Alcohol-related crash trends

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An important note for the reader

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Abbreviations and acronyms

AA	New Zealand Automobile Association
ACC	Accident Compensation Corporation
AUDIT	Alcohol Use Disorders Identification Test
BAC	Blood alcohol concentration
BrAC	Breath alcohol concentration
CAS	Crash Analysis System
CBT	Compulsory breath testing
DSI	Death and serious injury
EBA	Excess blood or breath alcohol
EHINZ	Environmental Health Intelligence New Zealand
ESR	Institute of Environmental Science and Research
ETSC	European Transport Safety Council
FARS	Fatality Analysis Reporting System (United States)
GPS	global positioning system
HPA	Health Promotion Agency
ID	Identification
IDI	Integrated Data Infrastructure
ISS	Injury Severity Score
ITF	International Transport Forum
KPI	Key Performance Indicator
MBT	Mobile breath testing
mg/dl	milligrams per decilitre
MRSB	Mobile road safety base
MVD	Multiple-vehicle daytime (crashes)
NHTSA	National Highway Traffic Safety Administration (United States)
NSW	New South Wales
NZHS	New Zealand Health Survey
RBT	Random breath testing
SVN	Single-vehicle night-time (crashes)
TAM	Transdermal alcohol monitoring
TCR	Traffic Crash Report
TfNSW	Transport for NSW
µg/l	micrograms per litre
VDoT	Victoria Department of Transport
WHO	World Health Organization

Contents

Executive summary

The consumption of any amount of alcohol impairs people's driving ability, increasing the risk and severity of crashes. At higher concentrations in the body, alcohol significantly increases the crash risk and potential for deaths and serious injuries to drivers, any passengers and other road users. Appropriate interventions should be effectively implemented, to dissuade drivers from driving after consuming alcohol and to ensure those who choose to drive while under the influence of alcohol are detected and penalised. Drivers with substance-abuse problems should be screened and treated as appropriate.

Data on alcohol-related crashes and interventions is needed to inform decision making, strategies and tactics aimed at reducing alcohol-related road trauma. Policy makers and researchers should have confidence in the data so they can draw accurate conclusions on crash trends and the effectiveness of interventions.

Waka Kotahi NZ Transport Agency (Waka Kotahi) contracted Abley Limited to conduct an investigative study into New Zealand alcohol-related crash data and related datasets. The research aimed to examine how 'fit for purpose' alcohol-related crash data is and to study trends in such crashes over the past 10 years and their connection with other factors.

This research addresses a knowledge gap around recent trends in alcohol-related crashes and what insights the underlying data can reveal. It focuses in particular on exploring alcohol-related crash trends following the 2014 change in legislation reducing alcohol limits for drivers aged 20 years and over. The research objectives were to:

- review relevant international literature
- identify existing and potential forms and sources of alcohol-related crash data and describe their fitness for purpose
- explain the strengths and limitations of the New Zealand data and what can legitimately be inferred from it, including what new data and testing may be required
- identify significant attitudinal and behavioural factors related to alcohol and crashes
- examine trends in crashes where alcohol was identified as a factor and explore the relationship between these trends and other relevant changes that occurred in New Zealand over the same period
- make recommendations regarding new approaches to data collection, combination, analysis and use.

The research project was undertaken during 2021 and completed in early 2022. It involved three stages:

1. Examining New Zealand, Australian and international literature to review data collection and reporting practices, and to identify factors that contribute to alcohol-related crashes. This included reviewing alcohol-related crash trends and enforcement practices among comparable international jurisdictions.
2. Engaging with stakeholders from relevant New Zealand organisations to understand how alcohol-related crash and drink-driving enforcement data is collected and how this has changed over time. The stakeholders also helped the research team identify other potential sources of alcohol-related crash and enforcement data and provided insights into current crash trends and drink-driving behaviour.
3. Undertaking exploratory analysis of selected datasets made available to the research team, as well as further investigation into the coding of alcohol-related crashes in the Waka Kotahi Crash Analysis System (CAS). This helped establish the usefulness and limitations of the data available for understanding trends in drink driving and alcohol-related road trauma, focusing on trends observed from 2010 to 2020.

The last major change in drink-driving legislation occurred in December 2014, dropping the blood alcohol limit for drivers aged 20 and over to 50 milligrams per decilitre (mg/dl), in line with international best practice. Rates of alcohol-related deaths and serious injuries (DSIs) were expected to decrease after the change, but this wasn't observed in the crash data. The proportion of alcohol-related DSIs, as a proportion of total DSIs (as reported from CAS), increased between 2014 and 2016 and fluctuated considerably from 2017 to 2020. Either the change in blood alcohol limit was not effective in reducing alcohol-related DSIs or a change occurred in how crash data was collected that affected how alcohol-related crashes were reported.

While New Zealand is good at testing drivers for alcohol after a crash, the research uncovered errors and inconsistencies in how this data is reported in CAS. Two significant errors detected from late 2018 onwards resulted in the alcohol-related cause codes being inaccurate for many drivers, which means these alcohol cause codes cannot currently be used for reporting on alcohol-related crashes and injuries.

Potential reasons for errors in CAS were identified and are discussed extensively. They include human data-entry errors, application design issues, and system updates affecting how data is translated between New Zealand Police (NZ Police) traffic crash reports (TCRs) and CAS.

A dataset of blood test results for drivers was investigated to identify trends in the blood alcohol concentration of drivers whose blood was tested after a crash or for enforcement purposes. Analysis of the data showed the percentage of hospitalised drivers with a blood alcohol concentration over 50 mg/dl (the current limit for drivers aged 20 and over) trended downwards between 2014 and 2020, indicating the proportion of fatal and serious crashes with alcohol as a cause factor has continued to reduce over time, despite the CAS data suggesting otherwise.

The project also explored trends in random breath testing (RBT) and offence datasets, to determine what impact changes in enforcement practices might have had on the effectiveness of the lowered alcohol limits. Around 2016 onwards, NZ Police became more targeted in its enforcement, undertaking fewer RBT while maintaining the number of offences being detected. It is difficult to judge whether the change in enforcement strategy was effective in reducing alcohol-related DSIs, however, the failure to meet RBT targets in the latter half of the decade suggests this activity was under-funded or not prioritised.

Newer breath-testing devices (the Dräger Alcotest 7510) used by NZ Police provide much richer information on breath testing activity, including date and time stamps, location coordinates, test results and the type of test performed. Once the device roll-out is complete, and with hardware in place to enable more frequent data download, the data generated will help NZ Police in targeting high-risk drivers, locations and times, and allow for more frequent reporting of testing counts so under-performance against RBT targets is more readily detected and corrected.

The research also investigated how New Zealand's alcohol limits and penalties compare with similar jurisdictions and against best practice. It was found the current penalties, particularly for lower-level first offences, may not have had a strong deterrent effect, potentially diluting the effect of reducing the alcohol limit for drivers aged over 20.

In summary, this research project reinforces the importance of high-quality alcohol-related crash data to inform decision making, strategies and tactics aimed at reducing alcohol-related road trauma. Several alcohol-related crash and enforcement datasets were identified and reviewed in depth. It is anticipated this will give researchers and policy makers an improved understanding of these datasets and inspire further research into the relationship between legislation, enforcement and alcohol-related crash trauma.

Recommendations to improve the collection and reporting of alcohol-related crash and enforcement data are as follows:

- Review the NZ Police TCR application to identify improvements in the user interface that would improve the quality and accuracy of alcohol-related crash data collection by police officers.
- Improve the training of police officers in the completion of TCRs, highlighting the importance of accurate and reliable crash data and how this is used by other agencies.
- Investigate the root cause of the driver ‘breath refused’ and ‘blood pending’ errors observed from late-2018 onwards. This should include reviewing data translation and data validation processes. Efforts should focus on quantifying and correcting these errors (and the affected crash and driver data) so confidence in the quality of alcohol-related crash data from late-2018 is restored.
- Develop metadata for CAS users on the interpretation of alcohol-related data, including documenting changes in crash coding over time, describing how cause codes are determined, and noting any known or suspected errors in the data.
- Consider and investigate a new data-sharing approach to updating blood test results in crash records using test data provided to Waka Kotahi by the Institute of Environmental Science and Research (ESR) instead of NZ Police. This would improve the accuracy and timeliness of updating blood alcohol data and simplify crash reporting processes for police officers.
- Review the visibility of alcohol-related driver data in CAS against privacy legislation and determine whether some data should be further restricted, especially the raw blood and breath test results.
- Consider removing the cause code ‘101’ (alcohol suspected) for crashes that occurred after the system update in 2016, given this is coded against all drivers tested for alcohol regardless of whether alcohol was suspected.
- Support measures by NZ Police to improve the frequency of downloading and reporting breath test counts and undertake further investigation into how additional measures, such as RBT by mobile road safety base versus mobile car operations, are quantified and reported.
- Support NZ Police in continuing to attend non-injury crashes, to maximise the completeness of the CAS data.
- Consider cleaning erroneous sample dates and other human errors in the ESR datasets, to improve data analysis.
- Investigate the reasons behind the decreasing number of annual breath tests administered by NZ Police and why targets have not generally been met in recent years. Waka Kotahi and NZ Police should work together to develop an approach that meets New Zealand’s road safety goals and is achievable for NZ Police.

It is noted some recommendations could also be applied to drug-related data collection, given this involves a similar process for testing drivers and reporting test results.

Potential areas for future research are as follows:

- Undertake further analysis of NZ Police detailed data on breath testing (date, time and location of tests) and detailed offences data (age and gender of offenders) to investigate the degree to which enforcement activities are targeting high-risk locations as well as those drivers who are most at risk of being involved in an alcohol-related crash. This would also provide further evidence of high-alcohol hours in New Zealand and how targeting of enforcement activities could be improved.
- Undertake further research into longer term trends on self-reported attitudes to drink driving and the perception of enforcement (before 2016), to better understand how attitudes and perceptions shifted around 2014 to 2016 when the legal alcohol limits were reduced.

- Support ongoing efforts by the Accident Compensation Corporation to investigate the usefulness of a possible emergency department ‘alcohol’ flag in the Stats NZ Integrated Data Infrastructure.
- Undertake further research into best practice around alcohol limits, drink-driving penalties and driver licensing, to determine whether further legislative changes should be recommended.
- Undertake further research into analysis of Dräger Alcotest 7510 breath test data, to identify RBT checkpoints. This data could then be used to evaluate the effectiveness of checkpoints by location and time of day, enabling better targeting of future checkpoints.
- Identify and review previous New Zealand research that used CAS data coding for ‘alcohol suspected’, ‘breath refused’ and ‘blood pending’, to determine whether their conclusions might be affected if corrected CAS data was used.

Abstract

The consumption of alcohol impairs driving abilities, increasing the risk and severity of crashes. Good quality data on alcohol-related crashes and interventions is essential for policy makers and researchers to inform decision making and refine strategies and tactics aimed at reducing alcohol-related road trauma.

The purpose of this research was to examine how ‘fit for purpose’ alcohol-related crash data and related data are in New Zealand, and to study trends in these crashes and their connection with other factors. The research focused on alcohol-related crash trends between 2010 and 2020, around the time a change in legislation reduced alcohol limits for drivers aged 20 years and over (December 2014).

This research was undertaken during 2021 and 2022, and involved reviewing New Zealand, Australian and international literature, comparing practices among similar international jurisdictions, and engaging with stakeholders from relevant New Zealand organisations. Several alcohol-related crash and enforcement datasets were identified and reviewed in depth, including detailed breath testing, blood testing and offence datasets.

A major finding was that, while the alcohol-related crash data in the Waka Kotahi Crash Analysis System indicated alcohol-related deaths and serious injuries increased following the change in alcohol limit, this data contains errors and is unreliable. An analysis of blood test results for hospitalised drivers indicated the proportion of fatal and serious crashes with alcohol as a cause factor continued to reduce over time, despite the Crash Analysis System data suggesting otherwise.

The report makes recommendations for improving the collection and reporting of alcohol-related crash and enforcement data and identifies areas for further research. It is anticipated this report will give other researchers a better understanding of relevant datasets and inspire further research into the relationship between legislation, enforcement and alcohol-related crash trauma.

1 Introduction

The consumption of any amount of alcohol impairs driving abilities, increasing the risk and severity of crashes. At higher concentrations in the body, alcohol significantly increases the crash risk and potential for deaths and serious injuries to drivers, any passengers and other road users. Appropriate and effective interventions should dissuade drivers from driving after consuming alcohol and ensure drivers who choose to drive while under the influence of high levels of alcohol are detected and penalised. Drivers with substance-abuse problems should be screened and treated as appropriate.

Access to data on alcohol-related crashes and interventions is necessary to inform decision making, strategies and tactics aimed at reducing alcohol-related road trauma. Policy makers and researchers need confidence in this data to draw accurate conclusions on crash trends and the effectiveness of interventions such as alcohol limits, penalties and enforcement in reducing alcohol-related death and serious injury (DSI) crashes.

In 2021, Waka Kotahi NZ Transport Agency (Waka Kotahi) contracted Abley Limited to conduct an investigative study into New Zealand alcohol-related crash data and related datasets. The research examines how ‘fit for purpose’ alcohol-related crash data is and studies trends in such crashes over the past 10 years and their connection with other factors. This includes investigating the way in which data is collected and classified, and the extent to which this may be influencing crash trends.

The research objectives were to:

- review relevant international literature
- identify existing and potential forms and sources of alcohol-related crash data and describe their fitness for purpose
- explain the strengths and limitations of the New Zealand data and what can legitimately be inferred from it, including what new data and testing may be required
- identify significant attitudinal and behavioural factors related to alcohol and crashes
- examine trends in crashes where alcohol was identified as a factor and explore the relationship between these trends and other relevant changes that occurred in New Zealand over the same period
- make recommendations on new approaches to data collection, combination, analysis and use.

This research addresses a knowledge gap around recent trends in alcohol-related crashes and what insights the underlying data can reveal. A particular focus is on exploring alcohol-related crash trends following the 2014 change in legislation that reduced alcohol limits for drivers aged 20 years and over.

The research outcomes can be used to inform approaches to future data collection, analysis and interventions that seek to encourage safe choices and behaviours and, ultimately, reduce alcohol-related road deaths and serious injuries.

1.1 Research methodology

This research project was undertaken during 2021 and completed in early 2022 and involved three stages:

1. literature review and international comparison
2. stakeholder engagement
3. data analysis.

Together, the three research stages addressed the project objectives by ensuring relevant information from both reported sources and current practices is captured. The analysis and comparison of relevant datasets was necessary to better understand the usefulness and weaknesses of these datasets, especially in explaining recent alcohol-related crash trends.

1.1.1 Literature review and international comparison

The literature review examined current and emerging practices in New Zealand and Australia. An extensive local and international literature review of the factors contributing to alcohol-related crashes was also undertaken. The review included a combination of published literature and reports.

To help direct the literature review process, the following research questions were developed from the objectives and agreed with the project steering group:

- What are the trends in alcohol-related crashes in New Zealand, and what research already exists to explain these trends?
- What data already exists, or are potentially available regarding the incidence of drink driving, alcohol-related road trauma, and the factors that influence rates of drink driving and alcohol-related trauma?
- How has the collection and reporting of data changed over time?
- What are the limitations and gaps in the data, and what opportunities exist to improve data collection and reporting?
- What factors contribute to drink driving and alcohol-related road trauma in New Zealand?
- What can be learned from similar research and trends in other countries?
- Why has alcohol-related crash trauma in New Zealand not decreased when blood alcohol limits have reduced?

The international comparison involved examining websites and reports for a subset of countries and jurisdictions to examine alcohol-related crash trends and the steps these countries are taking to reduce drink driving and alcohol-related trauma. Together with the project steering group, the project team identified the following jurisdictions to include in this comparison, considering their cultural and geographical similarity to New Zealand, with a focus on those that have a reputation as leaders in best practice:

- Denmark
- Finland
- Ireland
- Norway
- Scotland
- Australia – jurisdictions of New South Wales (NSW) and Victoria.

1.1.2 Stakeholder engagement

The primary purpose of the engagement was to better understand existing data around alcohol-related crashes, including its structure and how it is collected and communicated to other parties. The secondary purpose was to identify other sources of data that could be used to enhance crash data, and to understand participants' impressions of current trends and behaviour.

The engagement stage was undertaken mainly during July and August 2021 and involved interviews with people representing organisations in relevant fields. This included government departments, advocacy groups, as well as teams within these organisations that collect or curate data that could be used to explain trends in alcohol-related harm. Representatives from the following New Zealand government agencies or

Crown research institutes were interviewed: New Zealand Police (NZ Police), Ministry of Justice, Institute of Environmental Science and Research (ESR), Ministry of Health, Stats NZ, Waka Kotahi and the Accident Compensation Corporation (ACC). Representatives from the advocacy groups Alcohol Healthwatch and New Zealand Automobile Association were also interviewed. Internationally, feedback was sought and received from Transport for NSW and the Department of Transport in Victoria, Australia, to understand their data collection and reporting practices.

1.1.3 Data analysis

The data analysis stage involved analysing selected datasets made available to the project team following the stakeholder engagement phase, as well as more in-depth investigation into alcohol-related crash reporting in New Zealand. The purpose was to establish the usefulness of the available data for understanding trends in drink driving and alcohol-related road trauma, focusing on trends observed over 2010 to 2020. Note that, due to limitations in the datasets provided and the scope of this project, the analysis undertaken in this stage was primarily exploratory.

1.2 Report structure

The findings across all stages of the research were collated and reported against topic-specific chapter headings. This approach was taken to improve readability and better address the research objectives.

The chapters and topics are arranged as follows:

- Chapter 2 sets the context on drink-driving and alcohol-related crash harm, including a summary of drink-driving legislation, penalties, attitudes and perceptions in New Zealand, with international comparisons where relevant.
- Chapter 3 explores alcohol-related crash data collection in New Zealand, including a detailed review of data collection and reporting processes and how these have changed over time. This chapter includes stakeholder perceptions of this data and identifies crash data linkage projects.
- Chapter 4 describes drink-driving and enforcement practices in New Zealand, focusing on how data on drink driving and offences is collected and reported. This includes a comparison with similar international jurisdictions and a review of public perceptions of alcohol-impaired driving and enforcement.
- Chapter 5 identifies additional datasets that provide context on alcohol use factors and alcohol-related harm that could influence rates of drink driving.
- Chapter 6 identifies and describes factors that influence alcohol use, alcohol-related harm, drink-driving and alcohol-related crash rates.
- Chapter 7 presents the outputs of the exploratory analysis of selected datasets made available to the project team, as well as further investigation into the coding of alcohol-related crashes in CAS. The purpose was to establish the usefulness and limitations of the data available for understanding trends in drink driving and alcohol-related road trauma, focusing on trends observed from 2010 to 2020.
- Chapter 8 collates and summarises the key findings from all stages of the research, integrating findings across topics and chapters to address the research objectives. These learnings were aggregated and reported under the following question headers:
  - What are the trends in drink-driving and alcohol-related crashes in New Zealand?
  - What data already exists, or are potentially available regarding drink-driving and alcohol-related trauma?
  - Why has alcohol-related crash trauma in New Zealand not decreased when blood alcohol limits have reduced?

- Chapter 9 outlines the conclusions arising from the research and presents recommendations for improving the collection and reporting of alcohol-related crash and enforcement data, as well as recommendations for future research.

1.3 Impact of the COVID-19 pandemic in 2020 and 2021

The collection and reporting of some datasets reviewed in this report were affected by the COVID-19 pandemic, particularly the New Zealand national ‘level 4’ lockdown from 25 March to 27 April 2020, and less restrictive national or regional ‘level 3’ lockdowns throughout 2020 and 2021. The lockdowns changed people’s travel behaviour and affected enforcement activities. In particular, the following trends in 2020 and 2021 could be fully or partially attributed to the impact of COVID-19 in New Zealand:

- fewer reported road DSIs
- fewer breath tests being undertaken by NZ Police (for resourcing or health and safety reasons)
- fewer drink-driving offences reported by NZ Police, due to less roadside breath testing being undertaken.

Changes in drink-driving behaviour due to the effect of the COVID-19 pandemic are unclear at this stage because people travelled less during lockdowns, potentially reducing the incidence of driving after consuming alcohol. However, the disruption caused by lockdowns could have also shifted rates of alcohol consumption, with rates increasing among some population groups.

The reader should take these factors into account when interpreting data and trends for 2020 and 2021.

2 Context

Most adults in New Zealand drink alcohol, and many do so responsibly and in moderation (Ministry of Health, 2015, 2020). However, alcohol consumption is also associated with a range of harms. Consuming alcohol before driving impairs driving skills, and impaired drivers are a danger to themselves and other road users. Legislation that sets acceptable blood or breath alcohol limits for drivers, combined with adequate penalties and enforcement are important interventions for discouraging driving after consuming alcohol and reducing alcohol-related DSIs.

2.1 Alcohol impairment and crash risk

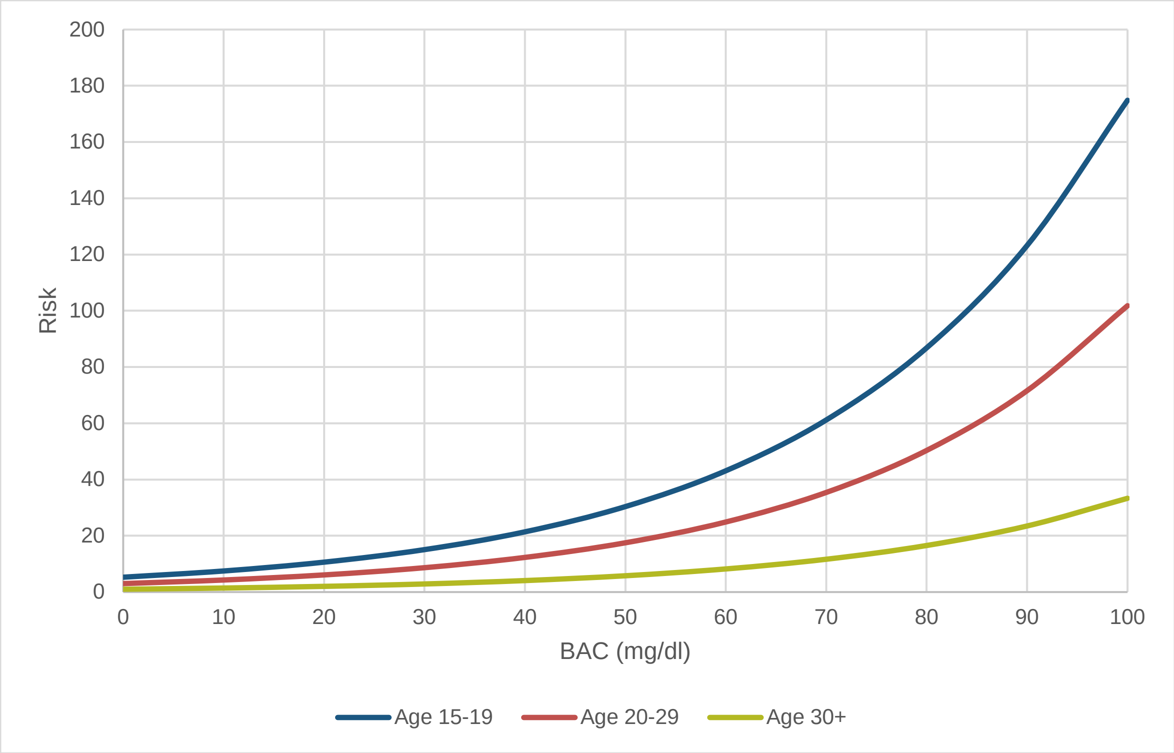
The consumption of any amount of alcohol impairs driving skills and no threshold blood alcohol concentration (BAC) exists below which drivers will be unimpaired (Ferrara et al., 1994; Moskowitz & Robinson, 1988; Ogden & Moskowitz, 2004). Even at low levels of consumption, and even though an individual may not feel or appear 'drunk' to others, the cognitive and physical abilities employed when driving will be adversely affected. The effects of alcohol are so prevalent that alcohol impairment is the standard against which other impairment is measured (Shinar, 2017). The level of impairment can vary significantly, however, across individuals at the same BAC, although the level of impairment will always increase as BAC increases. As a result, it is unsurprising that drink driving is primarily associated with binge-drinking, defined in New Zealand by the Health Promotion Agency (HPA) as six standard drinks[1] in a short period. Not only is impairment high at these levels of consumption, but the likelihood of a person driving is higher due to reduced decision-making abilities (Shinar, 2017).

