disqualified drivers, unlicensed drivers, drivers involved in illegal street racing, repeat drink/drug drivers, high BAC offenders, repeat speed offenders and high-level speed offenders.

This is similar to some of the categories covered by irresponsible road users in the Australian National Road Safety Strategy 2011–2020 (Australian Transport Council, 2011).

After the release of the initial strategy, further data was requested on high-risk drivers, in order to examine their crash patterns compared to that of other drivers. It was decided to conduct a review using the data to hand, with a view to being able to potentially update these findings as a time series on an ongoing basis. This meant that the definitions were based on available data, which focused the research on behaviour exhibited with respect to crashes, as opposed to risky behaviours as considered in the literature (e.g. unlicensed drivers and their characteristics, Begg et al., 2010, youth problem behaviour and traffic crash involvement, Begg and Gulliver, 2008, Fergusson et al. 2003, Fergusson et al. 2008).

Data sets that were available included the New Zealand Crash Analysis System (CAS), post-mortem and alcohol offence data, and selected data from the Driver Licence Register.

Using these data sets allows the following definitions for high-risk drivers:

- drivers who were unlicensed and disqualified at the time of the crash (including drivers who were forbidden to drive or who had an expired licence or the wrong licence class for the vehicle being driven)
- drivers identified as evading enforcement or racing or showing off at the time of the crash
- drivers with a blood alcohol level of at least fifty percent over the adult legal limit (i.e. 120 mg/100 ml) at the time of the crash
- repeat alcohol offenders, specifically drivers in alcohol-related crashes who had at least one prior alcohol conviction (includes full offence histories for drivers whose most recent conviction occurred since 2000)
- repeat speed offenders, specifically drivers in speed-related crashes who had at least two prior speeding offences, with at least one involving 35 or more demerit points (excludes offences prior to July 2000 and all speed camera offences).

We give an overview of the data sets that were combined and discuss their features and limitations. We then present a selection of the results found as related to fatal crashes.

2 Data used

Three types of data were found to be available:

- crash data from the Crash Analysis System
- selected data from the Driver Licence Register
- post-mortem and other blood alcohol readings from the Institute of Environmental Science and Research (ESR) and alcohol offence data provided by police.

2.1 Crash Analysis System

Data on motor vehicle crashes reported by police in New Zealand is accessed via the Crash Analysis System (CAS). Police report the crash on a Traffic Crash Report and the data is then entered into CAS by the New Zealand Transport Agency.

Each traffic crash report is a detailed report, filled in by the attending/reporting police officer. This includes a wide array of data. More information on this is available from www.transport.govt.nz/research/crashdatacollection/.

For this analysis, the following information was used:

- Crash severity
- Crash location
 - Urban/open road
 - State highway
 - Region
- Time of day and day of week
- Driver demographics
 - Age and gender
 - Ethnicity
 - Licence number and/or licence status (e.g. unlicensed or disqualified)
 - Fault in crash¹
- (Injured) passenger involvement
- Other vehicles involved
- Crash contributing factor code flags
 - Evading enforcement
 - Racing
 - Showing off
 - Speeding as characterised by travelling too fast for conditions
 - Alcohol as suspected by police
- Blood and/or breath alcohol levels where available

2.2 Blood alcohol analysis

Crashes with alcohol as a contributing factor in CAS are flagged by either a driver testing above the limit (or refusing the test), or alcohol being suspected by the reporting police officer (as identified through the crash contributing factor codes). While it is useful for more in-depth analysis to have a blood or breath alcohol concentration (BAC) level recorded in CAS, it is not always practical and it is not always the case that it makes it into the system via the Traffic Crash Reports (TCR) filled out by police. Between 2004 and 2008, 18,729 drivers were involved in fatal or serious injury crashes and of these, 2,063 had a BAC recorded in CAS. However a further 1,329 drivers were suspected of being impaired by alcohol but a BAC was not recorded (Ministry of Transport, 2010a).

To improve information on alcohol levels for drivers in crashes, an effort was made to get BAC values from sources other than the TCR. Blood alcohol measurements are often taken as part of post mortem examinations for fatally injured drivers. In 2009, 191 (80 percent) of the drivers/riders killed in road crashes were given a blood test to detect the presence of alcohol (Ministry of Transport, 2010b).