It is long established that BAC is linked to crash rates. As impairment increases with alcohol consumption, it follows that as blood alcohol levels increase, the risk of a fatal crash occurring also rises (Compton & Berning, 2015; Keall et al., 2004; Voas et al., 2012; Zador et al., 2000). Furthermore, the risk of a fatal crash rises proportionally faster relative to the driver's blood alcohol levels. Up to a BAC of roughly 200 mg/dl,[2] the risk rises exponentially, doubling for every increase of 20 mg/dl. An adult can be within the legal BAC limit for driving and still have a risk of fatal injury more than five times that of a sober driver. Age is also a major factor in fatal crash risk, with increased risk for drivers aged under 30 and even greater risk for those aged under 20. Figure 2.1 shows the fatal injury risk for drivers of different age groups at blood alcohol levels between 0 mg/dl and 100 mg/dl (the current legal limit is 50 mg/dl for drivers 20 years and older), relative to a driver aged 30-plus with no alcohol (for which risk = 1). All data is for a driver with one passenger. Risk is further elevated for drivers with two or more passengers or driving alone.

[1] The Australia New Zealand Food Standards Code defines a standard drink as the amount of a beverage that contains 10 grams of pure alcohol at 20°C.

[2] Milligrams of alcohol per 100 millilitres (1 decalitre) of blood. A range of conventions can be used for expressing BAC. In addition to mg/dl, which can also be expressed as mg/100ml, a common shorthand is to express it as a percentage (ie 50 mg/dl = 0.05[%]). Some countries also measure BAC by mass rather than volume (eg in milligrams per gram). The unit mg/dl has been chosen in this research report because it is commonly used internationally, easy to understand and visually unobtrusive.

Figure 2.1 Fatal injury risk for blood alcohol concentration (BAC) of 0 milligrams per decilitre (mg/dl) to 100 mg/dl by driver age group, relative to that of a sober driver aged 30-plus with one passenger (from Keall et al., 2004)



Many factors can affect BAC beyond the amount of alcohol an individual has drunk (Charlton & Starkey, 2013; Shinar, 2017). These include characteristics like weight, gender and personal metabolism, as well as the temporal context, for instance, the duration of drinking and time elapsed since finishing. It is common to see charts, calculators and ‘rules of thumb’ that are designed to equate a certain number of standard drinks, but, due to personal variation, these can only ever be approximative. A danger is that these can frame a certain amount of alcohol consumption before driving as ‘acceptable’. Recent Waka Kotahi and NZ Police drink-driving advertising has reflected this line of thinking in focusing on encouraging not driving at all after drinking.

In addition to increasing the risk of an accident, alcohol consumption can increase the severity of crashes. Even with a relatively low BAC, drivers impaired by alcohol drive significantly faster and are less likely to wear seatbelts than sober drivers (Research NZ, 2012). As crash severity increases, the likelihood of being killed increases faster for alcohol-involved drivers than for those where no alcohol was involved (House et al., 1982; Shinar, 2017). Controlled for severity, the risk of death is twice as high for drivers having drunk any amount of alcohol (Waller et al., 1986).

As many as 40% of casualties in alcohol-related crashes are not drivers who have consumed alcohol but, rather, their passengers and other road users, and this proportion is similar across fatal, serious and minor injuries (Research NZ, 2012).

2.2 Drink-driving legislation

The Land Transport Act 1998[3] sets out the current legal breath and blood alcohol limits for driving, and the offences and penalties that can be applied when these limits are exceeded.

2.2.1 Breath and blood alcohol concentration limits

In addition to BAC, New Zealand also has legislated equivalents for breath alcohol concentration (BrAC), measured as micrograms of alcohol per litre of breath (µg/l). Both measurements can be used evidentially.

Separate breath and blood alcohol limits are in place for drivers aged under 20 (Table 2.1) and drivers aged 20 years or older (Table 2.2). Drivers under the age of 20 have a 'zero alcohol' limit and are not permitted to drive with any alcohol in their system. The permitted alcohol level for drivers 20 years of age and older is a BAC not exceeding 50 mg/dl or a BrAC not exceeding 250 µg/l.

Table 2.1 Blood and breath alcohol concentration limits for drivers aged under 20

Tier	BAC range	BrAC range
Lower tier	>0 mg/dl and ≤30 mg/dl	≤150 µg/l
Upper tier	>30 mg/dl	>150 µg/l

Note: BAC = blood alcohol concentration; BrAC = breath alcohol concentration; mg/dl = milligrams per decilitre; µg/l = micrograms per litre.

Table 2.2 Breath and blood alcohol concentration limits for drivers aged 20 and over

Tier	BAC range	BrAC range
Lower tier	>50 mg/dl and ≤80 mg/dl	>250 mg/dl and ≤400 µg/l
Upper tier	>80 mg/dl	>400 µg/l

Note: BAC = blood alcohol concentration; BrAC = breath alcohol concentration; mg/dl = milligrams per decilitre; µg/l = micrograms per litre.

The penalties imposed for exceeding a legal limit depend on the band (or tier) in which the driver's breath or blood alcohol level is recorded. Lower tier offences result in an infringement notice issued by NZ Police, which includes a fine and demerit points. Drivers exceeding the higher tier threshold will be charged with an offence and, if convicted, the penalty is determined by the courts. A detailed discussion of penalties and sentencing options for drink-driving offences is given in section 2.2.2.

2.2.1.1 Recent changes in breath and blood alcohol concentration limits

Breath and blood alcohol concentration limits have been amended twice since 2010 through the following amendment Acts:

- Land Transport (Road Safety and Other Matters) Amendment Act 2011[4] (the 2011 Act)
- Land Transport Amendment Act (No 2) 2014[5] (the 2014 Act).

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[3] See www.legislation.govt.nz/act/public/1998/0110/latest/DLM433613.html for further information.

[4] See www.legislation.govt.nz/act/public/2011/0013/latest/DLM3231104.html for further information.

[5] See www.legislation.govt.nz/act/public/2014/0057/latest/DLM5735705.html for further information.

The 2011 Act introduced the current zero alcohol limit for drivers under 20 years of age. Before this, the legal limit for under-20-year-olds was a BAC of 30 mg/dl or BrAC of 150 µg/l. A lower tier of offence was set for offenders with a BAC exceeding zero but not exceeding 30 mg/dl or a BrAC exceeding zero but not exceeding 150 µg/l.

The 2014 Act reduced the limit for drivers aged 20 and older from 80 mg/dl to 50 mg/dl for BAC, and from 400 µg/l to 250 µg/l for BrAC. A lower tier of offence was set for offenders with a BAC exceeding 50 mg/dl but not exceeding 80 mg/dl or BrAC exceeding 250 µg/l but not exceeding 400 µg/l.

2.2.2 Penalties

The Land Transport Act 1998 prescribes the penalties that can be issued as infringements or ordered by the court against drink drivers. The penalties vary, depending on the driver's age (under-20 or 20 years and older), their evidential BAC or BrAC, their previous offences and whether someone has been killed or injured because of their actions.

Lower tier infringement penalties are demerit points that accumulate towards licence suspension (50 points per offence with suspension at 100 points) and a fine. The 2011 and 2014 Acts set the fine accompanying an infringement notice at $200 in the Land Transport (Offences and Penalties) Regulations 1999.[6] The amount has not changed since it was introduced.

Drivers tested with a BrAC above the infringement level can be given an on-the-spot (roadside) licence suspension by NZ Police. Courts can then impose higher fines, longer periods of licence suspension or disqualification, and alcohol interlock or zero alcohol licences. Drivers could face imprisonment for the most serious offences.

2.2.2.1 Alcohol interlock licences and zero alcohol licences

An alcohol interlock licence is a court-imposed licence restriction that requires the licence holder to only drive motor vehicles with an alcohol interlock device fitted. Alcohol interlock licences first became a sentencing option in September 2012, with the commencement of the 2011 Act. The Land Transport Amendment Act 2017[7] then made them mandatory from July 2018 for repeat offences within five years, and for first offences where alcohol levels were recorded above 160 mg/dl (blood) or 800 µg/l (breath). This licence must be held for at least 12 months, with exit dependent on the driver demonstrating either six months without violations or completing an approved drug and alcohol assessment and demonstrating three months without violations.

The mandatory zero alcohol licence was introduced in September 2012 (under the 2011 Act) for repeat offenders (ie those convicted of more than one drink-drive offence committed within five years). Drivers with a zero alcohol licence are required to hold the licence for three years and must maintain a zero alcohol limit when driving.

2.2.3 International comparison

It is estimated between 5% and 35% of global road deaths are alcohol-related (World Health Organization [WHO], 2018a, 2018b). Despite this, the national drink-driving laws in many countries do not align with best practice. In 2018, the WHO considered 45 countries to have laws meeting drink driving best practice, including New Zealand, with more than half the countries meeting best practice being either high-income or in Europe.

[6] See www.legislation.govt.nz/regulation/public/1999/0099/latest/DLM280110.html for more information.

[7] See www.legislation.govt.nz/act/public/2017/0034/latest/DLM6960717.html for more information.

2.2.3.1 Blood alcohol limits

The WHO (2018b) identifies 50 mg/dl BAC for the general population and 20 mg/dl BAC for young / novice drivers as best practice thresholds. Since the 2014 Act came into force, New Zealand's legal alcohol limits have met these thresholds. Furthermore, although not declared as a best practice criterion, the WHO also recommends a limit of 20 mg/dl for commercial drivers, because they transport passengers and larger vehicles and are more likely to lead to DSIs in the event of a crash. At the time of writing, the New Zealand limits do not make a distinction for commercial drivers.

Among the seven jurisdictions compared, all also have BAC limits at 50 mg/dl or below (Table 2.3). The only jurisdiction with a lower limit is Norway, which has set all limits at 20 mg/dl. Three jurisdictions (Denmark, Finland and Scotland) do not have a lower limit for young / novice drivers, using the same 50 mg/dl general limit. Two jurisdictions have reduced limits for commercial drivers.

Table 2.3 Summary of blood alcohol concentration limits in New Zealand and comparable jurisdictions

Jurisdiction	General limit	Commercial driver limit	Novice driver limit
New Zealand	0 milligrams per decilitre (mg/dl) (drivers under 20 years old) 50 mg/dl (drivers 20 years and older)	General limits apply	General limits apply
Australia – New South Wales	50 mg/dl	20 mg/dl for drivers of public vehicles or vehicles of gross vehicle mass of more than 13.9 tonnes, carrying dangerous goods	0 mg/dl
Australia – Victoria	50 mg/dl	0 mg/dl for drivers of vehicles of more than 4.5 tonnes gross vehicle mass, buses or commercial passenger vehicles, and driving instructors	0 mg/dl
Denmark	50 mg/dl	General limit applies	General limit applies
Finland	50 mg/dl	General limit applies	General limit applies
Ireland	50 mg/dl	20 mg/dl	20 mg/dl
Norway	20 mg/dl	20 mg/dl	20 mg/dl
Scotland	50 mg/dl	General limit applies	General limit applies

New Zealand is the only jurisdiction where a young / novice limit is applied based on age rather than years of experience. 'Novice' is a relative term that depends on the legislation in place in each jurisdiction, but typically refers to the period before a driver is fully licenced. To understand what this means in practice, it is important to consider the licensing requirements in each country (Table 2.4).

Table 2.4 Summary of licensing age requirements in New Zealand and comparable jurisdictions

Jurisdiction	Minimum unsupervised driving age (years)	Restricted licence period	Minimum full licence age (years)
New Zealand	16½	1 year	17½
Australia – New South Wales	17	3 years	20
Australia – Victoria	18	4 years	22

Jurisdiction	Minimum unsupervised driving age (years)	Restricted licence period	Minimum full licence age (years)
Denmark	18	3 years	21
Finland	18	2 years	20
Ireland	17	2 years	19
Norway	18	2 years	20
Scotland	17	n/a	17

New Zealand has the lowest age for unsupervised driving (16½ years) and is also near the lower end for the minimum age at which a full licence can be obtained (17½ years with an advanced driver course). It is possible for New Zealanders to have a full licence before drivers in Denmark, Finland, Norway and Victoria, Australia, are even able to obtain a restricted licence. This may provide justification for New Zealand's BAC limits being age-based rather than based on years of experience or licence level.

2.2.3.2 Penalties

Penalties for drink driving are complex, with each jurisdiction prescribing a range of punishments with variations in severity, depending on the driver's BAC level and previous offences. Table 2.5 summarises the lowest level of drink-driving penalties that apply for a first offence.

Table 2.5 Summary of first-offence penalties in New Zealand and comparable jurisdictions

Country	Minimum penalty (first offence)	Applicable at
New Zealand	$200 fine + 50 demerit points	• 51 milligrams per decilitre (mg/dl) to 80 mg/dl (age 20+) • 0 mg/dl to 30 mg/dl (age under 20)
Australia – New South Wales	A$581 fine + three-month disqualification	• 0 mg/dl to 80 mg/dl (novice) • 20 mg/dl to 80 mg/dl (other) • 50 mg/dl to 80 mg/dl (standard)
Australia – Victoria	A$545 fine + licence or learner permit cancellation + three-month disqualification + six-month alcohol interlock + course	50 mg/dl to 69 mg/dl (age 26+)
	A$545 fine + licence or learner permit cancellation + six-month disqualification + six-month alcohol interlock + course	50 mg/dl to 69 mg/dl (age under 26)
	A$454 fine + licence or learner permit cancellation + three-month disqualification + six-month alcohol interlock + course	Less than 50 mg/dl (learner, provisional and zero-BAC licences)
Denmark	Fine (net monthly income × blood alcohol concentration in g/l) + conditional withdrawal of licence (new theory test + new driving test within six months) + mandatory 12-hour course	51 mg/dl to 120 mg/dl
Finland	Fine (up to around 20 days disposable income) + two-month disqualification or 12 to 36 month alcohol interlock order	50 mg/dl to 59 mg/dl
Ireland	€200 fine (around $330) + three-month disqualification	• 50 mg/dl to 80 mg/dl (standard) • 20 mg/dl to 80 mg/dl (learner, novice, professional)
Norway	Fine (court-imposed based on income and financial situation)	20 mg/dl to 49 mg/l

Country	Minimum penalty (first offence)	Applicable at
	Fine (court-imposed based on income and financial situation) + 12 to 18 months disqualification	50 mg/dl to 80 mg/l
Scotland	Court-imposed fine, disqualification or imprisonment, depending on charge brought, seriousness of offence and mitigating circumstances	Above 50 mg/l

Many countries have zero tolerance for drivers who are caught with a BAC over the limit. Denmark, Finland, Norway and Scotland automatically charge drivers with an offence leading to court proceedings. The other three jurisdictions give police the option to bypass the courts by administering an infringement notice for low-level offending. This is similar to New Zealand. However, whereas in New Zealand an infringement notice includes demerit points, the infringement offences in these jurisdictions include a disqualification period of at least three months.

Other countries are much quicker to disqualify drivers than New Zealand. For a first offence at a BAC of 50 mg/dl, all the other jurisdictions have automatic disqualification, except for Denmark, where disqualification is conditional, and Scotland, where disqualification is possible but up to the courts to decide. In most cases, disqualification for a low-level first offence is for a few months, with Norway being a notable outlier with 12 to 18 months' disqualification possible.

At the time of writing, the fine accompanying an infringement notice in New Zealand is set at $200. Among jurisdictions that allow police to issue infringements, this amount is comparably low; for example, in both NSW and Victoria, Australia, the fine is several times higher (taking into account exchange rates).

In the Northern European countries (Denmark, Finland and Norway), it is common to link fines to a driver's ability to pay. The schedule of fines in these countries is based on net monthly income and ability to pay, with the fine calculated depending on the driver's measured BAC. In some cases, minimums are applied, so for individuals with modest incomes this can mean fines comparable to the infringement fine in New Zealand. For high-income individuals, this can mean much higher fines need to be paid. Ability to pay is also taken into account in Scotland, where fines are determined by the court with there being no maximum amount.

2.2.3.3 Alcohol interlocks

Alcohol interlock programmes for offenders exist in Finland and Denmark. Finland's programme came into effect in 2008 and is estimated to have prevented thousands of participants from drink driving. The reoffence rate for participants was found to be 5.7% as opposed to the usual 30% (European Transport Safety Council [ETSC], 2020b). Offenders can apply to enter the programme irrespective of their measured BAC. In 2020, Denmark's interlock programme had about 450 drivers participating (ETSC, 2020b). Depending on the severity of the drink-driving offence, offenders can opt to enter the programme to avoid a licence suspension.

All Australian states have alcohol interlock programmes. In Victoria and NSW, the programmes require repeat offenders or first-time offenders with a BAC greater than 150 mg/dl to fit an alcohol interlock as a condition of relicensing (Austroads, 2015).

Ireland and Scotland do not have interlock programmes. In the United Kingdom, the Department for Transport committed in its Road Safety Statement 2019 to investigating the feasibility of using alcohol interlocks for offender rehabilitation. Similarly, in Ireland, investigations into the cost benefit of an interlock programme are ongoing.

The voluntary fitting of alcohol interlocks in commercial vehicles is actively encouraged in Denmark, Finland and the United Kingdom (Austroads, 2015). In Finland, they are required in commercial vehicles that have been organised or funded by public institutions to transport children, the elderly and disabled people. Norway is phasing in the mandatory use of interlocks in all public transport vehicles, which will be complete from 2024. The possibility of requiring all vehicles to have interlocks, and potentially being sold with interlocks installed already, is being explored by the Norwegian government and the merits are being publicly discussed.

2.3 Drink-driving attitudes and perceptions

The report *Public Attitudes to Road Safety*, prepared by Kantar for Waka Kotahi (2020a), provides an insight into self-reported attitudes to road safety issues and behaviour. The report summarises findings from a public survey undertaken between May and July 2020, identifying the following observations on attitudes to alcohol-impaired driving:

- A minority of New Zealanders (9%) think careful driving after drinking will avoid crashes.
- Around a third of drivers think it is difficult to keep track of what you're they're drinking in social occasions and to drink less than the group.
- Few drivers (3%) claim to be comfortable having more than one or two drinks in an hour if they were driving immediately afterwards, and only 12% claim to have driven at least once while slightly intoxicated in the past 12 months, compared with 18% in 2016.
- Nearly a quarter of New Zealanders would use back streets to drive home after drinking if unsure whether they are over the limit or not.

Twelve percent of surveyed licensed drivers reported driving at least once during the past 12 months while slightly intoxicated, a statistically significant reduction from 18% recorded in 2016. This could be associated with the BAC limit reduction in 2014 or other factors. It is not clear how the COVID-19 lockdowns in 2020 might have affected drink-driving behaviour.

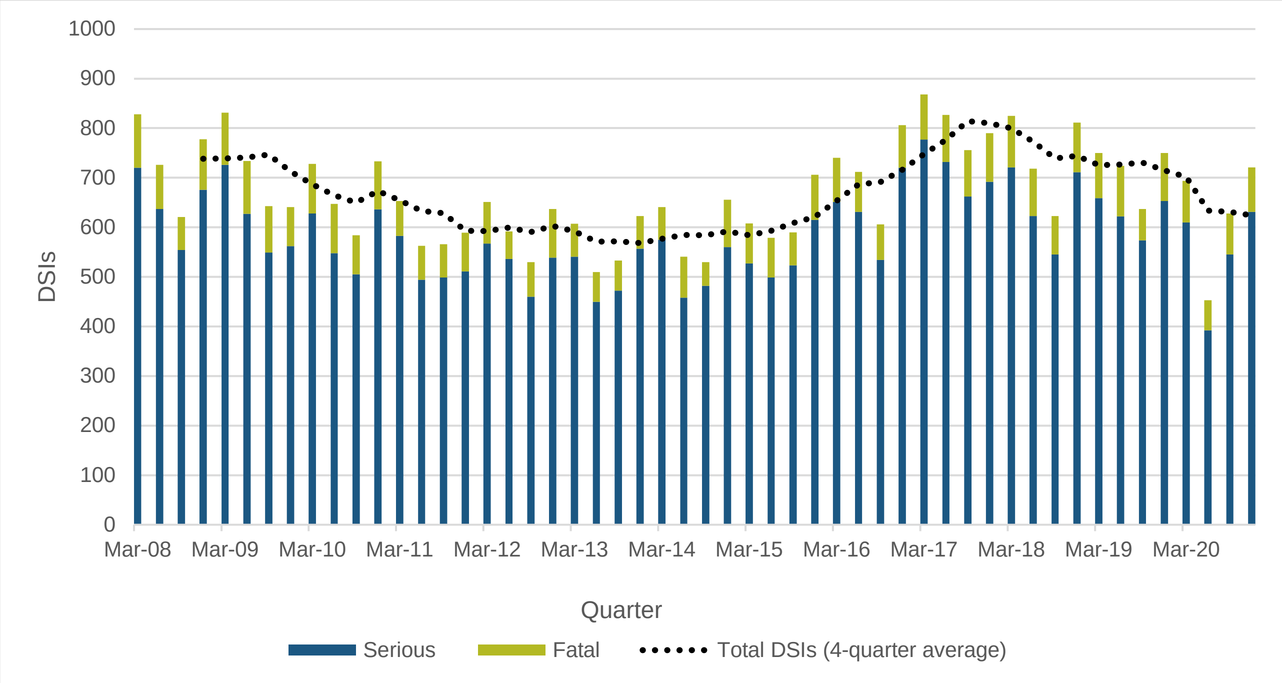
The report identifies no other major, statistically significant changes in attitudes to drink driving between 2016 and 2020, but changes in perceptions of drink-driving enforcement were observed over this period (as reported in section 4.4 of this report).

2.4 New Zealand road safety trends

The *Global Status Report on Road Safety 2018*, released by the WHO (2018b), shows that, internationally, the rate of road traffic deaths has stayed roughly steady in recent decades, though it has generally decreased among high-income countries. New Zealand's road traffic death rate, estimated at 7.8 per 100,000 people in the WHO report, is not dissimilar to the average for high-income countries, which is 8.3 per 100,000 people. However, not all countries in the high-income group are like New Zealand in having laws covering significant crash risk factors that are generally well aligned with best practice, demonstrating a good standard of enforcement, and dedicating significant investment into road safety. Compared with world leaders like Switzerland (2.7), Norway (2.7), Sweden (2.8) and the United Kingdom (3.1), New Zealand's death rate of 7.8 per 100,000 people is more than double. It is also significantly higher than the rates in other comparable countries like the Netherlands (3.8), Germany (4.1), Ireland (4.1), Australia (5.6) and Canada (5.8).

Figure 2.2 shows quarterly reported DSIs between 2008 and 2020 (Waka Kotahi, 2020b). The peak in 2017 and 2018 was an increase of a third over the historically low levels reached in 2011 and held steady through to 2014. While the evidence shows that DSIs reduced in 2019, at the time of writing, levels remain higher than their previous low, and it is unclear whether this is a long-term trend. Note that data from 2020 is affected by the COVID-19 pandemic and so does not provide reliable evidence of change. This effect is particularly visible in the June quarter of 2020.

Figure 2.2 Quarterly deaths and serious injuries (DSIs) recorded across all road crashes, March 2008 to December 2020



The increase in DSIs between 2014 and 2017 came in the middle of New Zealand's *Safer Journeys 2010–2020*[8] road safety strategy, and at a time when the drink-driving legislation was being changed to better align with international best practice. Therefore, the increase in DSIs was not only undesired but unexpected.

Taking these figures at face value and ignoring potential data limitations, this increase is a departure from the long-term trends seen not only in New Zealand but Europe and the United States of America (Shinar, 2017). New Zealand is not the only country to experience such a reversal, however, because both Australia and the United States of America experienced increases in road fatalities in the period 2015 to 2017, which have also since reduced (Bureau of Infrastructure, Transport and Regional Economics, 2020; National Highway Traffic Safety Administration, 2019).

The New Zealand *Road to Zero* 2020 to 2030 strategy identifies 'road user choices' as one of five focus areas for delivering this strategy over the next 10 years, recognising that poor choices continue to be a major factor contributing to DSIs (Ministry of Transport, 2019a). Other focus areas identified in the strategy are shifting public attitudes and behaviour, and the delivery of effective enforcement targeted towards risks.

[8] See www.nzta.govt.nz/safety/what-waka-kotahi-is-doing/our-advertising/safer-journeys/ for more information.

2.4.1 International comparison

Table 2.6 compares total road crash fatalities and fatality rates among comparable jurisdictions.

Table 2.6 Population and road fatalities in New Zealand and comparable jurisdictions in 2019

Jurisdiction	Population	Fatalities	Fatalities per 100,000	Source
New Zealand	4.9 million	352	7.1	ITF (International Transport Forum) (2020)
Australia – New South Wales	8.1 million	353	4.4	Transport for NSW (2021)
Australia – Victoria	6.6 million	266	4.0	Transport Accident Commission (2021)
Finland	5.5 million	209	3.8	ITF (2020)
Denmark	5.8 million	199	3.4	ITF (2020)
Scotland	5.5 million	158	2.9	Transport Scotland (2020)
Ireland	4.9 million	140	2.8	ITF (2020)
Norway	5.3 million	108	2.0	ITF (2020)

Every jurisdiction in the comparison shows a lower fatality rate, and this has also decreased at a faster rate, compared with New Zealand. The rate of fatalities per 100,000 population fell by 41% in New Zealand between 2019 and 2000. All other jurisdictions saw drops of at least 50% in the same period, with Ireland (75%), Norway (73%) and Denmark (63%) leading the way (ITF, 2020).

2.5 Drug-driving

This research focuses on alcohol alone and does not consider drug-driving directly. However, alcohol and drugs are known to frequently co-occur and, when they do, are riskier than either drugs (including some combinations of drugs) or alcohol alone (Frith, 2020; Malhotra et al., 2017; Poulsen et al., 2014; Robertson et al., 2014). Behaviour around drug-driving therefore cannot be completely ignored.

It is important to note that drug-driving is not limited to illegal drugs, although often these are the most studied. Prescription and over-the-counter drugs can also impair driving (Rudisill et al., 2016). Surveys undertaken by Starkey and Charlton (2017) found that between 25% and 50% of drivers who reported taking drugs of all types admitted to driving within three hours more than once a week in the previous year. Most drugs taken in these cases were on prescription for medical reasons. The most common were strong painkillers (9.81%), antidepressants (6.05%), anti-nausea medications (3.50%), anti-anxiety medications (2.86%) and cannabis (2.18%). Almost 17% of survey respondents admitted to driving within three hours of taking a combination of drugs (including alcohol) more than once a week.

3 New Zealand alcohol-related crash data and trends

This chapter describes how alcohol-related crash data is collected, coded and reported in New Zealand. It covers changes in practices that affect how alcohol-related crash data is reported, and trends in alcohol-related DSI crashes over time. Much of the information on practices around crash reporting was sourced from interviews with representatives from NZ Police, Waka Kotahi and ESR. This was supplemented with material from published reports, where available.

Stakeholder perspectives on alcohol-related crash data are also summarised, and a comparison of New Zealand practices with Victoria and NSW jurisdictions is provided. These Australian states were identified by the project steering group, who asked the research team to identify good practice that could be translated into the New Zealand context.

This chapter focuses mainly on blood alcohol sample collection and analysis, with breath testing practices and data covered in more detail in chapter 4 under drink-driving enforcement.

3.1 Alcohol crash data collection

The repository for crash data in New Zealand is the Crash Analysis System (CAS). CAS is a sophisticated database with multiple levels of data access. This allows personal data to be protected, in line with legislated privacy and official information requirements, while making redacted crash data available for road safety research and policy.

Information about crashes is collected at the scene of the crash by the attending police officer. Crashes can also be reported to NZ Police by members of the public. However, alcohol is unlikely to be recorded as a factor in these types of reports, because the people involved are less likely to admit alcohol was a factor, and it would be difficult to prove the level of impairment.

NZ Police records crashes as traffic crash reports (TCRs). The TCR includes data about the crash, the vehicle(s) involved and the people involved. This data is provided by the police officer to the best of their knowledge, following their investigation of the crash. TCRs are then used to generate and populate the crash record in CAS.

TCRs are usually created by the first police officer on the scene. They can be created, completed and submitted at the scene through the ‘OnDuty’ application on the officer’s iPhone. Officers can also use a desktop application to update and resubmit information on the crash later. In addition to completing TCRs, NZ Police also prepares serious crash investigation reports that are sent to Waka Kotahi.

3.1.1 Post-crash alcohol testing

Alcohol testing is administered to most drivers involved in crashes attended by police officers, meaning most instances of drink driving resulting in a DSI crash will be captured in TCRs. The way that breath or blood are tested for alcohol depends on whether the driver involved in a crash dies, is injured or uninjured.

ESR is responsible for providing all forensic toxicology blood testing for NZ Police, including testing for the presence of alcohol and drugs. If a driver dies, a blood sample is usually taken by the pathologist and sent to ESR to analyse the presence and level of alcohol and/or other drugs. In some circumstances, it may not be possible to take a blood sample from a deceased driver, for example, if the body was badly damaged due to fire. In practice, blood samples are obtained and tested for most drivers (estimated at 85% to 90% by stakeholders).

If a driver is injured and goes to hospital, they are accompanied by a police officer. At the hospital, a medical officer takes a blood sample, if it is safe to do so, which is provided to the police officer and submitted to ESR for analysis. This is done in much the same way as for a fatality, except the individual must be identified as ‘living’ so that the data is subject to appropriate privacy protection.

If uninjured, the driver is tested for the presence of alcohol by the attending police officer using the standard roadside breath testing procedure (as described in section 4.1). If a driver refuses the breath test, they can opt for an evidential blood test. If the driver declines both the breath and blood test, they are charged by NZ Police as if they were six times the legal limit.

ESR provides the results of evidential blood tests to NZ Police, which may not receive them for up to a couple of weeks after the sample is taken. Once the police officer receives the test result, they are required to update the TCR using the desktop application. The officer also uses the BAC to determine whether the driver will be charged with a drink-driving offence.

3.1.1.1 Institute of Environmental Science and Research evidential blood alcohol data

ESR maintains its own databases of tested blood alcohol levels. For living drivers, this distinguishes between those who were tested at a hospital following a crash, as opposed to drivers who refused a random breath test (RBT) and opted for an evidential blood test (which may or may not be associated with a crash). ESR holds results for most fatalities, using the samples provided by the coroner. If a driver was initially tested in hospital as a living driver but later dies due to injuries from the crash, the blood would have been tested as a part of the living driver process and ESR has no way to confirm this later as a fatality. Regardless, it is possible for ESR to extract and supply this information in an aggregated form for further analysis.

ESR issues monthly reports on the results of blood tests to be stored in a central database hosted by NZ Police. ESR also recently started issuing reports to the CAS team at Waka Kotahi, but it is not known if these are being used by Waka Kotahi to update or correct individual crash reports (where the police officer has not updated the crash report).

3.1.1.2 Hospital blood alcohol data

Hospital staff may collect blood and test for alcohol to help with the treatment of people injured in a crash. This information is stored against the individual’s case notes, and the samples destroyed shortly after. For privacy reasons, this information is not readily available, however, hospital staff may inform police officers of the blood alcohol level from these samples (which is then sometimes recorded in the TCR under the notes by the police officer). Note that caution must be used in interpreting the results of tests for alcohol undertaken in hospital because they may be reported in different units to evidential blood tests. Hospital test samples are separate from the evidential blood samples and are not provided to ESR or NZ Police. They are destroyed when no longer needed and cannot be used for prosecution.

3.1.2 Recording and coding alcohol impairment

The TCR includes fields for the officer to indicate whether a driver involved in a crash was impaired by alcohol. When the TCR data is submitted, CAS automatically uses the values provided by NZ Police to populate its schema. Information on alcohol impairment or suspicion is then translated into CAS, as shown in Table 3.1. The results in the fields in Table 3.1 are visible to most users with access to CAS.

Table 3.1 Alcohol fields in the Crash Analysis System

Field	Description
Alcohol suspected	Indication of whether the driver of a vehicle is suspected of consuming alcohol before driving, and whether they were tested. This is either 'Not Suspected', 'Suspected-Tested', 'Suspected-Not Tested' or 'Unknown'
Alcohol breath screening	The result of the initial test performed by a police officer to determine if alcohol was consumed: either 'Screen:[-]', 'Screen[+]', 'Breath Refused' or 'Nil'
Alcohol breath reading	The evidential breath alcohol reading (numerical value)
Alcohol breath result	Indicates whether the driver had an evidential breath test or refused the test: either 'Breath Tested', 'Breath Refused' or 'Null'
Alcohol blood reading	The evidential blood alcohol reading (numerical value)
Alcohol blood result	Indicates whether the driver had an evidential blood test, and the status of this test: 'Blood Pending', 'Blood Tested', 'Blood Refused' or 'Null'

CAS also automatically derives crash cause codes for drivers involved in crashes from the data in the TCR. Collectively, these codes are used to calculate, aggregate and report statistics around alcohol-related crashes. At the time of writing, three codes are used by CAS relating to the presence of alcohol for parties involved in the crash. The codes are as follows:

- '101' (alcohol suspected): indicating the attending police officer suspected alcohol involvement but does not have a breath or blood alcohol result (or the result is pending).
- '102' (alcohol test below limit): indicating a breath or blood test was undertaken and the result was below the legal limit for the driver.
- '103' (alcohol test above limit or test refused): indicating a breath or blood test was undertaken and the result was above the legal limit, or testing was refused (and the driver is therefore legally considered to be over the limit).

Additionally, code 105 indicates if an impaired non-driver (for example, a pedestrian, cyclist or passenger) was a factor in the crash.

It is not clear from CAS how 'alcohol test below limit' versus 'alcohol test above limit' is determined using the coded data from the TCR. Exploratory analysis of CAS driver data suggests the coding is determined by comparing the breath or blood alcohol reading for the driver with legal alcohol limits and considering the driver's age and licence restrictions (if any). This means the coding before and after the change in alcohol limits in December 2014 is not directly comparable for drivers aged 20 and over. For example, drivers with a BrAC of 251 μg/l would be coded as 'below the limit' before this date and 'above the limit' after it.

3.1.2.1 Changes in recording and coding alcohol crash data over time

The way in which police officers record and submit TCRs to CAS has changed in recent years:

- *Before July 2016:* police officers created a paper-based TCR to record details of a crash. The content of these reports was manually entered into CAS by the CAS coding team.
- *After July 2016:* NZ Police moved to preparing and submitting TCRs electronically using a digital application. This meant certain fields in the report could be populated automatically based on the data entered by the police officer. However, the CAS team continued to check and manually enter the crash information into CAS.
- *From 20 February 2019 onwards:* updates to CAS enabled TCRs from NZ Police to be submitted directly into the CAS database, with minimal oversight from the CAS team.

The change in mid-2016 also changed how ‘alcohol suspected’ is recorded. Previously, this was only recorded as ‘alcohol suspected’ where the police officer had reason to believe alcohol might be a factor in the crash. For example, seeing open alcohol vessels in the vehicle, the driver being visibly intoxicated, the driver admitting to having drunk alcohol before driving, or a witness confirming the driver had been drinking. After mid-2016, the change in how crashes are coded means ‘alcohol suspected’ is recorded whenever a driver is screened for alcohol, which happens as part of standard police practice following a crash. If a driver was tested for levels of blood alcohol, they will initially code it as ‘101’ (alcohol suspected). Once the blood test results are received by the police officer, the officer is responsible for updating the TCR, which will then update the alcohol cause code in CAS to either ‘102’ or ‘103’.

Note that the change in how ‘alcohol suspected’ was recorded in 2016 resulted in a large jump in drivers being coded as ‘101’ (alcohol suspected). Therefore, caution is advised when comparing alcohol-related crash data before and after this change. Since 2016, Waka Kotahi and the Ministry of Transport no longer include crashes with drivers coded as ‘alcohol suspected’ in official reports of alcohol-related crashes.

The changes to CAS in 2019 enabled electronic TCRs to be automatically added into the CAS database. When the TCR is submitted, the data within it is automatically populated as fields and tables in CAS, where it is automatically coded for causative and contributory factors based on the values provided by the police officer. The police officer can update the TCR at any time as new information becomes available. In addition to saving transcription time, this allows the Waka Kotahi CAS team to return TCRs to the attending officer for updating or correction, if any inconsistency is found. However, this also means the CAS team has less oversight of the information that is entered.

3.1.3 Alcohol-related crash data collection practices in Victoria and New South Wales, Australia

The project team sought feedback from Transport for NSW (TfNSW) and the Victoria Department of Transport (VDoT) in Australia, to understand how they collect alcohol-related crash data.

Like New Zealand, both state jurisdictions have a crash database with a direct link to their respective police data capture systems. This system has been in place for some time for both states, enabling automated crash data updates. Both jurisdictions also have similar practices for testing drivers for alcohol after a crash, including breath testing and state laboratory services that receive, process and report BAC from blood samples.

In NSW, when blood samples are taken from drivers, the NSW Police Force includes the blood sample identification (ID) with the crash reports. TfNSW then receives monthly data dumps of blood test results from the Forensic and Analytical Science Service. The data team use this information to determine if alcohol is a cause factor for drivers involved in the crash. This is an automated process that uses logic to determine whether the drivers involved were above the alcohol limit.

For injury crashes in Victoria, Victoria Police provides VDoT with batches of BAC data on a routine basis. This includes a unique accident number and is part of the police report of the crash. This data is based on evidential breath tests and/or blood tests for hospitalised drivers and/or riders. A similar process is used for fatal crashes, with alcohol data provided as part of the Accident Report as a separate batch supply to VDoT. Once blood or breath data is obtained by VDoT, it is validated and added to its Road Crash Information System.

Both Victoria and NSW have strict arrangements regarding privacy and health information, which affects how alcohol-related information is collated, stored and reported. Access to raw results and supporting information is heavily restricted. In both states, raw alcohol results (blood or breath alcohol levels) are hidden from all users who have access to the crash database. End users only see a flag indicating alcohol involvement. The

Victorian stakeholder also mentioned that the complex health and privacy data arrangements lead to delays in reporting of BAC data against crashes.

Considering the limitations of their data, the TfNSW stakeholder referred to changes in NSW Police Force practice that occurred around 2014, where officers no longer attend crashes where no injuries are reported, and so parties involved in those crashes are not tested for alcohol. Injuries associated with these types of crashes may also not be initially reported to emergency services. While this has not affected reporting of fatal and more serious crashes, after the change in police practice, the stakeholder stated that the number of less serious injury crashes reported by police dropped by about 50%.

The VDoT representative also reported that Victoria Police has not reported on ‘minor’ crashes, that is, those resulting in no injuries or minor injuries, since 1990, and does not generally attend them. This was confirmed in Parliament of Victoria (2021), which reviewed the role of data in developing road safety strategies. This inquiry recommended Victoria Police recommences capturing non-injury crashes, noting that capturing more data around crashes of all severities provides a greater insight into road safety and so is more effective for developing evidence-based targets. The inquiry was also critical of how toxicology data is captured and shared among road safety partners, recommending that the ‘Victorian Government expand its alcohol and other drugs testing regime to require all persons, other than passengers, who attend hospital as a result of a road accident to undergo a BAC test’ (Parliament of Victoria, 2021, p. 111). This recommendation is made on the basis that the BAC test is necessary irrespective of whether police attend or report the crash.

When comparing data collection and reporting practices between the two Australian states and New Zealand, the following important differences are apparent:

- CAS in New Zealand allows many users to view a driver’s raw blood or breath alcohol results, whereas Victoria and NSW heavily restrict access for health information and privacy reasons. Users of this data only see an alcohol ‘flag’ indicating whether alcohol is a factor against the driver or the crash. New Zealand could consider reviewing CAS access levels against privacy legislation, to determine whether the ability to view raw blood and breath test results should be restricted.
- Victoria Police and the NSW Police Force share alcohol data with the state transport agency differently than in New Zealand. Both jurisdictions update blood alcohol data in batches, rather than receiving this information separately against each crash report. NSW Police also shares the blood sample ID with TfNSW, which then independently matches this to blood results received from its state laboratory service. Similar practices in New Zealand could improve alcohol-related data sharing between NZ Police and Waka Kotahi.
- Unlike Victoria and NSW, NZ Police will attend reported non-injury crashes. According to CAS, around 70% of non-injury crashes are attended by a police officer and this reporting rate has remained relatively consistent over the past 10 years.[9] It is not surprising most reported non-injury crashes are attended by police officers because those not attended are less likely to be reported at all.

3.2 Stakeholder perceptions of alcohol-related crash data

The stakeholders interviewed in the engagement phase made it clear that CAS is the authoritative source for information on alcohol-related crashes in New Zealand. While other organisations hold data that intersect with CAS in various ways, none of these other datasets hold information that covers all alcohol-related crashes. This being the case, it is important that CAS data is accurate and transparent.

[9] Based on a query in CAS for non-injury crashes between 2010 and 2020, using the ‘Police attended’ attribute to calculate the percent of non-injury crashes attended by NZ Police. However, this only captures crashes that are reported, and police acknowledge many non-injury crashes go unreported.

However, several New Zealand stakeholders questioned potential inconsistencies or errors in the data on alcohol use in TCRs and in CAS. They noted that changes in how data is collected also make it difficult to compare crash data across different periods. The Waka Kotahi CAS team acknowledged potential issues with the data they manage.

3.2.1 Collection and update of alcohol data in traffic crash reports

More than one stakeholder suggested that police officers do not always update the alcohol test results in TCRs or update this information correctly. Several reasons were identified for this:

- Blood tests results are received some time after the crash, and after the TCR is initially submitted. The police officer must use the TCR desktop application to update the results and resubmit the TCR. Police officers may forget, or not know how, to do this, especially if they are not familiar with the desktop TCR application.
- The design of the TCR application appears to allow police officers to accidentally enter contradictory information. For example, it is possible to enter evidential breath or blood test results (indicating alcohol above the limit), yet also record that a ‘negative’ breath screening test was taken. Officers can also ‘save’ TCR updates in the desktop application but may not realise they need to click ‘submit’ for this update to be pushed through to CAS.
- Police officers may focus on collecting crash information and data for prosecution purposes and neglect or forget to add or update data that is unrelated to potential charges. For example, TCRs are more likely to be updated if the BAC is above the alcohol limit.
- Police officers are not trained in creating and completing TCRs at Police College. New officers learn to fill out TCRs on the job from more experienced colleagues. This risks imperfect knowledge being passed on and subtleties being missed. It also means officers may not understand the importance of accurate crash reports and how this information is used by policy makers and road safety professionals. However, it was noted by NZ Police and the CAS team that they are working to improve this understanding among officers, although only informally at present.

3.2.2 Accuracy of traffic crash report supporting data

Stakeholders raised concerns with the accuracy of some supporting data reported by NZ Police in TCRs. For example, the coding of ‘ethnicity’ in CAS is based on an assessment by the officer preparing the TCR and not how the person being reported on would describe their ethnicity. It was also suggested some officers may make judgements of injury severity based on the threshold of injury required for a ‘driving causing injury’ charge, with less visible serious injuries, such as whiplash, being recorded as a ‘minor’ injury or no injury at all. Research by McDonald (2006) also found that serious and minor injuries reported by NZ Police poorly reflected the actual threat to life.

Stakeholders also identified data sources for crashes or drivers (outside of alcohol-related data) that are potentially superior to what is in CAS. For instance, hospital and ACC data record self-identified ethnicity. ACC data could also give a better indication of the seriousness of injury based on the length and cost of treatment. Hospital data may include the Injury Severity Score (ISS), which is used by trauma services worldwide (Baker et al., 1974).

3.2.3 Accuracy of alcohol-related crash coding in the Crash Analysis System

Many CAS users (among the stakeholders interviewed) told the research team that recent crash data overstates the number of crashes where alcohol was a factor. These users expressed concern at this, because the whole sector relies on the accuracy of the data within CAS. This was confirmed by the CAS team, who indicated that crash codes ‘101’ (alcohol suspected), ‘102’ (alcohol test below limit) and ‘103’ (alcohol test above limit or test refused) were all over-reported at some point in the past 10 years.

Specific concerns raised by stakeholders included:

- Since 2016, the ‘101’ (alcohol suspected) code is no longer a reliable measure of determining whether a driver was suspected of drink driving.
- The significant increase in the number of drivers flagged with an alcohol breath result of ‘breath refused’ from 2019 onwards.
- Some drivers who did not undergo an evidential test are coded as ‘test refused’. In these instances, the driver possibly passed the screening test and did not require an evidential test.
- Where police have not updated test results received after the initial TCR was submitted, the alcohol blood result remains ‘blood pending’.
- Some records include contradictory alcohol-related information. For example, instances occur of drivers with an alcohol breath reading of ‘0’ (μg/l) and an alcohol breath result of ‘breath refused’.
- No metadata is provided for CAS users to help interpret alcohol-related crash data. For example, where the underlying data comes from, whether alcohol readings are binned or are the raw evidential values and how the six different alcohol-related data attributes for drivers (shown in Table 3.1) translate into the alcohol-related crash driver codes.

Suggested reasons for the errors in alcohol reporting include human error throughout the crash reporting system, from how information is collected by NZ Police (refer to section 3.2.1) to how it is displayed and reported in CAS.

Some problems were seen to be the result of updates in the crash reporting process and systems, specifically:

- The 2016 update, which means all drivers given a breath or blood test are coded as ‘101’ (alcohol suspected).
- Updates in early 2019 where TCRs are automatically pushed into the CAS database, which aligns with the significant increase in drivers coded as ‘breath refused’. This suggests an error may occur when the data is translated between the two systems.
- Less oversight of crash reports by the CAS team since the manual stage of entering TCRs into CAS was removed in early 2019. Mistakes made by police officers completing TCRs are less likely to be detected and corrected or are not being identified in data validation stages.

3.2.4 Communication and interpretation of alcohol-related crash data

Several organisations noted difficulties in inter-organisational communication around crash data. As a result, many working in this field do not have a complete understanding of how other organisations gather and manage their data.

A strong perception of miscommunication between the CAS team and NZ Police is held. This view was held both internal and external to these organisations. The biggest challenge identified was achieving a shared understanding of TCRs and CAS and how they interact. Engagement with the CAS team and NZ Police showed they were unclear on how the recording of crash data worked from the perspective of the other party, respectively.

A history of misunderstandings is evident around data definitions and how data is linked between TCRs and CAS, which is reflected in errors that have been observed in the data. It is understood the CAS team have not seen the electronic TCR application used by the police and so have not had the opportunity to suggest improvements to the application or consider adjustments to CAS to improve the flow of information. For example, user design errors may exist that result in officers unintentionally recording the wrong fields or inputs.

Furthermore, the current crash data recording process has several stages where it is possible for human error to affect the data. This has been reduced with the new CAS, which allows TCRs to be received electronically, although this improvement has also removed a previous check by the CAS team when they transcribed the data. The communication of blood test results is understood to be largely manual, with ESR sending out monthly spreadsheets to both the NZ Police and CAS team.

3.2.5 Planned improvements to crash reporting

The CAS team intend to improve the quality of data within CAS. Amongst these changes, improving alcohol coding has a high priority. It is not known exactly what the scope of the changes is, although it was suggested many users of CAS would like to see the reinstatement of the distinction of alcohol being suspected but not proven, like it was reported before 2016.

The stakeholders at NZ Police are also investigating alcohol coding issues in CAS. This includes an internal assessment of DSI crashes in Auckland around 2015 that found nearly 2% of crashes were incorrectly coded as ‘103’ (alcohol test above limit or test refused). Neither NZ Police nor the CAS team have attempted any recoding of incorrect records, but it was suggested such an exercise could be considered if the scope of the erroneous data could be defined.

3.3 Crash data linkage projects

Several crash data linkage projects were identified by stakeholders.

3.3.1 Study of Road Trauma Evidence and Data

The Study of Road Trauma Evidence and Data (SORTED) is, at the time of writing, in its second phase following an initial pilot. This study pulls together road trauma datasets from CAS, NZ Police, the Ministry of Health, ACC, ambulance providers and the National Trauma Network, with the intention of assessing the value of linking them together. However, SORTED is of limited use when studying alcohol-related crashes because most of the datasets do not include alcohol as a factor. Hence, the study provides little additional information on alcohol-related crashes beyond what is recorded in CAS.