¹ An at-fault driver is defined in CAS as the driver deemed to have the primary responsibility for a crash. This is based on the crash movements and crash cause factors assigned in CAS. It is not based on legal liability or court conviction.

It is also occasionally the case that a BAC level is recorded by police, but has not made it onto the TCR. Recently, a concerted effort has been made to enter this data into CAS.

Alcohol offence data containing blood and breath alcohol concentrations was obtained from police, and this was combined with dead driver post mortem blood alcohol levels and that data entered into CAS for the appropriate crashes.

For this analysis, drivers have been flagged as having high alcohol if they are more than 50 percent over the adult limit (i.e. 120 mg/100 ml or higher). No effort has been made to adjust for the youth limit for young drivers by matching the age of the driver to the limit. Where no blood alcohol level was available, but a breath alcohol level was available, this was converted to an approximate blood alcohol concentration.

This allows at-fault drivers in crashes with a blood alcohol level of greater than 120 mg/100 ml to be treated as high risk.

2.3 Driver licence register

Specific driver licence register data has been acquired from the NZ Transport Agency (NZTA) on various occasions. As the driver licence register is a transactional database, continually updated and changed, the data requested could only be a snapshot of particular data in the system as at a certain point of time. The New Zealand licence system has evolved over time, with shifts from lifetime paper licences to 10-year licences with a photo, and in the database technology and associated legislation. Care needs to be taken when considering applicable time periods, in order to take account of these changes in selecting a consistent data set.

As the crash data in CAS already had information on the licence status of the driver at the time of the crash, the information extracted from the driver licence register is the alcohol conviction data and the speed offence data.

2.3.1 Alcohol conviction data

The alcohol conviction data obtained consisted of full conviction histories for drivers whose most recent alcohol conviction was after 2000, based on information from the driver licence register. The conviction data on the driver licence register is updated on a daily basis by the Ministry of Justice. The conviction data available had originally been obtained as part of research into repeat alcohol offending and crashes involving those offenders.

In New Zealand at the time the report was published in January 2011, it was an offence for those aged 20 years and over to drive with a blood alcohol concentration of over 80mg/100ml or a breath alcohol concentration of over 400µg/l. For those under 20 years old, the limits were 30mg/100ml and 150µg/l, respectively².

This information was used to classify as high risk those at-fault drivers in crashes where alcohol was suspected as a contributing factor³, who had a prior alcohol offence. Offence histories were available for all drivers whose most recent offence was after 2000.

² Subsequent legislation to come into effect 1 August 2011 changes the youth limit to zero and introduces a zero limit for repeat drink drive offenders for 3 years following a period of disqualification.

³ Alcohol suspected is ruled out if the subsequent BAC is found to be below the legal limit.

2.3.2 Speed offence data

The speed offence data used consisted of speed offences committed since July 2000, based on information extracted from the driver licence register. This information was based on driver demerit points and so excluded speeding offences detected by speed cameras. This is because speed camera offences do not incur demerit points under the New Zealand system. Hence there is no record of such infringements on the driver licence record.

Demerit points are allocated based on how far over the posted speed limit the driver was found to be travelling, as shown in Table 1.

Table 1: Demerit points incurred based on speed

	Demerit points incurred
Exceeding speed limit by 10km/h	10
Exceeding speed limit by 11–20km/h	20
Exceeding speed limit by 21–30km/h	35
Exceeding speed limit by 31–35km/h	40
Exceeding speed limit by 36km/h or more	50

For the purpose of this analysis a serious offender was defined as an at-fault driver involved in a speed-related crash with at least two prior speeding offences recorded, with one of the offences incurring 35 or more demerit points, i.e. travelling 21 km/h or more over the posted speed limit.

It should be noted that in CAS, speed is flagged if the driver is travelling too fast for conditions. Due to the paucity of empirical data on the speed of vehicles before crashes, it is not possible to reliably identify drivers as being over the posted speed limit by an arbitrary amount at the time of the crash. Hence for this analysis there is no speed equivalent to high alcohol drivers in crashes.

2.4 High-risk driver data merging

The conviction and offence data were used to create flags associated with particular licence IDs, and these flags were then merged onto crash data via the driver licence ID using the statistical analysis package SAS. The resulting data was then restricted to at-fault drivers in crashes and the difference between the characteristics of the high-risk drivers and other drivers at fault in crashes were examined. As noted earlier (Footnote 1, section 2.1), an at-fault driver is defined in CAS as the driver deemed to have the primary responsibility for a crash. This is based on the crash movements and crash cause factors assigned in CAS. It is not based on legal liability or court conviction.