3.3.2 Accident Compensation Corporation claims and crash data linkage

ACC links claims data to crashes, which enables it to interrogate the impact of road trauma across various factors beyond those provided by ACC claimants, for example, the type of vehicle(s) involved and contributory factors. This information can be aggregated using claimant and/or crash information to highlight crash trends. For example, the Helen Clark Foundation recently used this data to report on the cost to ACC of alcohol crashes by local authority area (Helen Clark Foundation, 2021).

Unlike CAS, ACC can assess the cost of individual crashes and has better injury data and demographic information. However, ACC relies on CAS data to identify and analyse different types of crashes, including those where alcohol is a cause factor. Therefore, if the alcohol-related crash factors are incorrect, the ACC-matched data is also incorrect. While the raw data is closely protected by ACC for privacy reasons, ACC can provide aggregated datasets.

3.3.3 Integrated Data Infrastructure hospital emergency department 'alcohol' flag

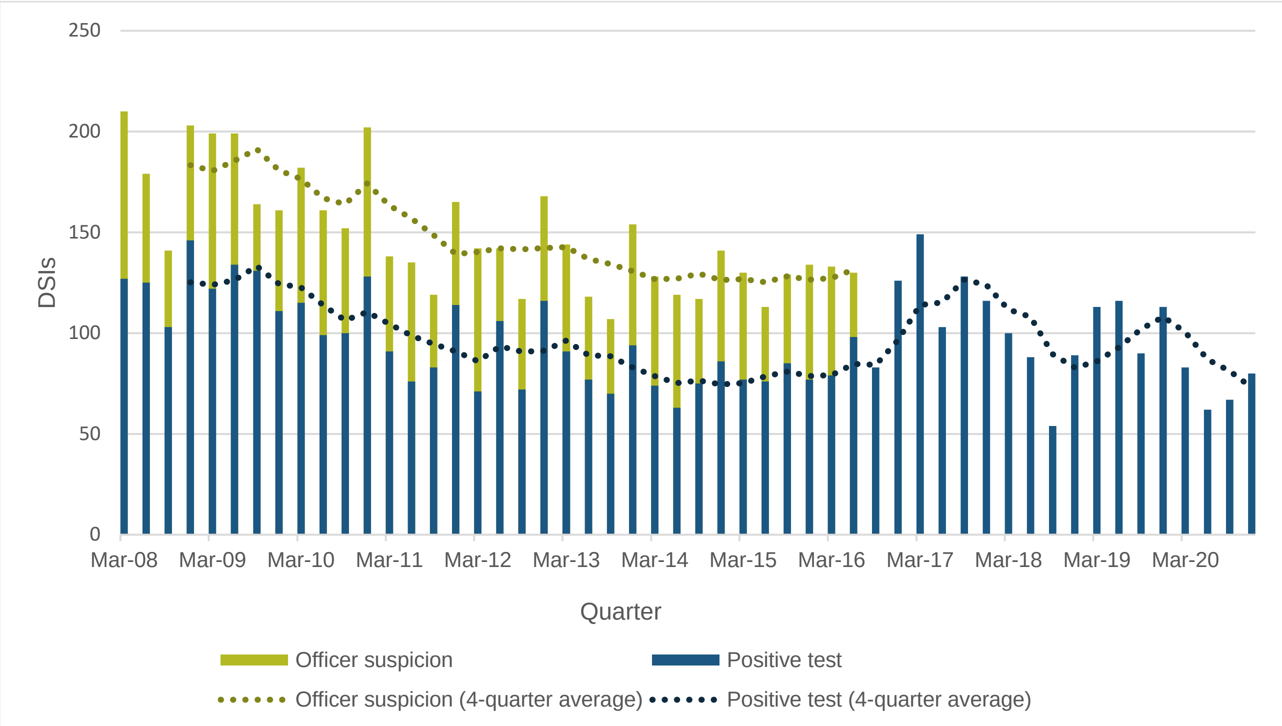
The Stats NZ Integrated Data Infrastructure (IDI) research database links microdata about people in New Zealand across many different data sources. This includes health data and ACC injury claims data. Access to the IDI is heavily restricted. Researchers granted access can only view the data in IDI on-site at Stats NZ or through certain universities.

At the time of writing, ACC is investigating a possible 'alcohol' flag or indicator attached to hospital emergency department admissions, which is accessible via the IDI. If the 'alcohol' indicator for emergency department admissions exists in a useful form, it could potentially be linked to injury claims and crash data as an alternative method for identifying alcohol-related crashes and injuries. Unfortunately, due to COVID-19 lockdowns in 2021, ACC was not able to investigate this potential data linkage during this research project.

3.4 Alcohol crash reporting and trends

Waka Kotahi regularly reported on alcohol-related crash trends in its quarterly road safety outcomes reports up to the end of 2019. The quarterly series was discontinued after 2019 but an additional report was published covering the period October to December 2020 (Waka Kotahi, 2020b).[10] Figure 3.1 shows quarterly combined DSIs for alcohol-related crashes, including before and after the 2016 change in coding for 'alcohol suspicion'. Table 3.2 provides annual reported alcohol-related crashes.

Figure 3.1 Quarterly reported death and serious injuries (DSIs) in alcohol-related crashes, 2008 to 2020 (source: Waka Kotahi, 2021)



[10] Note that figures for the quarter October to December 2020 were provisional at the time they were reported by Waka Kotahi in March 2021.

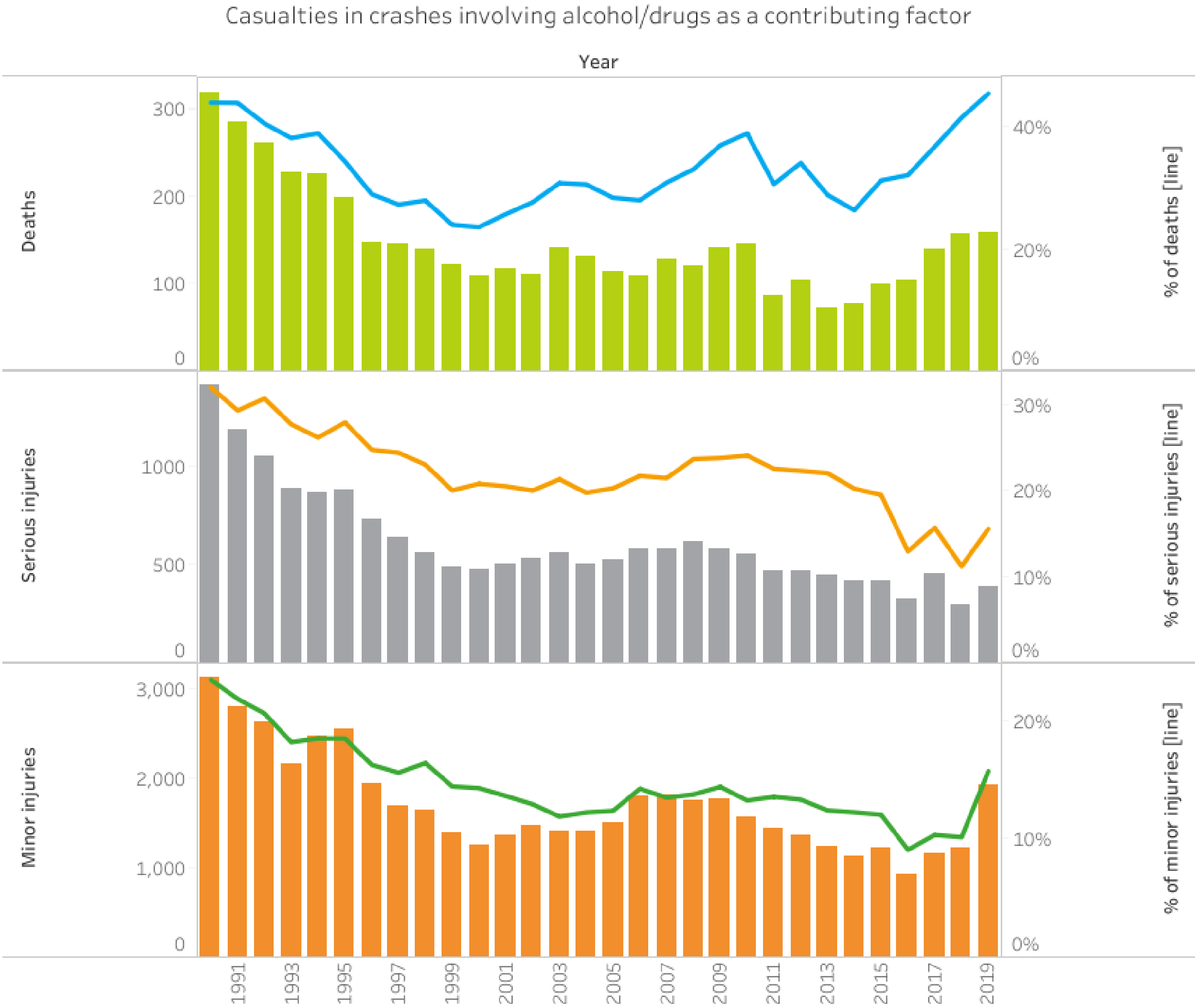
Table 3.2 Annual reported death and serious injuries (DSIs) in alcohol-related crashes, 2008 to 2020 (source: Waka Kotahi, 2020b)

Calendar year	DSIs in alcohol-related crashes (positive test)	Total reported DSIs	Percent of 'alcohol-related' DSIs (%)
2008	501	2,878	17
2009	498	2,809	18
2010	442	2,663	17
2011	364	2,344	16
2012	365	2,394	15
2013	332	2,273	15
2014	298	2,369	13
2015	315	2,485	13
2016	386	2,864	13
2017	496	3,241	15
2018	331	2,977	11
2019	432	2,861	15
2020	292	2,496	12

The Ministry of Transport also publishes online dashboards of statistics on alcohol- and drug-related crashes (Ministry of Transport, 2020). These statistics are generated from the crash data in CAS where alcohol or drugs were identified as a contributing factor. The Ministry of Transport reports serious and minor injuries over time (from 1990), as shown in Figure 3.2. Note that these figures do not include crashes where alcohol was suspected, due to the change in coding of these crashes from 2016 onwards.

For the period 2017 to 2019, the Ministry of Transport (2020) provides graphs and tables of injuries by age and type of road user killed, driver age, gender, vehicle type and licence status. Drug- and alcohol-related crash statistics are broken down by crash type, day of the week, time of day and region.

Figure 3.2 Trends in fatal and injury crashes involving alcohol and drugs 1991 to 2019 (Ministry of Transport, 2020)



The alcohol crash trends in Figure 3.1 and Figure 3.2 are based on CAS data, and so might include potential reporting errors, as highlighted by stakeholders in section 3.2. These errors are investigated in more detail in chapter 7, which indicates that alcohol-related injury and crash counts for 2019 and 2020 are unreliable.

3.4.1 New Zealand alcohol-related crash death and serious injury trends

Figure 3.1 and Table 3.2 show that the number of DSIs from alcohol-related crashes in New Zealand reached modern lows around 2014 (298 DSIs) then increased, peaking in 2017 (496 DSIs). Since 2017, the total number of alcohol-related crash DSIs has fluctuated, with 331 DSIs in 2018 and 432 DSIs in 2019, but numbers have not returned to previously observed lows in the past decade (ignoring 2020 due to the impact of the COVID-19 pandemic).

The proportion of alcohol-related DSIs compared with total DSIs also dropped between 2009 to 2014 (from 18% to 13%). This proportion remained steady at 13% of total DSIs from 2014 to 2016, but then appears to fluctuate between 11% and 15% until 2020.

3.4.2 International alcohol-related crash data collection and reporting

The WHO (2018b) states in its latest global status report on road safety that data on drink driving remains limited in many countries and is often estimated based on crash reports that may underestimate the scope of the problem.

Many of the jurisdictions in the international comparison were identified by the project steering group as leaders in targeting alcohol-related road trauma. However, practices around alcohol-related crash reporting are not consistent between jurisdictions and none are immune from gaps. The definitions of what constitutes an alcohol-related crash vary, and not all sources are clear on how they define it. For example, the figures for Ireland include drivers having any alcohol whatsoever present, while Victoria, Australia, has reported on those with a BAC exceeding the limit. Additionally, most countries (Australia, Finland, Ireland, Norway and Scotland) use the definition of an 'alcohol-related fatality' established by the 2008 European SafetyNet project: 'any death occurring within 30 days as a result of a fatal crash in which any active participant was found with a BAC above the legal limit' (ETSC, 2019, p. 18). Denmark and New Zealand use a slightly different approach (Vissers et al., 2018).

In the event of a fatal crash, not all jurisdictions will necessarily test drivers for the presence of alcohol. A best practice leader in this area is Finland, which tests all active participants in all crashes for alcohol (ETSC, 2021b). Generally, all drivers will be tested in the event of a fatal or serious crash in Ireland and New Zealand (WHO, 2018b). In Australia, fatal and hospitalised road users will generally be tested, while in Denmark, Norway and Scotland, testing is on police request (Vissers et al., 2018). Pasnin and Gjerde (2021) found that, in fatal crashes in Norway during 2016 to 2018, 90% of killed road users were tested along with 67% of surviving road users. In Scotland, in 2019, 52% of motorists involved in injury accidents were asked for a breath test (Transport Scotland, 2020).

3.4.2.1 Involvement of alcohol in crashes and crash injuries

Despite the limitations in comparing between jurisdictions, the involvement of alcohol in crash fatalities was typically around 15% to 20% among the jurisdictions reviewed, although outliers exist. The most recent figures for each jurisdiction are shown in Table 3.3.

Table 3.3 Alcohol involvement in crashes in international jurisdictions

Jurisdiction	Year(s)	Involvement of alcohol in crashes, fatalities and/or injuries	Reference(s)
Denmark	2019	19.1% of all road fatalities and 10% of personal injury crashes. Alcohol was reported as a factor in 38 deaths and 163 serious injuries.	ETSC (2021a) ITF (2020)
Finland	2019	15.5% of fatalities (37 deaths) and 9.4% of injury causalities (500 injuries).	ITF (2020)
Ireland	2013–17	36.5% of fatalities, as determined from the 600 out of 880 road users for which toxicology results were available. Note that these figures predate recent changes in legislation to increase penalties for drink driving at lower levels.	ITF (2020) ETSC (2020a)
Norway	2019	8% of fatal crashes (alcohol alone). 12% of fatal crashes (drugs or the combination of alcohol and drugs).	ITF (2020)
Scotland	2018	Around 13% of fatalities (estimated 20 deaths). Around 5% of serious injuries (estimated 70 serious injuries).	Transport Scotland (2020)
Australia – New South Wales	2019	13% of fatalities (61 deaths). 6.2% of serious injuries (285 serious injuries).	Transport for NSW (2021)
Australia – Victoria	2016	19% of drivers killed had a BAC of 50 mg/dl or higher.	Transport Accident Commission (2021)

Internationally, many governments have found that lowering the legal BAC limit resulted in significant reductions in alcohol-related crashes and fatalities (Fell & Scherer, 2017; Fell & Voas, 2006). This was observed when:

- Austria reduced BAC limits from 80 mg/dl to 50 mg/dl (Bartl & Esberger, 2000)
- New South Wales, Australia, reduced BAC limits from 80 mg/dl to 50 mg/dl (Homel, 1994)
- South Australia reduced BAC limits from 80 mg/dl to 50 mg/dl (McLean et al., 1995)
- Australian Capital Territory reduced BAC limits from 80 mg/dl to 50 mg/dl (Brooks & Zaal, 1993)
- Japan reduced BAC limits from 50 mg/dl to 30 mg/dl (Desapriya et al., 2007, Nagata et al., 2008)
- Serbia reduced BAC limits from 50 mg/dl to 30 mg/dl (Živković et al., 2013)
- Sweden reduced BAC limits from 50 mg/dl to 20 mg/dl (Norström, 1997).

However, other jurisdictions have had different experiences. Scotland reduced the BAC limit from 80 mg/dl to 50 mg/dl in December 2014, while the remainder of the United Kingdom stayed at 80 mg/dl. Initial findings two years following the introduction of the new limit identified no evidence of a change in Scotland's rate of fatalities and crashes, compared with the rest of the United Kingdom (Cooper et al., 2020). Denmark reduced the BAC limit from 80 mg/dl to 50 mg/dl in 1998, and alcohol-related fatal crashes increased as a proportion of all crashes in the following year (Bernhoft & Behrensdorff, 2003).

3.5 Research exploring New Zealand's alcohol-related crash trends

Historically, research into crash trends in New Zealand has focused on specific events like changes in legislation. For instance, the Sale of Liquor Amendment Act 1999,[11] which reduced New Zealand's legal alcohol purchasing age from 20 years to 18 years of age, has been subject to several studies. These have shown that the change likely had some effect on alcohol-related crash trauma, but the scale of this effect is uncertain. A challenge in isolating the effect of this change in legislation is that alcohol-related fatalities increased in number and proportion from around 1999 to 2010, but serious and minor injuries stayed relatively consistent. This is discussed further in section 6.3.8.

More recently, the increase in total DSIs observed between 2014 and 2017 prompted a study by Walton et al. (2020). The study analysed the factors in DSI crashes across 2010 and 2017 to understand the reasons behind the increase. This study found alcohol-related crashes were a significant contributor to the increase in the overall crash rate, and that this occurred despite recorded alcohol-related offences having fallen over the same period. The authors suggest this has more to do with enforcement than changes in drinking and driving behaviour.

[11] See www.legislation.govt.nz/act/public/1999/0092/latest/DLM32605.html for further information.

4 New Zealand drink-driving enforcement and offence data and trends

Visible enforcement encourages compliance with alcohol limits, reinforcing the perception among drivers that they could be stopped and tested at any time.

This chapter describes drink-driving and enforcement practices in New Zealand, focusing on how data on drink-driving enforcement and offences are collected and reported. Much of the information on practices around crash reporting were sourced from interviews with representatives from NZ Police, supplemented with material from published reports. Current enforcement practices are also compared against similar international jurisdictions.

4.1 Breath testing data collection

NZ Police is responsible for testing drivers for alcohol impairment and enforcing drink-driving legislation. New Zealand has random breath testing (RBT), which allows police officers to test drivers for alcohol at any time without needing to have good cause for suspicion. RBT is conducted at Police checkpoints, called compulsory breath testing (CBT), and by a mobile patrol when drivers are pulled over, called mobile breath testing (MBT). Police perform an RBT on drivers at every vehicle stop, irrespective of the reason for the stop (NZ Police, 2019).

An RBT is conducted as a three-step process:

1. *Passive test:* A passive 'sniffing' device determines whether alcohol is present in the driver's breath.
2. *Screening test*: If alcohol is detected in the passive test, a screening test is used to determine if the BrAC is likely to be above 250 µg/l (for drivers aged 20 years and over) or above 0 µg/l (for drivers aged under 20 years and holders of zero-alcohol licences). These amounts correspond to the infringement-level limits (though infringement notices cannot be issued off a screening test).
3. *Evidentiary breath test*: This test is performed if the screening test indicates BrAC is over the limit for the driver's age and licence status. This test returns an absolute breath alcohol result that can be used to confirm an offence and can be submitted as evidence in court.

Drivers have the right to refuse an evidentiary breath test, requesting an evidentiary blood test instead. Drivers can also request a blood test following a failed evidentiary breath test. More information on how blood is tested and reported is provided in chapter 3.

If a driver refuses the breath test and has an evidentiary blood test that shows the BAC was within the infringement range (50 mg/dl to 80 mg/dl for drivers aged over 20 years), the infringement fee is $700 rather than the usual $200. The 2014 Act also requires police officers to inform drivers that they can be fined at this higher cost. A driver may also refuse to provide a breath or blood sample, in which case they are charged by NZ Police as if they were six times the legal limit.

4.1.1 Breath testing devices

As breath testing technology has evolved, NZ Police has updated its processes and the devices it uses. The devices approved for passive and screening tests by the Land Transport (Breath Tests) Notice 2015[12] are the Dräger Alcotest 6510 (the 6510 device) and Dräger Alcotest 7510 (the 7510 device) handheld units. The

[12] See www.legislation.govt.nz/regulation/public/2015/0016/latest/whole.html for more information.

7510 device is also approved for evidential testing, as is the Dräger Alcotest 9510, which is a larger device used in police stations and mobile road safety bases (MRSBs; colloquially referred to as ‘booze buses’).

Testing devices are usually returned to Dräger for calibration once a year on a rolling schedule, at which time test data is downloaded. However, it is understood that NZ Police has begun using cradles for the 7510 devices, which enables more frequent data extraction, though the data feed is not able to be accessed (at the time of writing).

4.1.1.1 Dräger Alcotest 6510 handheld units

The 6510 device was introduced in 2006, becoming one of five devices by various manufacturers approved for passive or screening tests. From 2010, the 6510 device became the sole approved passive and screening test device. Because the 6510 device could not administer an evidential test, these had to be done at an MRSB or a police station. The 6510 device has limited memory and is only able to record the total number of breath tests administered on the device. The test count does not distinguish between passive and screening tests.

4.1.1.2 Dräger Alcotest 7510 handheld units

In 2015, the 7510 device was approved for use with the intention of eventually superseding the 6510. These devices started being used in 2015, but, due to faults, were temporarily withdrawn later that year. They began to be redeployed in 2016 and their roll-out is now largely complete, although the 7510 device does not yet account for all the passive and screening tests undertaken.

Unlike previous devices, the 7510 device can administer passive, screening and evidential breath tests, allowing police officers to charge motorists or issue infringement notices on the spot. Furthermore, the device records the date, time, location and result of every breath test administered, enabling greater analysis of testing data. Unlike the 6510, the new devices can distinguish between the different types of tests administered (though they cannot distinguish between an RBT at a crash site versus an RBT as part of regular enforcement activities).

4.1.2 Breath testing activities

Engagement with NZ Police revealed that little data is kept around RBT enforcement activities, other than the number of breath tests administered. While some data identifies where and when Police checkpoints were held, this data does not isolate alcohol checkpoints (CBT) from other types of checkpoints. As such, at the time of writing, the scope is limited to assess changes in CBT enforcement over time, for example, the time, location and size of checkpoints.

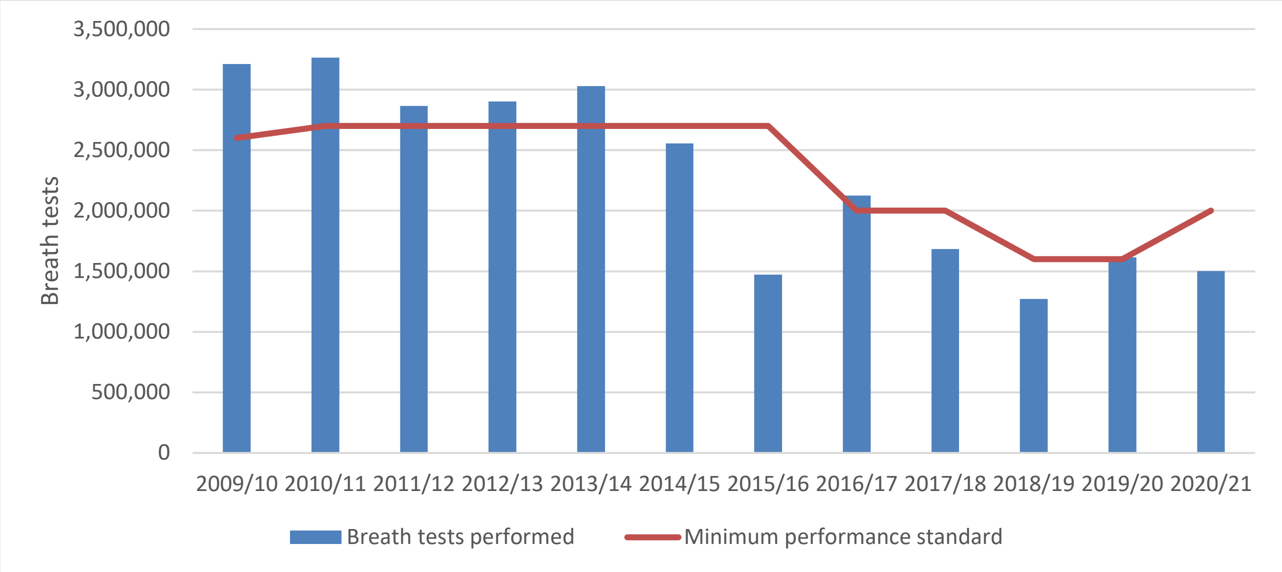
4.2 Breath testing data reporting

4.2.1 New Zealand Police

For at least the past decade, NZ Police annual reports have consistently contained a key performance indicator (KPI) for the ‘number of breath tests conducted’, which is used to compare against performance standards and between financial years.[13] Figure 4.1 shows the reported number of breath tests taken, against the (minimum) performance standard provided, as reported in annual reports (NZ Police 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021).

[13] Where a financial year covers the period 1 July to 30 June.

Figure 4.1 New Zealand Police reported breath test counts and minimum performance standard, by financial year



In its annual reports, NZ Police has provided additional information to explain RBT rates or changes in reporting for some periods:

- For 2009/10 and 2010/11, CBT and MBT were reported separately, with separate performance standards (NZ Police, 2010, 2011). Combined results were reported from 2011/12 (NZ Police, 2012). At the time, it was noted that this information was captured in different ways and to different timeframes to meet wider organisational needs, meaning the two reported results are not comparable. The combined measures and targets are shown in Figure 4.1.
- In 2017 it was noted that test volumes were downloaded and reported when devices were returned to Dräger for calibration (NZ Police, 2017). A change in calibration cycle (six monthly to 12 monthly) during the 2015/16 year resulted in fewer downloads in that year, and so fewer breath tests were reported. This also suggests the test counts for 2016/17 are over-reported because they include tests taken during the second half of the 2015/16 year.
- In 2018 it was noted that, due to increased demand in other priority areas, less-than-desirable resource levels were available for road policing activities in 2017/18 (NZ Police, 2018).
- In 2021 it was reported that 2020/21 included the COVID-19 lockdown period when breath alcohol testing was paused for health and safety reasons (NZ Police, 2021). Because no tests were recorded for this period, overall test volumes are significantly reduced, but it was noted that the reported test numbers do not necessarily reflect the current level of activity.

With these data limitations in mind, Figure 4.1 shows a reduction in the number of tests and the performance standard for testing before and after 2014/15. Ignoring the years with data issues and COVID-19, NZ Police also failed to meet the minimum performance standard in 2014/15, 2017/18 and 2018/19.

It is also mentioned in NZ Police (2019) that it is taking a targeted risk-based approach to impairment. Rather than concentrating on high volume traffic areas at random times, ‘hotspots’ and events are being targeted with enforcement activity:

> *Police has a greater focus on specific risk targeting interventions that may result in greater offence detection at the cost of test volumes. In addition, changes in the way in which road policing is structured in a number of Police districts has included the disestablishment of*

> *dedicated impairment teams. This may have also contributed to a reduction in test volumes.* (p. 15)

And also:

> *Risk targeting will be balanced to maintain general deterrence across the network, with each vehicle stop including a random breath test irrespective of the reason for the stop. This approach will assist in deterring driving whilst impaired by alcohol or drugs.* (p. 12)

From 2015 onwards, NZ Police also started reporting the median breath alcohol for drivers aged 20-plus caught exceeding the upper limit. In 2017 this was expanded to an additional KPI for those aged under 20 years.

4.2.2 Road to Zero: Action Plan 2020–2022

The *Road to Zero: Action Plan 2020–2022* includes the ‘number of breath tests conducted’ as an intervention indicator, to measure progress against an action to prioritise road policing (Ministry of Transport, 2019b, p. 35). This is the same indicator used by NZ Police. The Action Plan also has a target of 2 million breath tests in 2019/20 and 3 million breath tests in 2020/21. The failure to meet targets is acknowledged in the *Road to Zero: Annual Monitoring Report 2020*, noting the effect of COVID-19 on both breath testing activity and the reduction in road policing resources due to officers being diverted to help with lockdown checkpoints and managed isolation and quarantine facilities (Ministry of Transport, 2021).

Interestingly, the targets in the Action Plan do not align with NZ Police’s internal performance standards, which were 1.6 million to 2 million tests for 2019/20, and more than 2 million tests for 2020/21, respectively (NZ Police, 2021).

4.2.3 International comparison

In the latest *Global Status Report on Road Safety,* New Zealand’s self-reporting on enforcement of drink-driving laws places the country at ‘7’ on a 0-to-10 scale, putting it relatively high in the international context but recognising room for improvement exists (WHO, 2018b). This rating placed New Zealand slightly below countries such as Australia (8), Canada (8), the United Kingdom (8) and Finland (9), and well below Ireland and Norway (both 10). While this is a subjective measure, it shows a recognition within New Zealand that drink-driving enforcement could be improved and there are countries that believe they are doing just about all they can within their respective legislative environments.

Some of the jurisdictions included in the international comparison are known for their strong enforcement programmes. These are summarised in Table 4.1. New Zealand’s 2019/20 testing rate is around 0.33 tests per capita, which is a higher rate than most of the European countries examined but behind the Australian states. Australia is known for its approach to RBT and has a long history of using it for drink-driving enforcement. RBT first appeared in Victoria in 1976 and other Australian states in the 1980s (Wundersitz & Woolley, 2008). Ferris et al. (2013) report Australian states having loose RBT targets equivalent to one-third of the number of licensed drivers in their jurisdiction. Finland is considered a leader in Europe (ETSC, 2021b).

Table 4.1 Comparison of random breath testing (RBT) reporting and rates among comparable countries and jurisdictions

Country or jurisdiction	RBT rate per capita (year)	Notes	Source(s)
Scotland	Not reported	Scotland does not have an RBT programme. Police officers must have probable cause to breath test drivers, for example, when alcohol use is suspected or in the event of a crash. The number of breath tests administered is not reported.	ETSC (2021c)
Denmark	Not reported	Denmark has RBT but does not collect data on the number of breath tests administered.	ETSC (2021a)
Ireland	0.06 (2021)	Breath test data for Ireland has not been consistently recorded and was exposed as being heavily inflated by the Garda (police) in a 2017 scandal. In 2019, the Garda are recorded as operating 63,966 RBT checkpoints but actual count numbers are not available. Breath test numbers for 2020 are available (104,803 across 38,259 checkpoints) but counts were affected by the COVID-19 pandemic. In January and February 2020, before the pandemic, 51,801 breath tests were conducted at 9,782 checkpoints, which works out to 0.06 breath tests per capita on an annualised basis.	Garda (2021)
Finland	0.17 (2019)	Finland is one of the more active European countries in the use of RBT, administering 959,307 breath tests in 2019. Finland has been testing at this rate or better since the early 2010s, peaking at 1,558,924 tests in 2014, equivalent to 0.286 tests per capita. Additionally, in 2020, Finland gave Police the power to prevent a person from driving if they detected any alcohol in a driver, even if the BAC reading is under the limit. Police officers can order drivers to wait on the roadside until the alcohol in their body has been fully metabolised.	ETSC (2016, 2021b)
Norway	0.367 (2010)	Norway has not released data on the number of breath tests since 2010 when 1,783,702 were performed. Norway has adjusted its targets away from the absolute number of breath tests undertaken and focuses on reducing the proportion of breath tests that come back positive.	ETSC (2016)
Australia – Victoria	0.38 (2020)	Victoria performed 2,524,006 alcohol screening tests in 2018/19. Test numbers have been higher in previous years, with testing over 2006 to 2016 being in the range of 3 million to 4 million tests a year, at times exceeding 0.60 tests per capita.	Victoria Police (2020) Newstead et al. (2020)
Australia – New South Wales	0.57 (2020)	New South Wales reported 4.6 million random breath tests were undertaken in 2019/20.	NSW Police Force (2020)

4.3 Offences and sentencing

Where an evidential breath or blood test proves a driver was over the legal alcohol limit for their age and licence type, NZ Police can issue an infringement notice or prepare a charge for a criminal offence, depending on the level of offending and type of offence (as discussed in section 2.2).

Data on infringements, offences and sentencing is managed by NZ Police and the Ministry of Justice. NZ Police reports data on offences relating to driving under the influence of alcohol and drugs as part of its road policing driver offence dataset. This includes both charges and infringement notices (because infringement notices do not generate court proceedings). The Ministry of Justice reports data on offences prosecuted through the courts, including charges, convictions and sentencing.

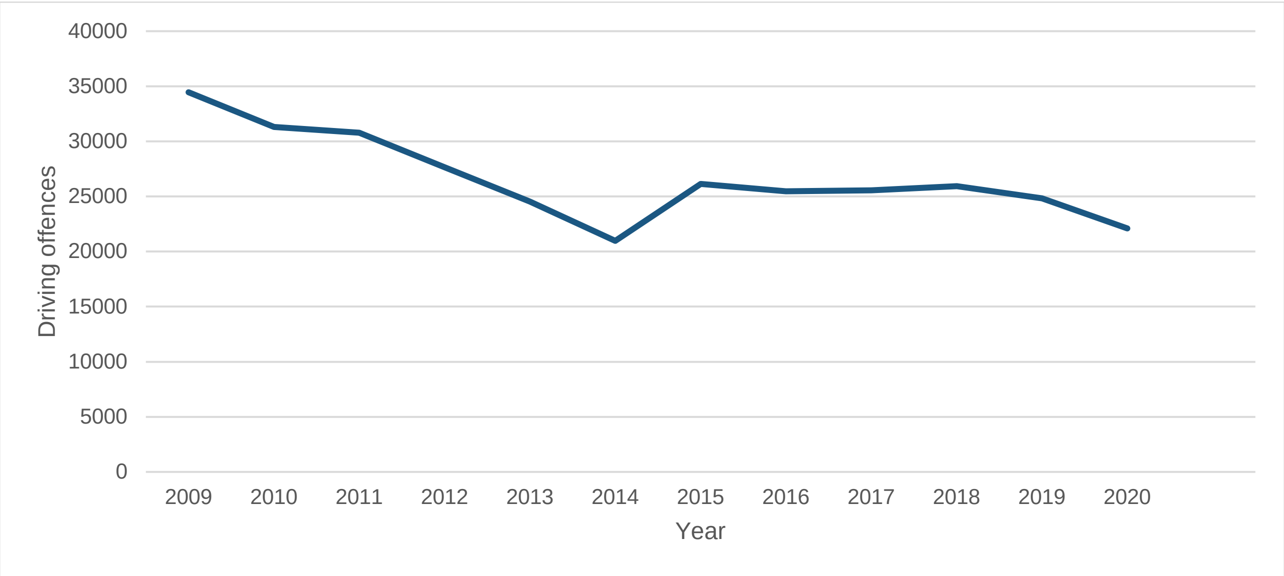
The data on offences that NZ Police and Ministry of Justice collect and report is of high quality, because it is generated from the legal system that requires data be to collected to an evidential standard.

4.3.1 New Zealand Police offence data reporting

NZ Police publishes summary data on road policing driver offences. These figures are updated quarterly and provided online in spreadsheet format. This dataset includes monthly alcohol-specific driving offences (proceedings and infringements) by police area and the monetary amount collected in infringement fees. Separate tables are provided for charges and fees collected against the lowered adult alcohol limit of 50 mg/dl and the under-20 years of age zero alcohol limit. Offences are split by alcohol and drug-driving offences, so it is possible to separate the two.

Figure 4.2 shows the number of annual alcohol-specific driving offences (charges and infringements) recorded by NZ Police for 2009 to 2020.

Figure 4.2 Annual alcohol-specific driving offences recorded by New Zealand Police, 2009–2020 (source: NZ Police, 2021)



The following trends are observed in Figure 4.3:

- From 2009 to 2014, a clear downward trend is evident, with recorded offences dropping from 34,457 to 20,969 in that time.
- After 2014, when the new limit came into effect for drivers aged 20 and over, the number of offences increased to 26,138 and held at around that level through to 2019.
- Fewer offences were recorded in 2020, but this figure will have been affected by the response to the COVID-19 pandemic (because fewer breath tests were administered over this period).

4.3.2 Ministry of Justice charges, convictions and sentencing data

The Ministry of Justice publishes annual summary tables online in a spreadsheet combining all driving under the influence offences:

- driving causing death (when under the influence of alcohol or drugs)
- driving under the influence of alcohol or other substance
- exceeding the prescribed content of alcohol or other substance limit.

The dataset includes the number of charges and number of people charged, split by charge outcome. The data can be divided by justice service area and court, the most serious sentence, repeat offenders and the demographics of the people charged (gender, age group and ethnicity). It also includes the number of people with orders for alcohol interlock devices.

The data held by the Ministry of Justice around court proceedings is based on the legal offence that was committed. As a result, ‘driving under the influence’ numbers do not differentiate between alcohol and drug offences, or if the driver was involved in a crash or not. Not all charges brought by NZ Police result in court proceedings and multiple charges may be associated with the same incident. Therefore, the number of charges that go to court provided by NZ Police do not necessarily align with the number of offences captured by the Ministry of Justice.

The Ministry of Justice data shows the number of annual alcohol interlock orders issued increased by a factor of 10 from 2017 to 2019 (Ministry of Justice, 2021). This reflects the changes brought about by the Land Transport Amendment Act 2017, which, from July 2018, made interlocks mandatory for repeat offences and first offences where high alcohol readings (greater than 160 mg/dl) were recorded.

4.4 Research into drink-driving enforcement in New Zealand

The Controller and Auditor-General issued a performance audit report in February 2013 looking at the enforcement of drink-driving laws by NZ Police. The report concluded that NZ Police needed to improve its assessment and reporting of enforcement, and to monitor indicators consistently to better understand performance (Controller and Auditor-General, 2013). The report also determined that agencies involved in road safety needed to co-operate better to improve results. Since the report was issued, significant changes have been made to how drink driving is enforced in New Zealand, including the reduction in BAC limits and the introduction of alcohol interlocks as a mandatory sentence for some drink-driving offences. According to a follow-up report by the Controller and Auditor-General (2015), NZ Police has also made procedural improvements in response to the first report, though further work remained, particularly around publicly reporting against a broader range of indicators.

The level of breath testing undertaken in New Zealand was identified as a concern by Howard (2021, p. 7) in his review of Auckland Transport’s Road Safety Business Improvement Review, saying:

> *An inability to enforce drink driving through adequate levels of breath testing of drivers and to deploy mobile camera technology on an adequate scale, both at levels that would approach good international practice, have heavily limited the potential gains available for the Auckland community*.

The report notes that, in 2019/20, the number of tests per person in Auckland was less than two-thirds of the New Zealand average. Ten priority recommendations are identified for improving road safety outcomes in the Auckland region, with the number one priority in terms of importance and urgency being to ‘substantially improve deterrence of drink driving’ (Howard, 2021, p. 33). The author recommended that Auckland Transport pursues detailed weekly tasking of MRSB sessions, mobile car-based general deterrence testing, and mobile car-based specific deterrence. In terms of monitoring and reporting, a road safety indicators programme is recommended that includes:

- percentage of annual RBT target achieved by month
- monthly targeted general deterrence RBTs (by MRSB and mobile car operations) and specific deterrence RBTs by mobile car operations to be deployed in high alcohol hours
- monthly actual general deterrence RBTs (by MRSB and mobile car operations) and specific deterrence RBTs by mobile car operations to be deployed in high alcohol hours.

Better monitoring and reporting would enable any shortfalls to be quickly addressed. This would also help ensure road policing is seen as a mainstream activity and not a subsidiary add-on to the general policing task.

4.5 Perceptions of enforcement

An issue often raised in the literature on alcohol-related crashes is the importance of effective enforcement in limiting the number of drink drivers. Drivers who demonstrate high-risk alcohol consumption patterns and are prone to drink-driving behaviour are more likely to drink drive when they believe they can get away with it (Stephens et al., 2017). The WHO states that the 'only consistently effective strategy for dealing with the problem of excess alcohol is to increase the perceived risk of being caught' (WHO, 2004, p. 83). While the mere presence of laws around drink driving and awareness of injury risk are sufficient preventive measures for some drivers, the evidence indicates that many only alter their behaviour out of fear of being caught. These behaviour changes are dependent on enforcement being visible within the community and their patterns being difficult to predict.

The latest *Public Attitudes to Road Safety* report (Waka Kotahi, 2020a) provides insights into self-reported perceptions of drink-driving enforcement. This can be compared with previous reports (most recently in 2016) to understand changes in perceptions over time. Note that this section of the report examines attitudes to enforcement, with more information on the usefulness of this survey in understanding drink-driving behaviour described in section 2.3.

The 2020 report identifies the following public perceptions regarding drink-driving enforcement and road policing:

- Almost three-in-five people are happy with the level of policing around road safety (more broadly) and, although 32% think NZ Police should put more effort into catching people, this is lower than in previous years.
- Nearly a quarter of New Zealanders would use back streets to drive home after drinking if unsure whether they are over the limit or not.
- One-in-three drivers claim to have been stopped at an alcohol checkpoint in the past 12 months and as many think the risk of being caught drinking and driving is small (43%) as disagree (42%).
- One in two, however, think it is at least fairly likely for a person who was driving after drinking to be stopped and breath tested in the early evening and 63% if late at night.
- Perceptions remain that a person would most likely be stopped and breath tested if driving after drinking in the city, with 68% thinking either fairly or very likely, compared with 38% thinking likely in a small town or on a major highway, and 18% on a rural road.
- Most (90%) believe compulsory breath testing helps lower the road toll, however, almost one in two think the penalties for drinking and driving are not very severe, even if you are caught, which is consistent with past years.

- Although 64% think New Zealand's drink-driving laws are effective in reducing the road toll, few think they are 'very effective', with most thinking they are 'quite effective'.

Statistically significant and substantial changes (more than 5%) in attitudes to policing and enforcement between 2016 and 2020 are as follows:

- An 8% increase in the number of people who disagree or strongly disagree with the statement that 'you can usually tell where alcohol checkpoints will be'. This suggests people are finding it harder to predict where checkpoints will be.
- A 10% increase in the number of people who agree the risk of being caught drink driving is small, with a 4% reduction in the number of people who disagree with this statement. This suggests people think they are less likely to be caught drink driving.
- A 13% increase in the number of people who disagree that, if you're driving late at night, a good chance exists of being stopped at an alcohol checkpoint. This suggests people believe they are less likely to encounter checkpoints late at night.
- A 10% increase in the number of people who think it is likely a person who was driving after drinking would be stopped and breath tested in the early-to-late evening (6 pm to 10 pm). A 9% increase occurred in the number of people who think they would be stopped and tested late at night (10 pm to midnight). This suggests people think drink drivers are more likely to be caught in the early-to-late evening.
- More people think drink drivers are likely to be stopped and breath tested in large cities (10% increase) and small towns (5% increase), and more people think they are less likely to be stopped on a major highway (10% increase). Opinions are split on whether drink drivers are more or less likely to be stopped on rural roads.
- More people agree compulsory breath testing helps lower the road toll (8% increase).

The changes in attitudes from 2016 suggest fewer people are seeing or being tested at Police checkpoints and find it harder to predict where they will be. Conversely, a perception exists that people driving after drinking are *more* likely to be caught in the evening (6 pm to midnight). This aligns with changes in NZ Police practices from around 2018 to 2019, when a more targeted risk-based approach to impairment was adopted (see section 4.2.1).

4.5.1 Stakeholder perceptions

The impact of drink-driving enforcement was mentioned by several stakeholders, with the perception that enforcement activity levels have decreased in recent years. This is consistent with Figure 4.1, which shows NZ Police was much less likely to meet breath testing performance standards from 2014/15 onwards.

5 Data on alcohol use and alcohol harm

Several surveys and data sources demonstrate an aspect of alcohol use or harm in New Zealand. These datasets provide context on alcohol use factors that could influence rates of drink driving. Some of these factors are discussed in more detail in chapter 6.

References with links to each dataset or source are provided in appendix A.

5.1 New Zealand Health Survey

The New Zealand Health Survey (NZHS) provides information about the health and wellbeing of New Zealanders (Ministry of Health, 2020). The NZHS became a continuous survey in 2011, enabling the publication of annual updates. Over 13,000 adults are surveyed each year. Several indicators are surveyed relating to alcohol use among adults, including the percentage of adults who had a drink containing alcohol in the past year (past-year drinkers[14]) and the percentage of adults engaging in hazardous drinking as defined by the Alcohol User Disorders Identification Test (AUDIT)[15] described in Saunders et al. (1993). Rates of past-year and hazardous drinking can also be broken down by gender, ethnicity, age group, neighbourhood deprivation and disability status.

The survey is updated and reported annually by the Ministry of Health, with some indicators only available for 2015/16 onwards. This data was collected in earlier years, but a change in question format meant it is no longer comparable.

Since 2011/12, the NZHS shows the proportion of the adult population having consumed alcohol in the past year has consistently stayed at around 80%. Of these drinkers, 25% are hazardous drinkers under the AUDIT criteria, with no significant change since the reporting of hazardous drinking began in 2015/16.

The NZHS reports the additional observations in drinking patterns from the most recent 2019/20 survey results (Ministry of Health, 2020):

- The prevalence of hazardous drinking among men was 28.7%, whereas it was 13.6% in women. Men were 2.1 times more likely to be hazardous drinkers than women, after adjusting for age.
- The highest prevalence of hazardous drinking was among those aged 18–24 years, at 32.4%. Hazardous drinking was also high among those aged 25–34 (23.8%), 35–44 (21.5%) and 45–54 years (27.7%). Of those aged 15–17 years, 11.6% had engaged in hazardous drinking over the year before taking part in the survey; this was an increase on the previous year, when it was 6.3%. From age 55 and over, the rate decreases.
- Of Māori adults, 36.1% were hazardous drinkers in 2019/20. Māori adults were 1.8 times as likely as non-Māori adults to be hazardous drinkers, after adjusting for age and gender. In contrast, Asian adults were much less likely than non-Asian adults to be hazardous drinkers, after adjusting for age and gender.

The NZHS identified the following changes between periods as statistically significant in the past 10 years:

- Female past-year drinkers increased from 75.1% to 78.5% between 2014/15 and 2019/20.

[14] 'Past-year' drinkers are defined in the NZHS as any adult aged 15-plus years who has had a drink containing alcohol in the past year.

[15] AUDIT is a 10-item questionnaire that covers three aspects of alcohol use: consumption, dependence and adverse consequences. Hazardous drinkers are defined as those who obtain an AUDIT score of 8 or more.

- Past-year drinkers aged 45–54 years increased from 81.7% to 86.1% between 2014/15 and 2019/20, including a 3% increase observed between 2018/19 and 2019/20.
- Past-year drinkers aged 75-plus increased from 67.7% to 73.4% between 2014/15 and 2019/20.
- Māori past-year drinkers increased from 78.9% to 83.4% between 2011/12 and 2019/20, with statistically significant increases for both Māori men and women over the same period.
- Pacific past-year drinkers increased from 55.8% to 63.5% between 2014/15 and 2019/20, with a statistically significant increase for Pacific women over the same period.
- Asian past-year drinkers increased from 55.6% to 65.1% between 2014/15 and 2019/20, with a statistically significant increase for Asian women over the same period.
- European women past-year drinkers increased from 81.7% to 84.1% between 2014/15 and 2019/20.
- Hazardous drinkers aged 15–17 years increased from 6.3% to 11.6% between 2018/19 and 2019/20, and hazardous drinkers aged 45–54 years increased from 22.1% to 27.7% between 2018/19 and 2019/20.

Overall, the findings from the NZHS over the past five-to-10 years suggest a slight increase occurred in adult past-year drinkers between 2014/15 and 2019/20, but no change was observed in the amount of hazardous drinking overall. An increase has been observed in past-year and hazardous drinking among some population sub-groups.

5.2 Hospitalisations and mortality wholly attributable to alcohol

Environmental Health Intelligence NZ (EHINZ) at Massey University reports on several indicators of alcohol-related harm. These indicators can be interactively explored as dashboards on the Healthspace website.[16]

Most of the indicators are covered elsewhere in this chapter, however, two additional indicators reported in Healthspace are:

- hospitalisations wholly attributable to alcohol
- mortality wholly attributable to alcohol.

The indicators are generated from the Ministry of Health's National Minimum Dataset, a national collection of public and private hospital discharge information, including coded clinical data for inpatients and day patients. This data is reported annually, from 2001 to 2019. Hospitalisations and mortalities can be queried by district health board, sex, age group, ethnic group and deprivation index. Hospitalisations can also be queried by drinking pattern (chronic or acute), where chronic hospitalisations are related to conditions associated with chronic drinking patterns, and acute hospitalisations are related to conditions associated with acute intoxication drinking patterns.