3 Selected results

As stated earlier, the following characteristics were used to identify high-risk drivers in the population of at-fault drivers in crashes:

- unlicensed and disqualified drivers (including drivers who were forbidden to drive or who had an expired licence or the wrong licence class for the vehicle being driven)
- drivers identified as evading enforcement or racing or showing off at the time of the crash

- drivers with a blood alcohol level of at least fifty percent over the adult legal limit (i.e.120 mg/100 ml)
- repeat alcohol offenders, specifically drivers in alcohol-related crashes who had at least one prior alcohol conviction (includes full offence histories for drivers whose most recent conviction occurred since 2000)
- repeat speed offenders, specifically drivers in speed-related crashes who had at least two prior speeding offences with at least one involving 35 or more demerit points (excludes offences prior to July 2000 and all speed camera offences).

Table 2 shows the total casualties in motor vehicle crashes for the 2005–2009 period and shows the scale of those casualties in crashes involving high-risk drivers at fault. Thirty-three percent of deaths occurred in crashes involving at-fault high-risk drivers.

Table 2: Road deaths and injuries 2005–2009

	Deaths	Serious injuries	Minor injuries
Number			
Total number 2005–2009	1,969	12,960	63,129
Number in crashes with a high-risk driver at fault	642	2,857	9,704
Percent			
Percent in crashes with a high-risk driver at fault	33%	22%	15%

The rest of this report will focus on a selection of the results of the analysis of the high-risk drivers in fatal crashes. The complete set of results and an additional breakdown by the same patterns for fatal and serious injury crashes is available in the published report (Ministry of Transport, 2011b).

3.1 Within the high-risk category

Of those categorised here as high-risk drivers in fatal crashes, 25 percent have a prior alcohol conviction, 25 percent have committed two or more prior speed offences, with at least one involving 35 or more demerits, 34 percent do not have an appropriate licence (licence factors), 50 percent have a high blood alcohol level in the crash, 7 percent are racing or showing off and 3 percent are evading enforcement at the time of the crash. Any one driver may fall into several risk categories.

3.1.1 Overlap of categories

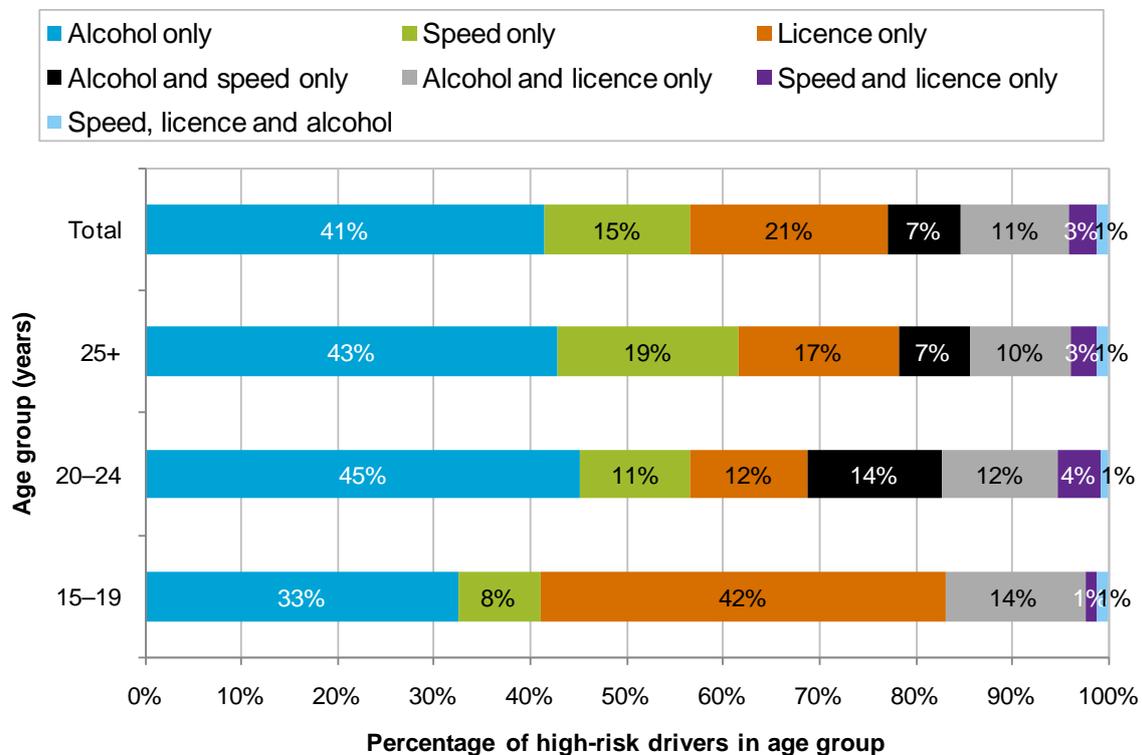
Table 3 and Figure 1 show the distribution within the high-risk driver subsets, divided broadly based on the involvement of alcohol (both high alcohol in the crash and/or prior alcohol convictions), speed and licence factors. The largest subset is those involving alcohol only (221 drivers), followed by licence factors only (110 drivers), and speed only (81 drivers). Seven drivers fall under all three categories: the involvement of alcohol (potentially previously as well), multiple prior speeding offences, and disqualification at the time of the crash.