5.3 Availability and access to alcohol

Several data sources provide an indication of alcohol use, availability and accessibility. Each dataset reflects one aspect that could influence alcohol use and alcohol-related harm.

5.3.1 Alcohol available for consumption

Stats NZ provides data on alcohol available for consumption (beer, wine, spirits and spirit-based drinks). These statistics measure how much alcoholic beverage is released to the domestic market and is therefore

[16] See https://healthspace.ac.nz/ for more information.

available for consumption (not the same as actual alcohol consumption). This information is updated and reported quarterly.

Statistics on alcohol available for consumption are provided via the Infoshare web application, which gives options to view statistics by the total amount of alcohol available, by type and per capita.

5.3.2 Alcohol affordability

No dataset is readily available that provides indicators of alcohol affordability, however, the HPA (2018) used data provided by Stats NZ and information from the Liquor Information Pricing Service to estimate:

- the price of alcohol per standard drink
- the 'real' price of alcohol (the price of alcohol adjusted for inflation)
- alcohol affordability
- minutes of work needed to earn one standard drink.

The output report *Trends in affordability of alcohol in New Zealand* shows trends in these indicators over time, from the 1980s to 2017, but the raw data was not publicly released (HPA, 2018).

Alcohol affordability reported by HPA takes income into account when considering alcohol price and is shown as an index scaled to equal 100% in June 2006.

5.3.3 Alcohol licences and alcohol outlet density

The Ministry of Justice Register of Alcohol Licences lists active alcohol licences across New Zealand. The spreadsheet register is updated quarterly and can be filtered by district licensing committee, licence category and conditions. This register cannot be used to examine trends over time because it only shows a current snapshot of active alcohol licences.

The alcohol licence register was used by EHINZ to calculate alcohol outlet densities (per population and by area) in 2016, as reported on the Healthspace website.

6 Review of factors influencing alcohol-related crashes

This chapter provides an overview of factors that influence alcohol-related crashes, as identified in the literature review stage. Common themes around factors in alcohol-related crashes that emerged during the stakeholder engagement stage are also noted. Because many factors were considered in this review, efforts were made to restrict findings to a high level of review without going into detail. Also, because many factors have cultural elements, New Zealand studies have been referenced where possible. Otherwise, research from regions with similar cultures to New Zealand (Australia, North America and Western Europe) are included where relevant.

The literature has not, in all cases, made it possible to link factors directly to alcohol-related crashes. Many more sources instead link factors to alcohol consumption. However, as has been established, a strong relationship exists between alcohol consumption and alcohol-related crashes. Common themes around factors in alcohol-related crashes that emerged during the stakeholder engagement stage are also noted.

6.1 Education and prevention programmes

In New Zealand, education around alcohol use and road trauma is delivered to the public from several angles, including from NZ Police, the transport sector (eg Waka Kotahi, the New Zealand Automobile Association) and health sector (eg Ministry of Health, HPA, district health boards and Alcohol Healthwatch). Education around drink driving can be targeted at high-risk groups of individuals, for instance, through the licensing process or offender programmes, or at the wider public through advertising, whether it is on billboards, on television or at specific higher-risk locations, such as on-licensed drinking establishments. Econometrics have shown that drink-driving advertising is effective at reducing DSI crashes. Newstead et al. (1995) estimated the scale of the reduction at 7% each year in Victoria, Australia, between 1989 and 1993. However, education is most effective when it is supported by other countermeasures, such as highly visible enforcement (Austroads, 2020).

Prevention programmes can also reduce the incidence of drink driving. These programmes work by showing would-be drink drivers that options are available to avoid drink driving, and by normalising the use of these options. In group drinking situations, designated driver programmes encourage the group to self-identify a driver who will stay sober before drinking starts. Alternative transport schemes encourage drinkers to use a ride-hailing service rather than drive, though in New Zealand these services are limited outside of major urban areas. Community and sport club programmes allow authorities to work with local organisations to prevent drink driving in environments where alcohol consumption is likely but where other education and enforcement may have difficulty reaching. Although these types of programmes have anecdotally had some success, the evidence for their effectiveness is mixed (Austroads, 2020).

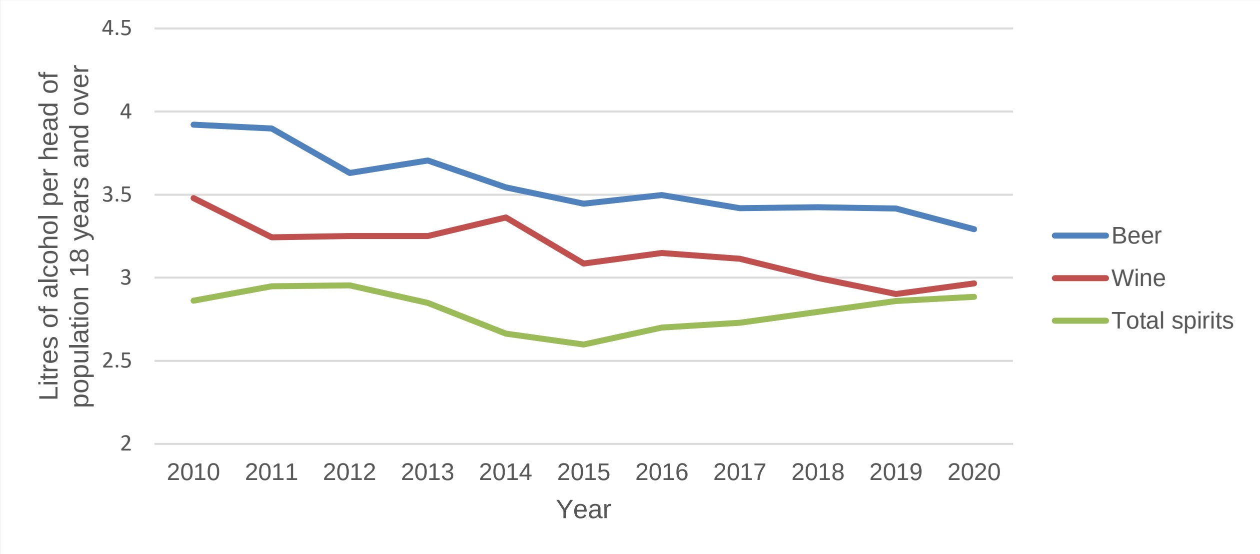
Another route of prevention identified in Shinar (2017) is one where programmes are implemented aimed at training servers on how to identify when patrons have consumed too much alcohol and refuse to serve them further. It is already illegal to serve alcohol to intoxicated people in New Zealand.

6.2 Availability and accessibility of alcohol

Econometric modelling shows that access to alcohol is related to the number of crashes and casualties, and their severity (Fridstrøm, 1999). The accessibility of alcohol differs across populations and is affected by pricing, legal restrictions and the physical proximity of alcohol outlets to the areas where people live. The accessibility of alcohol also varies across different types of alcohol. Amongst these, beer is often considered the alcoholic drink that is most relevant to drink driving (Shinar, 2017).

Figure 6.1 shows total alcohol available for consumption, by adult population, between 2010 and 2020 (Stats NZ, 2021). The source for this data is described in more detail in section 5.3.1. Figure 6.1 shows that all forms of alcohol available for consumption decreased overall between 2010 and 2015. Since then, wine and beer have continued to decrease slightly, while a noticeable increase can be seen in the amount of spirits available for consumption per adult population.

Figure 6.1 Alcohol available for consumption, by total population aged 18 years and over, by alcohol type, 2010–2020 (source: Stats NZ, 2021)



In the literature, limiting access to alcohol is often considered as a potential measure to limiting alcohol harm. Many studies conclude by suggesting further limits to alcohol availability, such as raising prices (HPA, 2018), limiting the number of outlets permitted to sell alcohol (Connor et al., 2011) or increasing the purchase age (Huckle & Parker, 2014; Kypri et al., 2006). However, just because people cannot access alcohol, does not mean they will not drink it. Some people, particularly those in high-risk groups, may seek other routes to access alcohol that may be equally or even more harmful, such as switching to unrecorded (illegally produced) or surrogate (non-beverage) alcohols, for example, mouthwash, hand sanitiser and industrial spirits (Bobrova et al., 2009; Neufeld et al., 2019; Pauly et al., 2020).

6.3 Demographic factors

Many international studies have attempted to identify demographic profiles of people who are most likely to drive after drinking.

6.3.1 Age

Most research around age and alcohol focuses on the behaviour of young drivers. According to the NZHS, 32.4% of 18- to 24-year-olds in New Zealand are hazardous drinkers, which is more than any other age group (Ministry of Health, 2020). Young people are also more likely to engage in risky driving behaviour (Scott-Parker et al., 2014; Starkey & Isler, 2016), particularly those who report high alcohol use (Begg et al., 2017). As a result, young drivers are more likely to crash, and fatal crashes involving young drivers are more likely to involve alcohol.

As shown in chapter 2, Figure 2.1, the risk of a fatal crash in New Zealand is three times higher for drivers aged 20 to 29 and 5.3 times higher for drivers aged 15 to 19 than it is for drivers aged 30 and above with a similar BAC (Keall et al., 2004). This is clear from the Ministry of Transport (2020) data for 2017 to 2019, where 40% of drivers aged 20 to 24 involved in fatal crashes were affected by alcohol or drugs, more than any other age group. Younger drivers in fatal alcohol- and drug-related crashes are also more likely to kill other people, particularly because they are more likely to be carrying passengers. The high rate of serious alcohol-related crashes among young drivers is why New Zealand introduced zero-alcohol limits for under-20-year-olds in 2011 (see section 2.2).

Ministry of Transport (2020) data also indicates a secondary, though much lower, peak in fatalities from alcohol- and drug-related crashes involving drivers in the 50–54-year age group. This aligns with the Ministry of Health NZHS (2020), which shows 27.7% of people in the 45–54-year age group are hazardous drinkers, second only to people aged between 18 and 24 years. Though they are less likely to binge drink than younger drivers, they often drink more regularly. In Australia, people in the 55–74-year age group are the most likely to exceed lifetime risk guidelines by consuming more than two standard drinks per day on average (Australian Institute of Health and Welfare, 2021). Though hazardous drinking in older people has often been a problem throughout their adult life, one-third of older adult problem drinkers are late onset, meaning their drinking has escalated as they have aged. Increased alcohol consumption in this age group can result from major life events and lifestyle changes. These adults are more likely to be experiencing divorces, retirement and deaths of family members and friends. As they age, they are also at greater risk of chronic medical conditions and may require the use of regular medication (Hodges & Maskill, 2014), which could interact with alcohol.

6.3.2 Gender

The NZHS shows that males are roughly twice as likely as females to be hazardous drinkers (Ministry of Health, 2020) and about 1.7 times more likely to report having driven under the influence of alcohol (Ministry of Health, 2015). However, the disparity in road safety outcomes is even greater. Between 2017 and 2019, Ministry of Transport (2020) data shows that 82% of drivers affected by alcohol or drugs in fatal crashes were male. This is slightly higher than the proportion of male driver deaths across all crashes over the same period (78%). International studies indicate that males are as much as three times more likely to drink drive than females (Chou et al., 2006; Stephens et al., 2017). These figures consider the likelihood of greater alcohol consumption amongst males as well as the fact that males are more likely than females to engage in risky driving behaviour (Rhodes & Pivik., 2011).

6.3.3 Socioeconomic deprivation

The international literature indicates drink drivers are more likely to be from a lower socioeconomic group, in a blue-collar occupation, and not have tertiary education (Ferguson et al., 1999). Unlike age and gender, however, these factors are not as ubiquitous across the literature, presumably due to greater susceptibility to variations in culture and lifestyle across studies. In Australia, a study by Stephens et al. (2017) found greater rates of drink driving are associated with being in full-time employment, presumably due to its correlation with the need to travel.

In New Zealand, data is limited demonstrating how socioeconomic status affects alcohol-related crash risk, but it has been found that people in more deprived neighbourhoods have a higher risk of DSI across all crashes and are more likely to drink hazardously. The DSI risk across all crashes for people living in the most deprived areas is two-to-three times that of people living in the least deprived areas (Waka Kotahi, 2021). Deprivation is associated with systematic barriers around safe road use and education, which leads to road safety implications, such as vehicle safety, occupant numbers, seatbelt use and longer trips on higher-risk roads (Waka Kotahi, 2021).

Furthermore, the results of the 2012/13 NZHS (Ministry of Health, 2015) indicate that people living in more deprived neighbourhoods were more likely than people in less deprived neighbourhoods to drink to intoxication with high frequency and be classified as hazardous drinkers, despite being less likely to consume alcohol overall. When it comes to drink driving, a similar proportion of drinkers reported having driven under the influence of alcohol in both high- and low-deprivation neighbourhoods. However, people from high-deprivation neighbourhoods were less likely to report as driving under the influence of alcohol after adjustment for sex, age and ethnic differences.

6.3.4 Ethnicity

Trends in alcohol consumption patterns across ethnicities in New Zealand are regularly reported as a part of the NZHS. However, little information is in the literature linking ethnicity to crash risk, especially alcohol-related crash risk.

Waka Kotahi (2021) sought to fill this information gap with the release of the report *He Pūrongo Whakahaumaru Huarahi Mō Ngā Iwi Māori: Māori Road Safety Outcomes*. This report raised issues in the way crash data is recorded with reference to ethnicity. First, it is noted that when a police officer fills out a TCR, ethnicity information is often based on their observation and does not necessarily reflect how the people involved would identify themselves. Secondly, while statistics are available that break down DSI data by ethnicity, this is rarely done in combination with other demographic factors, such as age, gender or region, making it difficult to analyse trends in detail and determine how factors are interrelated. These are important issues to address in relation to alcohol-related crashes, because alcohol is more likely to be a factor in fatal or serious crashes involving Māori, compared with non-Māori.

It is stressed that ethnicity is not in itself a cause factor in crashes. Rather, it is its association with other sociodemographic factors that increases crash risk amongst some groups. Māori, for instance, are more likely to be living in areas with high levels of social deprivation, and the population's younger age structure increases exposure to road safety risk. Furthermore, the literature is increasingly identifying racism as a major factor in inequalities between Māori and New Zealand Europeans. Recently, a study by Winter et al. (2019) found that 35% of hazardous drinking by Māori can be attributed to discrimination.

Even less data is available around crashes amongst other minority ethnicities in New Zealand, such as Pasifika people. The NZHS shows that, amongst those who consume alcohol, Pasifika men and women are more likely to drink hazardously (Ministry of Health, 2020). It is not known what this means in terms of alcohol-related crashes.

6.3.5 Family structure

Several studies have indicated that drink drivers are more likely to be single, including widowed and divorced (Chou et al., 2006; Ferguson, 1999). It is surmised that drivers are more likely to be averse to the risks of drink driving when they have cause to concern themselves over the welfare of close family members. The literature review was unable to find any studies looking at this factor in the New Zealand context.

6.3.6 Rurality

Despite accounting for a fraction of the New Zealand population, compared with urban areas, rural areas account for a disproportionate amount of DSIs from alcohol-related crashes. The rural driving environment carries higher risks of DSI crashes occurring than urban ones. Rural roads are driven at higher speeds, and rural drivers also have longer distances to travel to get home, which increases their exposure to crash risk and limits alternative transport options. When a crash does occur, post-crash care is often difficult, because it can take time for emergency services to reach crash sites. These factors give rural roads a high risk of fatalities, especially when alcohol is involved (Siskind et al., 2011). In New Zealand, between 2015 and

2019, 40% of injury crashes occurred on high-speed rural roads but these accounted for 55% of DSI casualties and 74% of fatalities (Ministry of Transport, 2020).

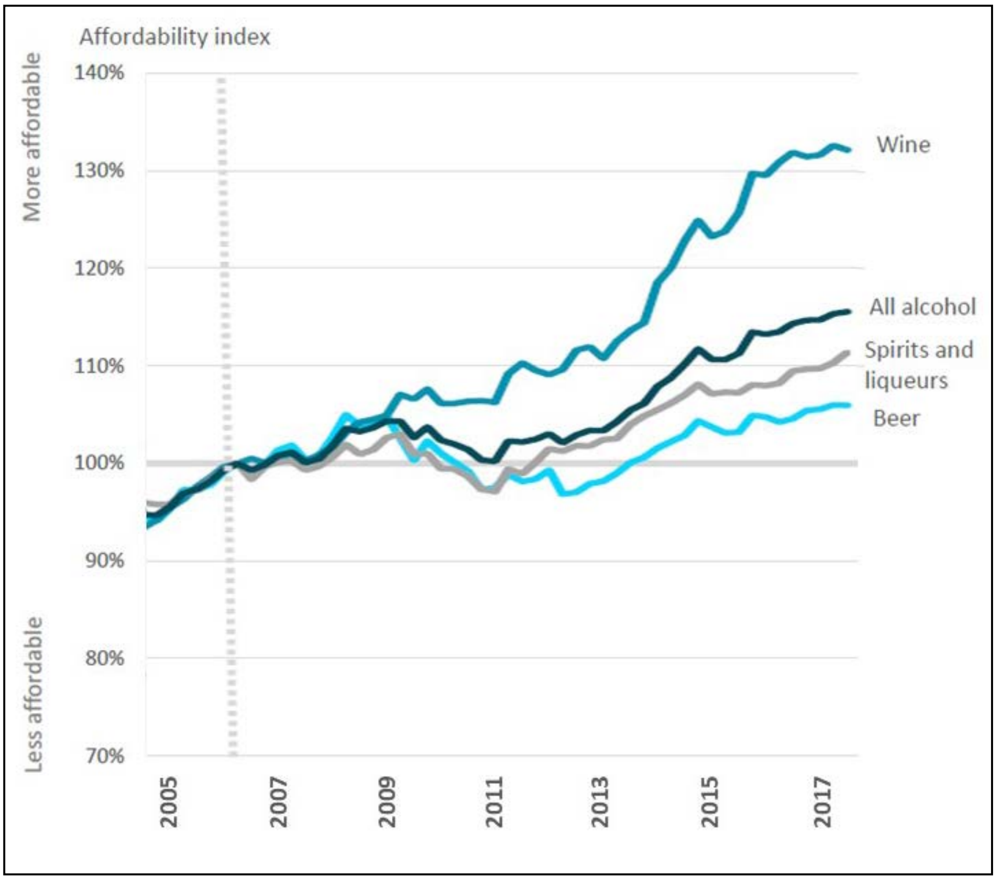
Rural regions also face difficulties with enforcement. These regions often have low population densities, and so the rural road network is lengthy with low road volumes. This makes setting up alcohol checkpoints, for instance, less efficient and less economic than in urban areas. Consequently, the likelihood of drink drivers being detected is much lower in rural than urban areas (Ferguson et al., 1999). Members of the public also perceive less enforcement in rural areas, with 68% of participants in the 2020 survey Public Attitudes to Road Safety (Waka Kotahi, 2020a) stating it is unlikely for a drink driver to be stopped and tested on a rural road.

6.3.7 Pricing and affordability

Greater affordability of alcohol is associated with higher levels of alcohol consumption (HPA, 2018). This relationship is generally inelastic, with an increase in prices resulting in a less than proportionate decrease in consumption (White et al., 2014). However, different alcohol consumption patterns show different levels of elasticity to changes in prices. Heavier drinkers are less responsive to changes in price because they are more likely to switch to different, cheaper alcohol products. An Australian study found that increases in alcohol prices were associated with an increase in both the number of days no alcohol was consumed and the number of days a low amount of alcohol was consumed, but no change in high- or moderate-intensity drinking trends (Byrnes et al., 2012).

Recent evidence (Figure 6.2) indicates that alcohol has become more affordable over the past 20 years (HPA, 2018). The real price of wine has continually decreased since the late 1980s, and its affordability has increased by more than 20% between 2012 and 2018. The real price of beer and spirits increased since the late 1980s, but incomes have been rising faster, making them more affordable overall. The HPA (2018) notes the affordability of alcohol, pointing out that, in 2017, the average worker took just over 10 minutes to earn sufficient wages to buy enough cheap alcohol to exceed low-risk drinking advice. Young people, who are over-represented in alcohol-related crashes, consume the highest quantities of low-cost drinks that are high-alcohol by volume (White et al., 2014).

Figure 6.2 Affordability index of alcohol in New Zealand 2005 to 2017, indexed to June 2006 (adapted from HPA, 2018)



A significant difference is also evident in affordability between on- and off-licensed premises (HPA, 2018). An average-priced alcoholic beverage from off-licensed premises was more affordable in 2017 than 1999. However, a beer at on-licensed premises has become less affordable over the same period. While a beer in 1999 was less than twice as affordable at off-licensed than on-licensed premises, in 2017, it was more than three times as affordable. These trends are likely to influence when and where individuals drink alcohol. For example, the availability of cheap alcohol from off-licenses can encourage drinking at home in advance of going out (termed 'pre-drinking' or 'pre-loading'), though this is a complex area that is closely linked to social norms (HPA, 2014). Nevertheless, when and where alcohol is consumed has implications for road safety and the effectiveness of drink-driving enforcement.

6.3.8 Purchasing age

The Sale of Liquor Amendment Act 1999[17] resulted in New Zealand's legal purchasing age being lowered from 20 to 18 years of age. Many studies were published by New Zealand health researchers looking at the periods before and after this change, showing that because of the change more alcohol-related crashes have occurred among under-20-year-olds (Huckle & Parker, 2014; Kypri et al., 2006) and a greater incidence of injury is attributable to them (Kypri et al., 2017). However, the same relationship does not seem to extend to fatal alcohol-related crashes (Huckle & Parker, 2014). Furthermore, research has been released by economists debating whether the change in purchase age had any effect at all, arguing that crash rates

[17] See www.legislation.govt.nz/act/public/1999/0092/latest/DLM32605.html for further information.

amongst 18- to 19-year-olds were already rising before the change (Boes & Stillman, 2013). However, the authors do admit the change had an effect in other areas of alcohol harm, leading to an increase in alcohol-related hospital admission, and follow-up work has shown that crashes do increase among drivers who have just turned 18, though this is suggested to be a short-lived phenomenon (Boes & Stillman, 2017). It is therefore clear the change in purchasing age in 1999 had some effect on alcohol-related road trauma, though the scale of this is less conclusive.

Internationally, the relationship between purchasing age and crashes is not clear. The United States of America, with a higher-than-average crash rate for a high-income country and a similar proportion of fatal crashes involving alcohol as New Zealand (WHO, 2018b), has an alcohol purchasing age of 21. Evidence shows, however, that raising the minimum age to 21 reduced alcohol-related crashes and other alcohol harm in the United States of America (Decker et al., 1988; Fell, 2013; O'Malley & Wagenaar, 1991; Wagenaar & Toomey, 2002), though other sources suggest the issue is more about drinking experience and the change has merely resulted in high-risk drinking behaviour being delayed to a later age (Asch & Levy, 1987; Cheng & Anthony, 2016).

Some countries with much lower crash rates than New Zealand and much lower numbers of fatal crashes involving alcohol, notably Switzerland and Germany, allow the independent purchase of some types of alcohol at ages as young as 16. Though much of this variation may be cultural, research in a New Zealand context speculated that 'limited exposure to moderated drinking experiences prior to permitting alcohol purchasing rights might be more effective in mitigating alcohol-induced risky behaviours' (Dasgupta et al., 2020, abstract). In an NSW study, Lindo et al. (2015) found a link between legal access to alcohol and certain types of alcohol-related harm, but not crashes, and the authors attribute this to the tenacity with which NSW enforces and punishes drink driving.

6.3.9 Outlet trading hours and density

The Sale of Liquor Act 1989[18] liberalised the alcohol market at the time. This change resulted in the number of alcohol outlets increasing from 6,200 in 1990 to 10,800 in 1995 (Hill & Stewart, 1996). The legislation did not include any national limits to trading hours; they were instead set at the discretion of the Liquor Licensing Authority. This meant outlets often had their hours set without input from the community, and, in some cases, 24-hour outlets were established. Further legislation in the form of the Sale and Supply of Alcohol Act 2012[19] addressed this issue by limiting maximum trading hours for alcohol outlets to 8 am to 4 am for on-licensed premises and 7 am to 11 pm for off-licensed premises. In the stakeholder engagement, one participant noted that the 2012 change in legislation had a positive effect on rates of alcohol-related assaults.