Table 3: Overlaps in risk categories for high risk drivers in fatal crashes (2005–2009)⁴

Driver age	Risk categories						
	Alcohol			Alcohol	Alcohol		Alcohol
		Speed		Speed		Speed	Speed
			Licence		Licence	Licence	Licence
15–19	27	7	35	0	12	1	1
20–24	52	13	14	16	14	5	1
25+	139	61	54	24	34	9	4
Other	3	0	7	0	0	0	1
Total	221	81	110	40	60	15	7

Based on Figure 1, licence factors predominate for 15-19 year olds and the proportion of multiple categories is far fewer than in older age groups.

Figure 1: Overlap between risk categories for high-risk drivers in fatal crashes (2005–2009)



3.1.2 Limitation of overlaps

Care should be taken in drawing conclusions from the category overlaps within the high-risk category due to the issue of merging datasets based on driver licence ID. If driver licence ID is not recorded, then we have no way of merging the data, so we have no statistics on crashes by those with alcohol convictions or speeding offences with no driver licence. More generally, of the 15-19 year old drivers without an appropriate licence at fault in fatal crashes

⁴ 'Other' includes drivers aged under 15 years or whose age is unknown. 54 of the high-risk drivers shown were evading enforcement (17) or racing or showing off (37) at the time of the crash. 27 high-risk drivers were evading enforcement or racing or showing off at the time of the crash and do not fall in any of the other categories, so are not shown in Table 3 and Figure 1.