The association between alcohol consumption and density of alcohol outlets, including on-licensed and off-licensed premises, has been recently studied in New Zealand and internationally. The research shows mixed results, with many studies finding positive associations with alcohol consumption at some level for some populations, but inconsistencies exist between these results. A complication in assessing the effect of outlet density on alcohol consumption is the direction of causality, because, from an economic perspective, it would be expected to find higher outlet densities in areas where more demand exists for alcohol. Many studies have shown positive associations between the density of outlets and levels of deprivation.

In New Zealand, research looking at Manukau City (now part of Auckland City) found that outlet density was associated with a range of police events, but only off-license density was associated with crashes (Cameron et al., 2012). This research was later extended to all the North Island (Cameron et al., 2013), finding instead

[18] See www.legislation.govt.nz/act/public/1989/0063/latest/DLM165121.html for more information.

[19] See www.legislation.govt.nz/act/public/2012/0120/latest/DLM3339333.html for more information.

that nightclubs and bars were most associated with crashes, while supermarkets and grocery stores were negatively associated with them. However, significant regional variation exists across the modelled area, which is attributed to various locally specific factors that cannot be easily accounted for.

6.4 Health

Excess consumption of alcohol is, above all, a health issue, with alcohol-related crashes being one of the many harms that can emerge from excessive or hazardous drinking. Alcohol and general health are often interdependent, with alcohol consumption affecting driver health in the short and long term, and health affecting both the consumption of alcohol and the scale of the effects from that consumption. The extent to which health factors co-occur in alcohol-related crashes in New Zealand is not clear from the literature.

6.4.1 Sleep and fatigue

Alcohol can have a disruptive effect on sleep, to the point where it can cause sleep loss and upset circadian rhythms (HPA, 2016; Ogden & Moskowitz, 2004). The resulting tiredness can increase crash risk even after alcohol has left the body. Furthermore, fatigue, whether attributable to alcohol consumption or not, can increase susceptibility to the effects of alcohol, such that impairment is higher at a lower BAC than it would otherwise be if the driver were not tired.

6.4.2 Health conditions

Alcohol can worsen other health conditions not related to alcohol consumption, for instance, diabetes and mental health conditions. Even if alcohol does not affect a health condition directly, it may interact with medications taken to control the health condition. Alcohol can interact with a variety of prescription drugs including benzodiazepines, opiates, paracetamol, antidepressants, antibiotics, antihistamines, anti-inflammatory drugs, hypoglycaemic agents, warfarin, barbiturates, and some heart medicines (HPA, 2016). This is a particular risk factor in aging adults, who, as previously established, are more likely to have a medical condition.

Alcohol can sometimes be used as a coping mechanism in times of psychological distress (see section 6.5). This can result in excessive alcohol consumption. Reporting from the Australian Institute of Health and Welfare (2021) indicates that people experiencing higher levels of psychological distress are more likely to report consuming more than four standard drinks on one occasion. The report also indicates that people with mental health conditions are more likely to report drinking at risky levels. The consumption of alcohol has an interdependent relationship with mental health, with long-term consumption of alcohol causing or exacerbating mood disorders such as depression and anxiety (HPA, 2016).

6.4.3 Alcohol abuse

People with a history of alcohol abuse are more likely to be in crashes (Shinar, 2017) and arrested for drink driving (Fell et al., 2010). In the United States of America, a study by Baker et al. (2002) found that potential problem drinking was closely correlated with BAC measurements in drivers killed in crashes. Two-thirds of drivers with BACs greater than 150 mg/dl had at least one indicator of potential problem drinking. Alcohol abuse can also result in other impacts on health that can lead to a greater risk of crashes occurring. Alcohol affects all parts of the body, and chronic consumption can cause a range of health issues (HPA, 2016), many with repercussions on a person’s ability to drive. These include:

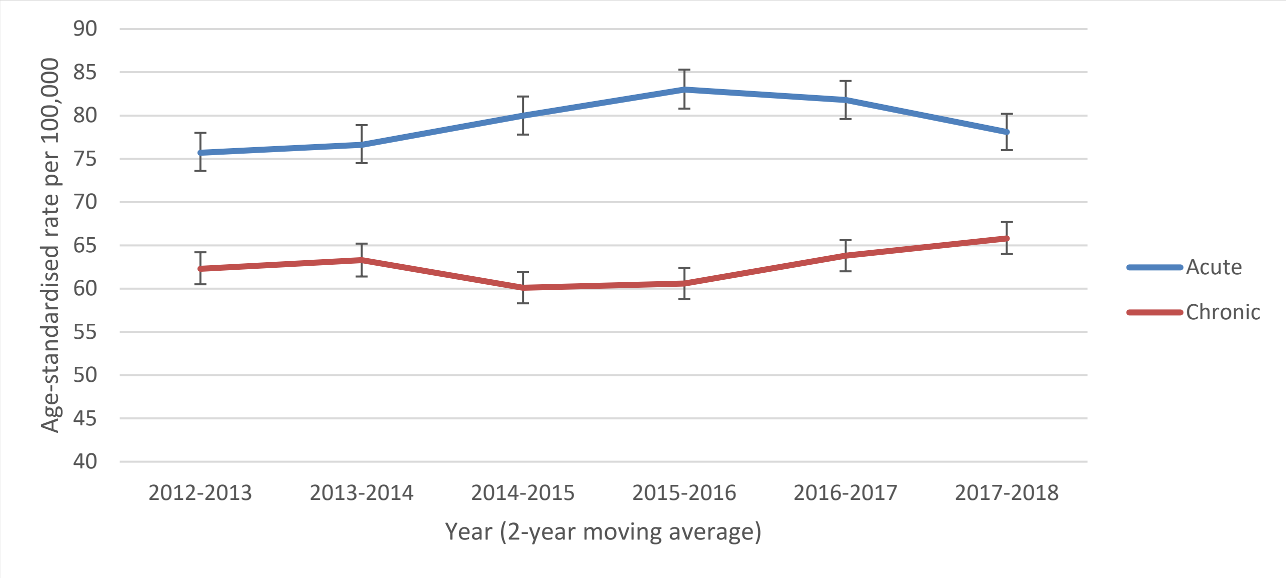
- alcohol dependency, requiring further alcohol consumption for relief
- raised blood pressure, potentially leading to stroke
- brain and nerve damage, leading to problems from memory difficulties to reduced motor functions

- alcoholic liver disease
- difficulty controlling blood sugar, leading to fatigue
- reduced ability to fight infections, resulting in susceptibility to illness.

If a chronic alcohol consumer is involved in a crash, they can also be at greater risk of death due to factors such as heart weakness, muscle wasting, reduced bone strength and reduced ability to recover.

The EHINZ (2021) hospitalisations and mortalities dataset (as discussed in section 5.2) shows trends in emergency department admissions related to acute and chronic alcohol use (Figure 6.3). This shows admissions related to chronic and acute alcohol use have generally increased between 2012/13 and 2017/18, although a downward trend can be seen in acute alcohol admissions from 2015/16 onwards.

Figure 6.3 New Zealand hospitalisations wholly attributable to alcohol (including emergency department visits of more than 3 hours), aged 15-plus years, by drinking pattern, 2012–2018 (source: adapted from EHINZ, 2021)



6.5 Economic conditions

The economic climate at a national and local scale can affect alcohol-related crash rates because of impacts on both alcohol consumption and driving behaviour. It has been noted that alcohol consumption has a strong collective component, with all consumers contributing to wider drinking habits and their social activity or attractiveness (Fridstrøm, 1999). As such, a relationship exists both on the aggregate and individual level with the economy. Effects due to economic factors can, however, be complex and multifaceted.

Economic downturns can increase drinking problems due to psychological distress triggered by unemployment or reduced income, as well as restricting access to alcohol because of reduced affordability. Increased distress and alcohol consumption are particularly linked in the case of males (de Goeij et al., 2015). Fuel prices, which are partially related to the overall state of the economy, also influence alcohol-related crashes. When fuel prices are high, drivers may change their travel behaviour to drive less and so conserve fuel. Research from the United States of America found that higher fuel prices are associated with fewer alcohol-related crashes, in particular, non-injury crashes (Chi et al., 2010). Higher alcohol consumption, however, is associated with more alcohol-related crashes, particularly fatal and injury ones. It is suggested that higher fuel prices are more likely to deter lighter drinkers from drink driving, as opposed to heavier drinkers. Meanwhile, heavier drinkers are more likely to drink even more in response to distress from economic factors.

The complex and sometimes opposing interrelationships between the economy, fuel prices, alcohol consumption, driving behaviour and other economic factors can make it difficult to identify clear causal relationships. Internationally, a significant effort has been made to use time-series analyses to connect road crashes to wider economic trends, a practice known as econometrics. Though these models typically do not look specifically at alcohol-related crashes, they can relate the effect of drink-driving countermeasures on fatal crashes. For instance, researchers in Victoria, Australia, have had success in separating out the annual contributions of speed cameras, publicity campaigns, breath testing, alcohol sales, reduced economic activity, and accident black spot treatments to reductions in DSI casualties (Newstead et al., 1995, 1998; Thoresen et al., 1992).

6.6 Societal attitudes and behaviours

Societal attitudes and behaviour around drink driving have improved in past decades in much of the developed world. This can be attributed to greater awareness of risks and changes in social acceptability, often driven through effective advertising campaigns.

Research indicates that most people tend to have a good understanding of the legal ramifications of drink driving and the risk of physical, mental and social harm to themselves. However, drink drivers are less likely to have the same level of concern around these risks as is seen in the overall population (Freeman et al., 2016). The more this is the case, the more drink driving becomes an issue centred on a small subset of the population, rather than one that is endemic in the population at large. Indeed, as overall compliance with drink-driving legislation improves, further measures can be perceived as less effective due to those who are inclined to comply continuing to comply, while those who are disinclined to comply being unlikely to do so under any circumstances.

The latest edition of the survey report *Public Attitudes to Road Safety* (Waka Kotahi, 2020a) shows that 12% of drivers admit to driving while slightly intoxicated, a significant decrease from the 18% recorded in the 2016 survey, and much lower than the proportions around 30% recorded in the mid-1990s.

6.6.1 Perceptions of crash risk

Waka Kotahi (2020a) indicates that only 9% of New Zealanders believe not much chance exists of a crash when drink driving, and this proportion has stayed relatively level since the mid-1990s. This indicates the awareness of the risks is high. The fact that self-reported drink driving has dropped over the same period, whether or not this is in fact reflective of actual habits, may indicate that much of the change has been around the social acceptability of drinking and driving rather than actual awareness of the risks. The literature shows, however, that perceptions are not uniform across the population. Drivers who self-report drink-driving behaviour and are hazardous drinkers are less likely to agree that drink driving increases crash risk (Stephens et al., 2017) and convicted drink drivers have lower levels of knowledge around safe drinking (Ferguson et al., 1999).

6.6.2 Perceptions of alcohol consumption and legal limits

Even when drivers are aware of the risks of drink driving, it may not be clear to them when their behaviour is putting themselves and others at risk. If drivers are aware of the exact legal BAC limits, which is not necessarily the case, they are often unable to translate them into actual drinking behaviour.

Surveys are periodically run and reported on by news outlets showing New Zealanders' less-than-perfect knowledge of the BAC limit and how this relates to how much they have drunk. For example, a recent survey commissioned by beverage company Lion NZ (2019) showed that only 17% of surveyed drivers knew the BAC limit and three-quarters were unfamiliar with New Zealand's guidelines around healthy drinking. This is supported by international research, which has also found similar results in other jurisdictions (Shinar, 2017).

Furthermore, one of the issues with alcohol consumption with respect to drink driving is that drivers' perceptions of their level of impairment and the amount of alcohol they can safely drink may deteriorate as more alcohol is consumed (Kypri & Langley, 2003). Drivers may know they have drunk enough to be impaired, but may not realise just how impaired they are (Charlton & Starkey, 2013). Even if a driver's perceptions around drink driving are reasonably accurate when sober, these perceptions can change once alcohol has been consumed. Furthermore, when drivers have been drinking and were provided information about their alcohol levels, they may discount the accuracy of this information, choosing instead to trust their subjective perception, which is often that they are not as impaired as they in fact are (Shinar, 2017). The literature indicates it may be common for drivers to hold beliefs around a certain 'permissible' amount of alcohol that, in their estimation, will not put them over the BAC limit and allow them to drive safely. In some cases, drivers may believe that consuming one or two drinks will not affect their driving ability at all (Keatley et al., 2019). While this has been shown not to be true, the practice demonstrates the type of thinking drivers resort to when they have imperfect information around impairment levels.

Internationally, some jurisdictions attempt to improve drivers' understanding of BAC limits and what this means in terms of alcohol consumption by including general rules or BAC tables in driving manuals and safety guides (Shinar, 2017). However, because alcohol processing varies by individual and situation this is inherently inaccurate. It also risks the BAC limit as being seen as advocating a 'permissible' amount of alcohol consumption. It is therefore a challenge to educate drivers, particularly after they have already consumed alcohol and perceive themselves to be less impaired than they really are.

6.6.3 Peer influence

The behaviour of drivers can be influenced by their peers through social norms. Depending on the attitudes of peers, this could be towards either a greater or lesser likelihood of drink driving. Drivers are likely to associate with peers who hold similar views and sometimes may find themselves changing their views and behaviour to align with their peers, to achieve social acceptance (Ferguson et al., 1999). Younger drivers are particularly susceptible to this (Keatley et al., 2019). Even if peers are not actively supportive of drink-driving behaviour, it can be implied by being a passenger of a drink driver or not taking steps to prevent a peer from driving after drinking. Meanwhile, disapproval of drink-driving behaviour on the part of family and friends may help to reduce the likelihood of drink driving by potential offenders.

NZ Police (2009) provides anecdotal evidence of peer pressure where rural pub patrons, particularly males, are discouraged from phoning partners to drive them home, illustrating the sort of attitudes that can be found among some peer groups. Peers also have a role in developing driver behaviour and attitudes from a young age. The primary determinant of drink-driving behaviour is the level and pattern of alcohol consumption, and this is often learned through family influences (Ferguson et al., 1999).

6.7 Personality

Societal-level trends can only account for some of the likelihood of drink driving. A significant factor at the individual level is personality. This is a broad area that has been subject to much study.

While common trends can be addressed through national strategies around education and enforcement, personality can lead to differential impacts at the individual level, because drivers with a strong willingness to comply will quickly change their behaviour while others may not at all. This differential deterrence is an important consideration because it can sometimes result in counter-intuitive outcomes resulting from measures intended to reduce alcohol-related crash harm. For instance, when Ontario (Canada) brought in automatic 90-day licence suspensions for drivers found to be over the legal BAC limit, the mean alcohol consumption of drink drivers increased (seemingly counter-intuitively) due to more compliant drivers dropping out of the drink-driving population (Mann et al., 2003).

As societal tolerance of drink-driving behaviour has been on a downward trend over the past several decades, more attention is being put to the personality traits common among drink drivers and how these can be addressed. Increasingly, many alcohol-related crashes are being perceived as caused by individuals who show opposition to drink-driving countermeasures, and many in this group may show other harmful behaviour in other parts of their lives. This is particularly so among drivers who show patterns of recidivism.

6.7.1 Recidivism – repeat offending

Recidivist drink drivers account for a high proportion of drink-driving offences, In Australia, roughly one-in-five detected drink drivers have a previous offence in the preceding five years (Austroads, 2020). Furthermore, these drivers are over-represented in road trauma.

Personality is much more likely to be a factor in recidivist drivers than first-time offenders, because it is much less likely to be the result of an ‘unlucky’ lapse of judgement. Multiple offenders have repeated the behaviour, despite having faced legal, moral and/or social consequences on one or more previous occasions. Recidivist offenders are also more likely to have personalities scoring higher in terms of hostility, sensation seeking, psychopathic deviance, mania and depression than first-time offenders while showing lower levels of emotional adjustment and assertiveness (MacMillen et al., 1992). They are associated with more previous non-traffic-related arrests, accidents and traffic tickets. Their alcohol consumption tends to be higher and riskier, and their BAC at the time of offence tends to be higher. Often, addiction and mental health issues are factors in recidivism.

7 Additional data analysis

During the literature review and stakeholder engagement phase, several datasets were identified for further investigation that are not publicly accessible. This chapter describes the analysis of selected datasets made available to the project team, as well as further investigation into the coding of alcohol-related crashes in CAS. The purpose of the analysis was to establish the usefulness and limitations of the data available for understanding trends in drink driving and alcohol-related road trauma, focusing on trends observed over 2010 to 2020.

Note that, due to limitations in the data, the analysis undertaken was primarily exploratory. As such, the project team is reluctant to draw conclusions about causal relationships between alcohol-related crashes and related factors. It is anticipated future research could build on the information in this chapter to undertake more detailed and focused analyses.

7.1 Methodology

The following datasets were made available to the project team for further analysis:

- blood test results from ESR for fatal, injured and non-injured drivers
- detailed offences data from NZ Police
- detailed breath test data from NZ Police.

The project team used this and crash data from CAS to:

- Assess the overall usefulness of each dataset for understanding trends in drink driving and alcohol-related road crashes.
- Explore how changes in data collection or reporting methods, drink-driving legislation or enforcement practice could have affected observed trends in the data.
- Investigate alcohol-related crash data to quantify stakeholder concerns around how alcohol is coded.

The project steering group also provided feedback and agreed on the scope of the analysis for this stage. The results of the analysis are presented in the sections that follow.

7.1.1 Data banding

Where relevant, attributes within each dataset were aggregated against defined bands, to ensure consistency across how results are reported. The schema for data banding is provided in appendix B.

7.2 Institute of Environmental Science and Research blood test data

ESR provided anonymised driver blood sample test results to the project team. Results are stored in one of two databases, depending on whether the driver was alive or dead at the time of testing, due to differences in privacy requirements. These databases are:

- The ‘fatal driver’ database, which includes blood samples and test results collected by the coroner from drivers killed in crashes between July 2004 and December 2020.
- The ‘living driver’ database, which includes blood samples and test results from two groups of drivers collected between July 2003 and June 2021. These are further subdivided into:
  - hospitalised drivers injured in accidents who had blood taken in hospital
  - non-hospitalised drivers who had blood taken as part of an evidential blood test.

In each case, the data spans several database versions (four in the case of fatal driver data, three in the case of living driver data). Data fields are not necessarily the same from each database version to the next. Two important limitations to the data stem from this. First, fatalities from July 2009 through to December 2012 do not include dates (648 records are available that may have occurred at any point within this period). Secondly, the age of drivers in the living database is only available from 2015.

The ESR data has further limitations as a time series. It only includes results for drivers where it has been possible to take blood samples and these have been provided to ESR for testing by NZ Police. Samples classified by ESR as a fatal or hospitalised driver are based on the information accompanying the sample when provided to ESR. As such, drivers who are hospitalised but later die are likely to remain in the living driver database, even though they would be updated to a fatal injury in CAS. In some cases, blood samples are not tested for the presence of alcohol if police officers request they be tested for drugs.

Not all the ESR blood records relate to crashes. While the records for fatal and hospitalised drivers are clearly crash-related, for non-hospitalised drivers, it is not possible to know whether the blood test was taken from an uninjured driver at a crash or from a driver who police officers suspected was drink driving.

Communication with ESR revealed further data limitations. Many fields are manually entered by ESR staff, and obvious errors in sample dates and time were identified as a result. The date and time the sample was received by ESR, however, is system generated and could be reliably used because it is legally required that samples are sent to ESR within seven days of being taken. Using the received date generates a small amount of error where results are carried over from one period to the next (eg with samples collected over the Christmas period not being received until early January). However, this should be relatively consistent from year to year.

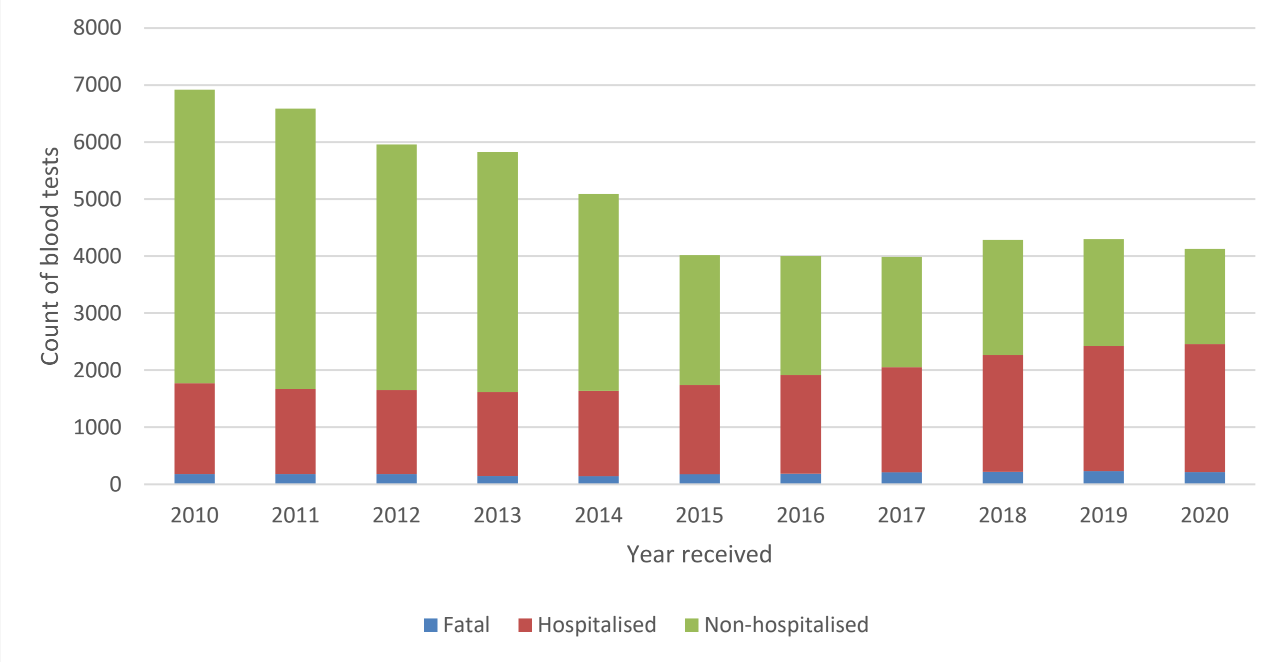
ESR also indicated that some records will likely belong to passengers or other road users, like cyclists and pedestrians. It is still expected, however, that the data captures most drivers who have died in a crash or gone to hospital.

Because of these limitations, the potential for linking this data to other data sources is limited. It is expected, however, the full datasets could be linked to NZ Police and CAS data using protected personal information. The identification numbers associated with each blood sample are unique to ESR. If a common identification number were used between ESR, NZ Police and CAS, this could facilitate data linking in the future. Such an identification number would need to originate with NZ Police because it has first contact with most cases.

7.2.1 Analysis by blood test type

The data across all databases was combined to identify the number and percentage of blood tests per year, per test type. Figure 7.1 shows the results, and two main trends can be observed. First, a steady decrease occurred in the number of blood tests from 2010 to 2014, followed by an observable decrease in 2015. This aligns with changes brought in by the 2014 Act, which discouraged drivers from requesting an evidential blood test.

Figure 7.1 Blood tests by type, by year



Secondly, the number of blood tests for fatal and hospitalised drivers (combined) remained steady between 2010 to 2014, at around 1,650 tests per year, but increased steadily between 2014 to 2020 from 1,643 tests in 2014 to 2,454 tests in 2020. Assuming this data is mostly complete, and no change occurred in testing practices for deceased and hospitalised drivers, this suggests a steady increase in the total number of drivers killed or hospitalised between 2014 and 2020. Note that these are counts of total blood tests administered, which is unrelated to whether the driver was impaired by alcohol, because this is determined by the result from the test. Furthermore, many of those identified as hospitalised may have been drivers who elected for a blood test and attended a medical centre where the sample was taken.

7.2.2 Analysis of fatal driver blood alcohol concentration

The ESR fatal driver database contains records for most drivers who have died on New Zealand roads since 2004, except for those where it was not possible to collect a blood sample or those who were still living when their blood sample was submitted to ESR. However, the missing dates for crashes that occurred between July 2009 and December 2012 creates a significant gap. Figure 7.2 and Figure 7.3 show the number and proportion of fatal driver blood samples at the different legal BAC levels. The figures between quarter 3 2009 to quarter 4 2012 are represented as the average of the total over that period.