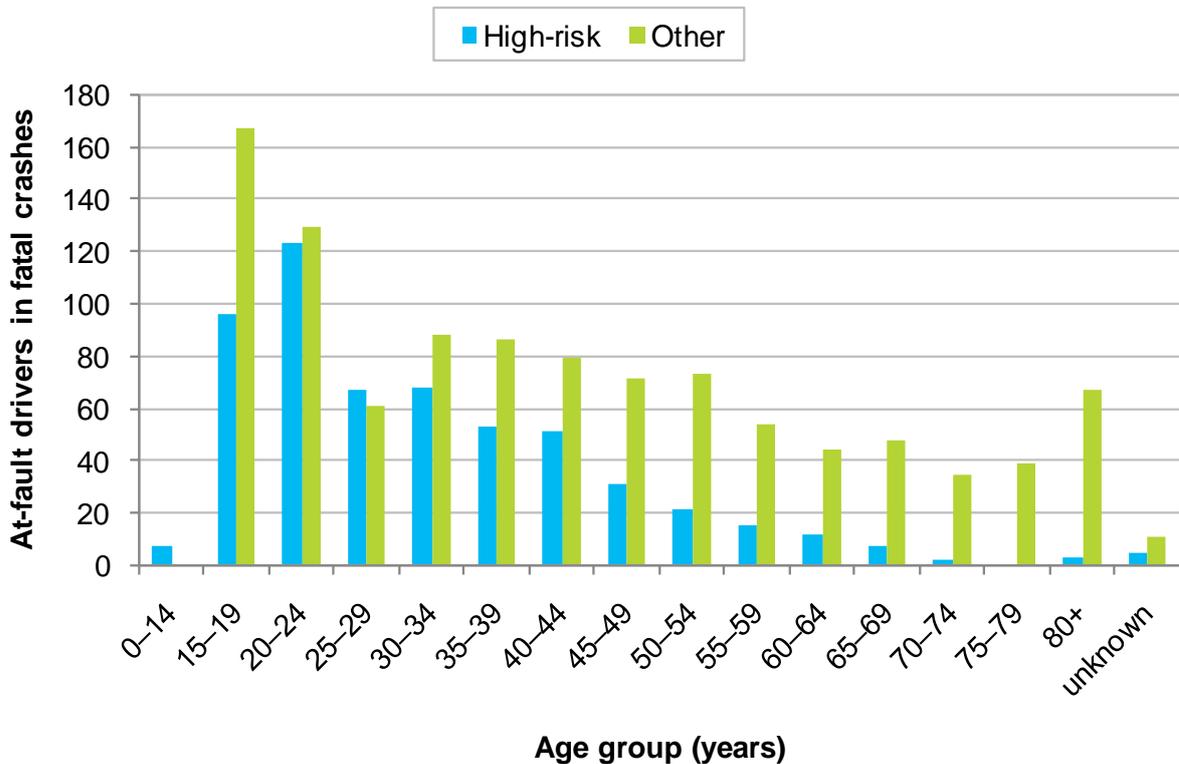
between 2005 and 2009, over half (54 percent) had no licence. This falls to 41 percent for those 20-24 years old and 12 percent for those aged over 25 years. This means that for the younger high-risk drivers with licence factors, potentially up to half may also have prior alcohol convictions or committed speed offences, but we have no way of knowing the actual predominance.

It should also be noted that a higher proportion of the high-risk drivers will involve alcohol, as even the unlicensed drivers can have a high alcohol level recorded. As mentioned, there is no equivalent for unlicensed repeat speed offenders. Thus the involvement of speed for high risk drivers will be understated, especially with respect to the licence status and/or alcohol.

3.2 Demographics

Figure 2 shows the age profile of high-risk drivers compared to other at-fault drivers involved in fatal crashes. The peak number of at-fault drivers falls between ages 15-24, with the high risk drivers peaking age 20-24, whereas the other at-fault drivers peak in the age range 15-19 years old.

Figure 2: At fault drivers in fatal crashes by age (2005–2009)



About half (52 percent) of the high-risk drivers are under 30. A higher proportion of younger drivers are in the high-risk group. High-risk drivers comprise nearly half (45 percent) of at-fault drivers aged under 30 whereas they make up 30 percent of at-fault drivers aged 40-59.

Overall, 76 percent of at-fault drivers are male. Males make up 83 percent of high-risk drivers at fault, compared to 72 percent of other at-fault drivers.

This gender disparity is supported by New Zealand research finding that males were most likely to indulge in frequent risky driving behaviours (Fergusson et al., 2003).

3.3 Time of day and day of week

High-risk driver crashes tend to occur late at night and later in the week (Table 4 and Figure 3). High-risk drivers comprise 61 percent of at-fault drivers involved in late-night crashes. The proportions are lower for Monday and Tuesday nights.

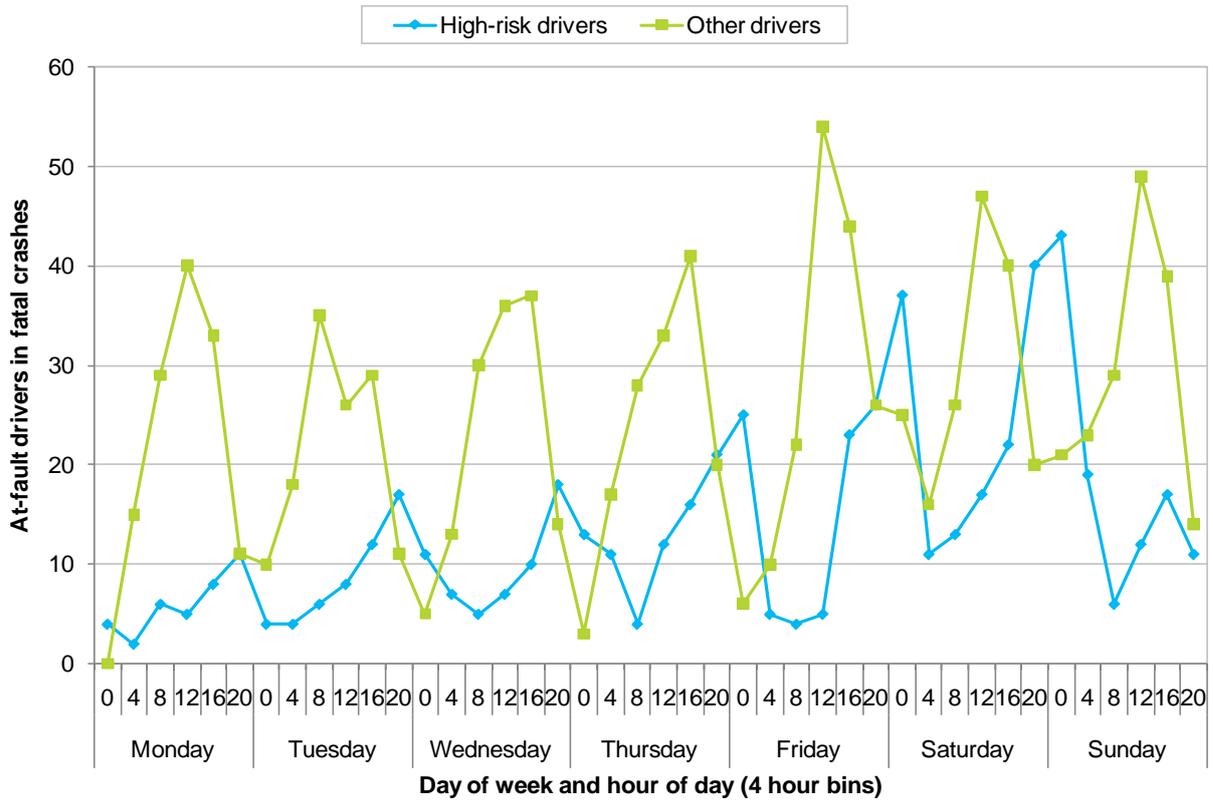
Table 4: At-fault drivers in fatal crashes by time of day and day of week (2005–2009)

Day of week	Day (0600–1759)			Evening (1800–2159)			Night (2200–0559)		
	High-risk drivers	Other drivers	% high risk	High-risk drivers	Other drivers	% high risk	High-risk drivers	Other drivers	% high risk
Monday	17	105	14%	12	17	41%	7	6	54%
Tuesday	22	90	20%	16	17	48%	13	22	37%
Wednesday	22	97	18%	11	25	31%	25	13	66%
Thursday	24	103	19%	24	24	50%	29	15	66%
Friday	20	104	16%	24	32	43%	44	26	63%
Saturday	43	107	29%	29	28	51%	68	39	64%
Sunday	33	116	22%	12	20	38%	63	39	62%
Total	181	722	20%	128	163	44%	249	160	61%

Note: On the day shown, night is from 2200 until 0559 on the following day. A time is not recorded for about half a percent of fatal crashes.

Not only are high-risk drivers more likely to be the driver at fault in late night crashes, but more of them crash late at night. Forty-five percent of high-risk driver crashes occur late at night (2200–0559 hours). This compares to only 15 percent of crashes for other at-fault drivers. From Figure 3, the peak time for high risk driver crashes shifts to later at night towards the weekend, with the highest number of high-risk driver crashes occurring between 2000 on Saturday evenings and 0400 on Sunday mornings.

Figure 3: At-fault drivers in fatal crashes by day of week and hour of day (2005–2009)



Other studies have also found similar trends for time of day, especially for unlicensed drivers. Begg et al. (2010) note this was the case in two studies (Hanna et al., 2010 and Lam, 2003), however these are in the context of never-licensed drivers only. This also correlates with what are considered in New Zealand to be the high-alcohol hours: between 2200 and 0400 daily, plus 0400-0600am on Fridays, Saturdays and Sundays, based on motor vehicle crash risk due to alcohol and alcohol offence data (McSaveney, 2009 and Ministry of Transport, 2010b).

3.4 Urban/open road distribution

For both high-risk and other at-fault drivers, the majority of fatal crashes occur on the open road (72 percent for high-risk drivers and 77 percent for other at-fault drivers), where open road is defined to be a posted speed limit of over 70 km/h. As shown in Table 5, a lower proportion of high-risk driver crashes are on open road state highways (39 percent) than other at-fault driver crashes (52 percent).

Table 5: Roading environment on which at-fault drivers crash

Crash location	High-risk drivers	% of high-risk drivers	Other drivers	% of other drivers
Urban road	157	28%	245	23%
Open road State highway	216	39%	550	52%
Other open road	188	34%	257	24%
Total	561	100%	1,052	100%

High-risk drivers are much more likely to be involved in single-vehicle crashes (62 percent) than other at-fault drivers (35 percent). Most single-vehicle crashes are 'loss of control' or 'run off road' crashes, which are a feature of crashes where alcohol or speed are contributing factors (Ministry of Transport, 2010c and Ministry of Transport, 2010d). High-risk drivers comprise 49 percent of all at-fault drivers in single-vehicle fatal crashes (Table 6). This becomes more pronounced for urban areas, where the equivalent figure is 59 percent.

The relatively high predominance of single-vehicle crashes for never-licensed drivers is also found in the literature (Begg et al., 2010; Hasselberg and Laflamme, 2009 and Hanna et al., 2010).

Table 6: At-fault drivers and the number of vehicles involved in the crash⁵

Crash location	Crash type	High-risk drivers	Other drivers	% that are high-risk
Urban road	Single-vehicle	96	67	59%
	Other	61	178	26%
Open road	Single-vehicle	250	296	46%
	Other	154	511	23%
Total	Single-vehicle	346	363	49%
	Other	215	689	24%

Twenty-eight percent of the high-risk driver single-vehicle crashes happen in urban areas, compared to only 18 percent of other driver single-vehicle crashes.

The open road predominance observed for single-vehicle crashes is similar to that observed in crashes for non-licensed drivers (Begg et al., 2010; Hasselberg and Laflamme, 2009 and Hanna et al., 2010).

⁵ 'Other' includes crashes with multiple vehicles or with at least one road user outside the vehicle driven by the at-fault driver.

3.5 Deaths in crashes

Overall, high-risk drivers tend to kill themselves and their passengers. Over half (59 percent) of the deaths in these crashes are the high-risk drivers themselves. This reflects the predominance of single-vehicle crashes (as mentioned in Section 3.4). A further 28 percent are passengers with high-risk drivers. The remaining 14 percent of deaths are other road users involved in the crash. Table 7 and Figure 4 show the distribution of deaths in crashes with at-fault high-risk drivers.

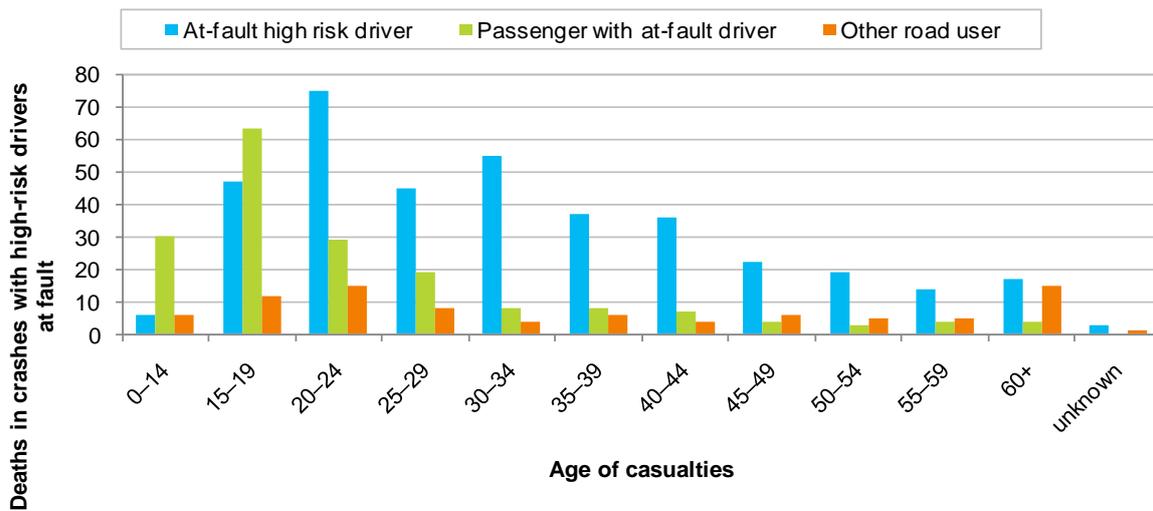
While not specifically examined in the desktop review, previous research shows that in the New Zealand context, passengers in vehicles tend to be in a similar age group to the driver or (especially for older drivers) children (Ministry of Transport, 2009a). This is especially true for 15-19 year olds, who have the highest number of trip legs with passengers their own age (approximately 27 per 100 driver trip legs), compared to other age groups (next closest age group is those aged 30-79 (22 per 100 driver trip legs with passengers of the same age)). For 15-24 year olds their passengers are also less likely to be household members (Ministry of Transport, 2009a).

Table 7: Deaths in crashes with at-fault high-risk drivers

Casualty age	At-fault high risk driver	Passenger with at-fault high risk driver	Other road user
Under 15	6	30	6
15–19	47	63	12
20–24	75	29	15
25–29	45	19	8
30–34	55	8	4
35–39	37	8	6
40–44	36	7	4
45–49	22	4	6
50–54	19	3	5
55–59	14	4	5
60+	17	4	15
unknown	3	0	1
Total	376	179	87

This also reflects the predominance of crashes with young drivers with young passengers, as demonstrated by previous research (e.g. Ministry of Transport, 2010e and Keall et al., 2004), and why New Zealand’s graduated licence system restricts passengers carried by those on a restricted licence, without supervision by a full licence holder.

Figure 4: Deaths in crashes with high risk drivers at fault



4 Discussion

High risk drivers and driving can mean different things to different people. In the context of this report, Safer Journeys provided initial guidance on the definitions, which were then moderated by the data sets available. As such, this work has used an operational definition with a crash focus, in contrast to other definitions based on behavioural studies.

The conviction and offence data available allowed for a variety of definition thresholds to be considered. The threshold for speed offending used was set quite high, but potentially lower (or higher) speeds over the limit could be used in future work. Using only one conviction was considered to have too much of a potential to include much of the driver population, given 18 percent of New Zealand drivers (self) reported receiving a speeding ticket in the last 12 months (Ministry of Transport, 2010f).

With respect to the crash data used, New Zealand is fortunate to have a quite detailed crash data base, allowing complicated aggregations and disaggregations of data. Some work exists in combining this data with other available datasets, for example with roadside alcohol operations (Keall et al., 2004) and travel survey data (Ministry of Transport, 2009b). As far as the authors are aware, no previously published work has used the New Zealand crash data in conjunction with information from the driver licence register.

While New Zealand has a strong history of investigating risky driver behaviour in the context of cohort studies, these are based on self reporting as opposed to offence data. Both the longitudinal studies of the Christchurch Child Health and Development Study (CHDS) and the Dunedin Multidisciplinary Health and Development Study (DMHDS) have examined youth behavioural problems and crash involvement (Begg and Gulliver, 2008, Fergusson et al., 2003, Fergusson et al., 2008). Reeder et al. (1998) combined DMHDS data with traffic conviction data, although they were specifically looking at predictors of traffic convictions, rather than crashes. However both CHDS and DMHDS are limited to young drivers in that their cohorts were born in the early and late 1970s.

The authors are aware of the limitations of examining risk in terms of focusing on the behaviours people are caught for and/or exhibit when crashing, as opposed to the broader behaviours they may exhibit. For the purposes of a desktop review with data to hand, the definitions used are sustainable from a long-term monitoring perspective. One of the goals set out in Safer Journeys was to attempt to reduce the heightened crash risk that high-risk drivers expose New Zealanders to (Ministry of Transport, 2010a and Ministry of Transport,

2011a). Progress towards this can best be evaluated through using a clear set of definitions that can be quantified with the data available in a repeatable manner. The review has established that this is possible with the data to hand.

5 Conclusion

The combination of crash data with offence and conviction data from the New Zealand police and Driver Licence Register has allowed a useful analysis of crash and driver characteristics for the Safer Journey's sub-category of high-risk drivers. Under the constraints of being a desktop review of data to hand, rather than a specific longitudinal behavioural study, agreement with other research (both New Zealand and international) has been found. The techniques and data sources used have the potential to be used for future yearly monitoring of the trends of high-risk drivers.

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