This data does not show any significant change in the number or proportion of driver fatalities that had alcohol present. Across the fatal driver dataset, 31.1% of drivers had some alcohol in their blood, 24.9% were above the legal limit at the time of their crash, and 24.4% had a BAC greater than 80 mg/dl.

The fatal driver data does include driver ages, but due to the small number of fatalities reported quarterly, separating the data into cohorts does not provide significant value.

Figure 7.2 Driver fatalities by blood alcohol concentration band (in mg/100ml), by quarter, 2004 to 2020

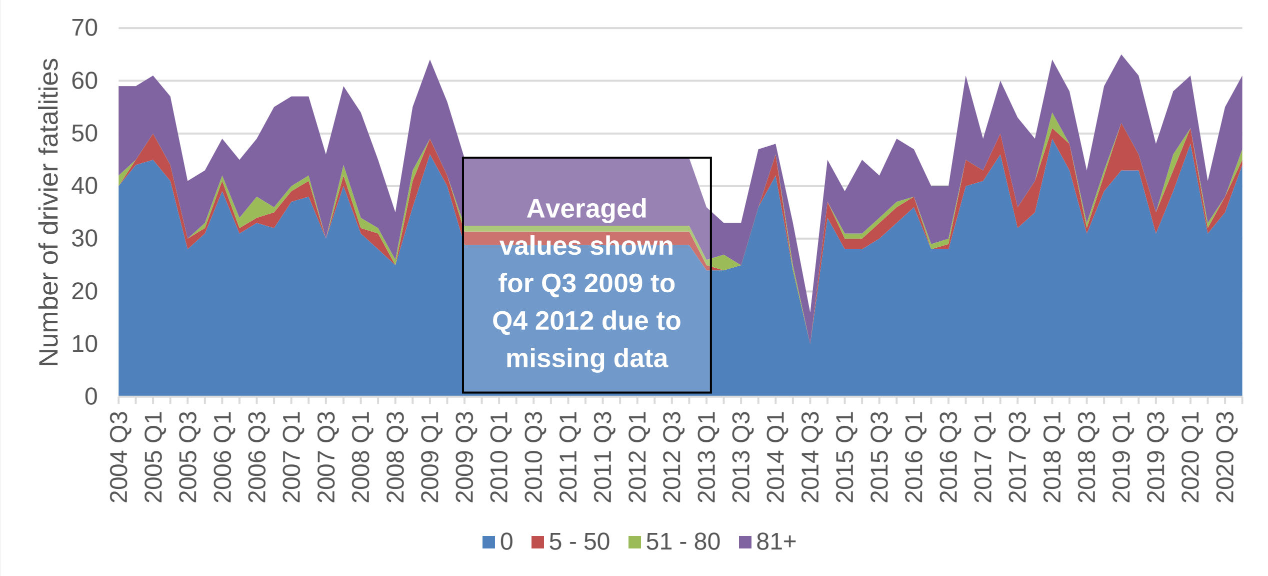
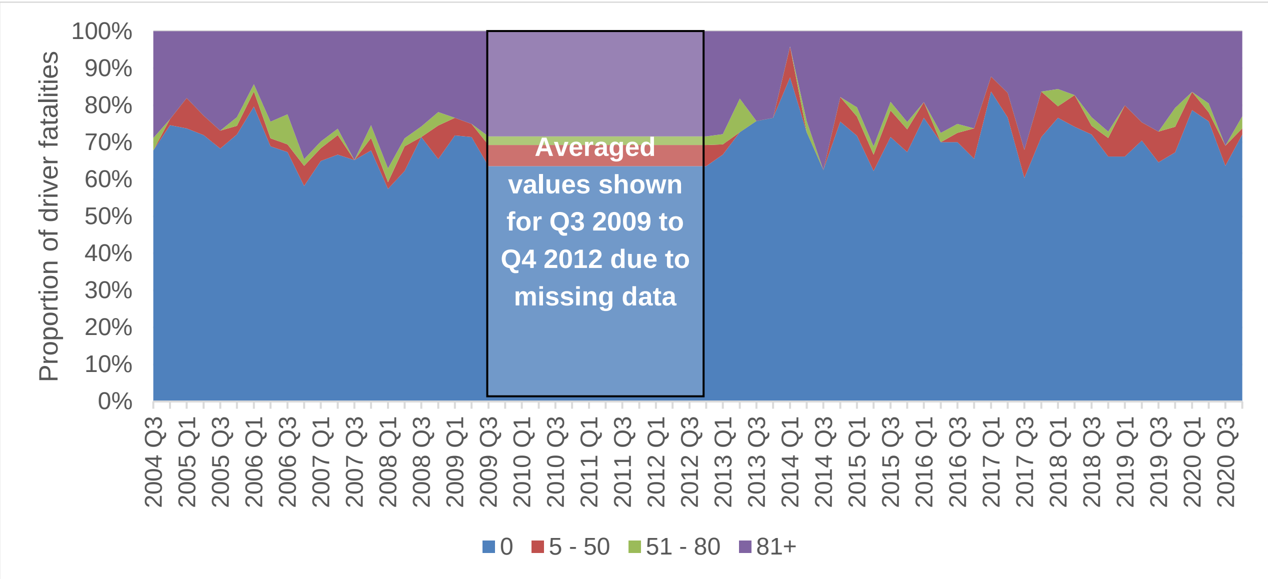


Figure 7.3 Proportion of driver fatalities by blood alcohol concentration band (in mg/100ml), by quarter, 2004 to 2020



7.2.3 Hospitalised drivers' blood alcohol concentration

The hospitalised driver dataset is much larger than the fatal driver dataset and provides for more robust analysis. Ideally, the fatal and hospitalised datasets would be combined into a single dataset for analysis, but the 2009 to 2012 gap in fatal crash dates prevents this.

Unlike the fatal driver database, the hospitalised driver data shows changes over the time series (Figure 7.4 and Figure 7.5). Although the number of hospitalised drivers has grown steadily since 2014, the number of drivers with alcohol present has not kept pace with that growth. Indeed, the proportion with any alcohol has dropped from 48.1% in 2014/15 to 40.7% in the four quarters before the COVID-19 pandemic started in 2020. This is down considerably from the quarterly peak of 59.9% in 2007. Of those with a BAC over

80 mg/dl, the proportion has dropped from 48.3% in 2007 to 38.3% in 2014 to 32.3% in the four quarters before the COVID-19 pandemic.

Figure 7.4 Hospitalised drivers by blood alcohol concentration band (in mg/100ml), by quarter, 2003 to 2021

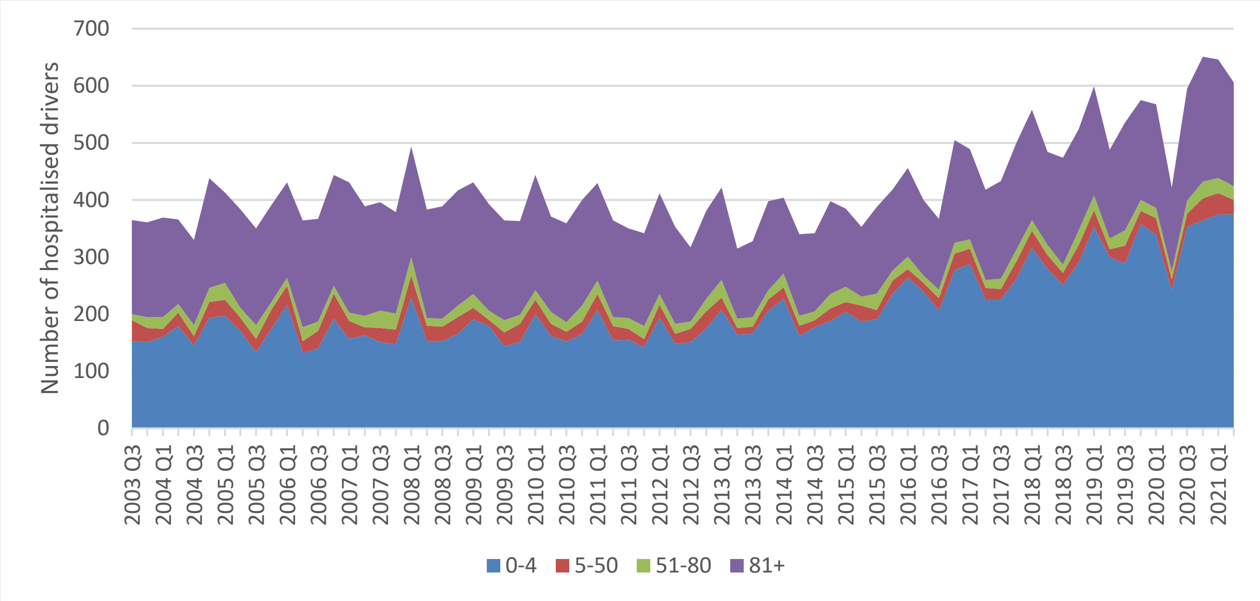
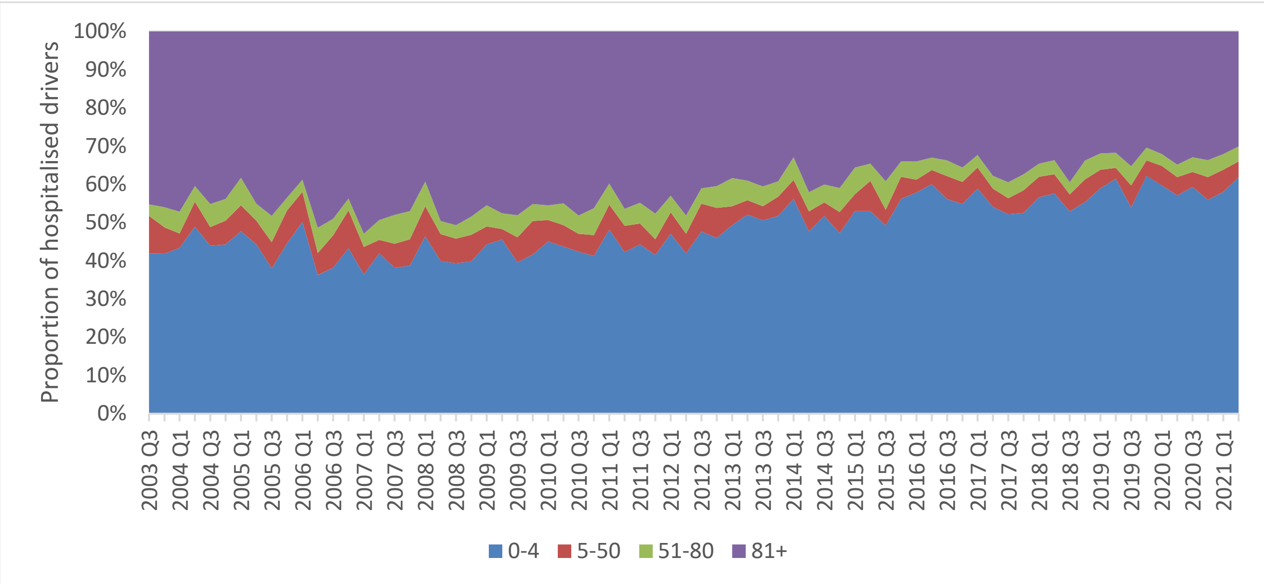


Figure 7.5 Proportion of hospitalised drivers by blood alcohol concentration band (in mg/100ml), by quarter, 2003 to 2021



7.2.4 Non-hospitalised drivers' blood alcohol concentration

The data for non-hospitalised drivers shows the number of people who elected to have an evidential blood test, and their BACs. Blood test results for non-hospitalised drivers represent a small proportion of those tested as a part of RBT, because most do not elect for a blood test. Unsurprisingly, most drivers opting for an evidential test end up having a BAC above 80 mg/dl (Figure 7.6).

Figure 7.6 Non-hospitalised driver blood tests by band (in mg/100ml), by quarter, 2003 to 2021

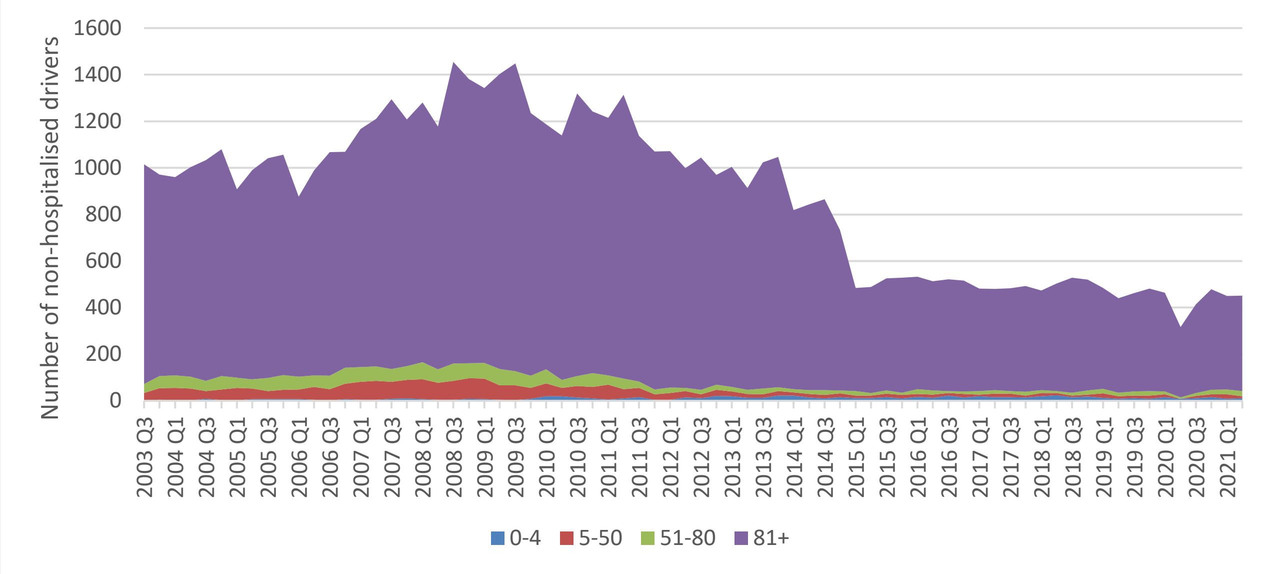


Figure 7.6 shows a reduction in the overall number of non-hospitalised driver blood samples being tested by ESR. The time series demonstrates a significant difference between the period up to 2014, when generally 1,000 or more non-hospitalised driver blood tests were done per quarter, compared with the period after 2015 when the number of tests is typically around 500 per quarter. The change between the two periods aligns with the introduction of the 2014 Act, which introduced higher infringement fees for drivers with a breath alcohol reading within the infringement range who requested an evidential blood test (which then also proved they were within the infringement range). The abruptness of the change in trend suggests this strongly discouraged drivers from requesting a blood test. This is likely to be the reason why the number of evidential blood tests dropped, rather than fewer people being caught and tested.

7.3 Alcohol-related crash (driver) data analysis

The literature review and stakeholder engagement highlighted concerns around how alcohol-related crash information for drivers is recorded in CAS. The main patterns of concern were identified as follows:

- Many drivers were coded as ‘101’ (alcohol suspected), with an alcohol blood result of ‘blood pending’ during 2019 to 2020. Without the blood results, it is not possible to confirm whether a driver was under or over the limit, and therefore whether the crash was alcohol related.
- A significant increase in the number of drivers recorded with an alcohol breath result of ‘breath refused’, including many instances where drivers had recorded a negative breath screening result. These drivers are coded as ‘103’ (alcohol test above limit or test refused), but it is suspected this is a coding error.
- Automatic coding of crashes where drivers are routinely breath tested as ‘101’ (alcohol suspected), from 2016.

To explore these issues, further analysis of CAS crash data was undertaken to estimate the degree to which alcohol-related crashes are being incorrectly reported, focusing on 2019 to 2020.

7.3.1 Drivers with alcohol blood result: ‘blood pending’

Feedback from the stakeholder engagement, and an initial review of the CAS crash dataset, indicates many crashes are recorded from late 2018 onwards where alcohol blood results are left as ‘blood pending’. This results in many of these drivers being coded as ‘101’ (alcohol suspected) with no final resolution as to whether the crash was alcohol related (unless alcohol was otherwise proven through a positive evidential or screening breath test for at least one of the drivers involved).

Figure 7.7 shows the number of drivers with an alcohol blood result of 'blood pending' across all reported crashes increasing substantially from late 2018, and averaging 379 drivers per month and 4,174 drivers between quarter 4 2018 and quarter 2 2021.

Figure 7.7 Number of drivers with an alcohol blood result of 'blood pending', where alcohol was suspected and tested, by crash injury outcome (date extracted: 15 September 2021)

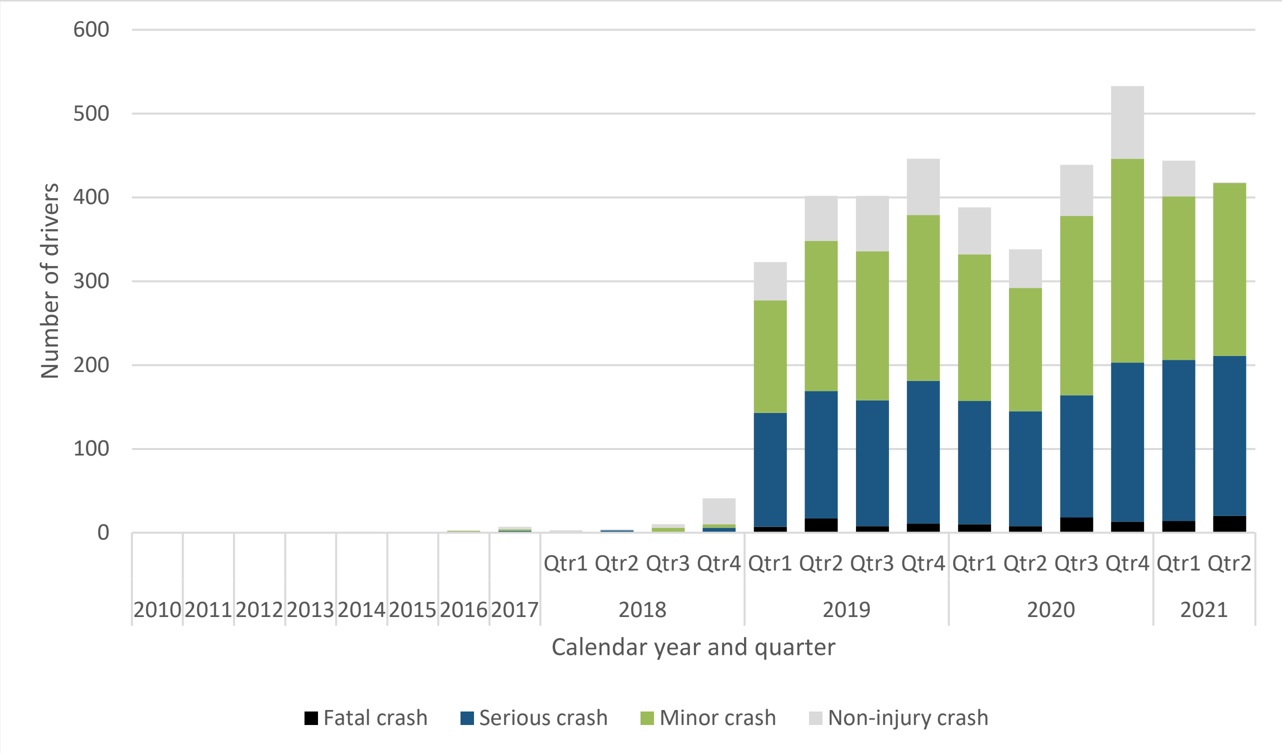


Table 7.1 shows the role of alcohol in injury crashes between 2019 and 2020, where at least one driver is coded with 'alcohol blood pending'. This shows that 2,259 injury crashes occurred where the role of alcohol as a cause factor is undetermined.

Table 7.1 Role of alcohol in injury crashes in 2019 to 2020 with at least one driver with an alcohol blood result of 'blood pending'

Injury crash severity	Unknown (at least one driver coded '101' (alcohol suspected))	Alcohol related (at least one driver coded '103' (alcohol test above limit or test refused))	Not alcohol related (all drivers coded '102' (alcohol test below limit))	Total
Fatal	38	26	23	**87**
Serious	1,044	99	5	**1,148**
Minor	1,177	236	21	**1,434**
Total	**2,259**	**361**	**49**	**2,669**

7.3.1.1 Comparing drivers with alcohol blood result ‘blooding pending’ with ESR blood results

By matching drivers with ‘blood pending’ in CAS to the ESR fatal and living driver blood database, it was possible to estimate how many drivers were under or over the alcohol limit. This was undertaken by investigating a sample of 100 injury crashes with at least one driver with blood pending.

The methodology for this analysis was as follows:

1. A random sample of 100 injury crashes was selected from CAS for 2019 to 2020, where at least one driver had an alcohol blood result of ‘blood pending’ and null readings for both alcohol breath and blood readings. The sample was stratified to select a mix of crash injury outcomes: 20 fatal crashes, 40 serious crashes and 40 minor crashes.
2. The details of every driver with ‘blood pending’ were compared with the ESR blood data for fatal and living drivers. A match was confirmed where all the following criteria were met:
   - The date of birth in the ESR living or fatal driver dataset matched the driver’s age recorded in CAS.
   - The date and time stamp of the blood sample in the ESR dataset was close to the date and time of the crash recorded in CAS, ensuring the sample was taken after the crash occurred.
   - The police station related to the sample in the ESR dataset was close to where the crash occurred, noting that drivers may have been transported and tested at a regional base hospital some distance from the crash site.
3. Where a match was confirmed, the police station, collection date and time and final blood result were extracted from the ESR blood results dataset for that crash driver record.
4. Once all drivers with blood pending were checked and matched, each driver was re-coded based on the blood results:
   - If the driver’s blood result could not be found, they were coded ‘101’ (alcohol suspected) because the involvement of alcohol could not be proved otherwise.
   - If the driver’s blood result was under the limit for their age, they were coded ‘102’ (alcohol test below limit).
   - If the driver’s blood result was over the limit for their age, they were coded ‘103’ (alcohol test above limit or test refused).

The matched results were used to estimate the proportion of drivers with blood pending as above or below the limit, and to determine whether the crash the driver was involved in was ‘alcohol related’. Across the 100 crashes sampled, 108 drivers had an alcohol blood result of ‘blood pending’, of which:

- 101 (93.4%) of the drivers were originally coded in CAS as ‘101’ (alcohol suspected)
- four drivers were originally coded in CAS as ‘102’ (alcohol test below limit)
- three drivers were originally coded in CAS as ‘103’ (alcohol test above limit or test refused).

Among the 101 drivers originally coded ‘101’ (alcohol suspected) with blood pending, 88 (87%) were successfully matched to ESR blood records. Of these:

- 59 (67%) were below the alcohol limit for their age
- 29 (33%) were above the limit for their age.

No obvious reasons could be seen for why 13 drivers with ‘blood pending’ could not be found in the ESR dataset. It could be due to errors or omissions in the ESR dataset, blood that was taken and tested for drugs but not alcohol, or a Police coding error in the TCR indicating blood samples were taken when they were not. Three of these drivers were fatally injured, including a cyclist.

Of the four drivers originally coded in CAS as ‘102’ (alcohol test below limit):

- One driver was incorrectly coded ‘102’ (alcohol test below limit) when the ESR blood result showed they were over the limit. The attending police officer also noted in the TCR that the driver was ‘extremely intoxicated’, so the original ‘102’ code is an error.
- Two of the drivers were confirmed to be ‘under the limit’ when matched with the ESR blood results. One driver had a negative breath screening result but a positive drug screen result (pharmaceutical) in the CAS record.
- One driver could not be matched in the ESR blood results but had a positive drug screen result (illicit) in the CAS record. It is possible in this instance blood was taken from the driver to be screened for drugs but not alcohol.

For the three drivers originally coded in CAS as ‘103’ (alcohol test above limit or test refused):

- Two drivers in the same crash were proved to be ‘under the limit’ when matched to the ESR blood results. The crash record shows no evidence that alcohol was suspected, and no other drivers returned blood or breath results over the limit. This also appears to be an error in the CAS data.
- One driver was confirmed as ‘over the limit’ when matched to the ESR blood results. This confirmed the driver’s positive breath screening result in CAS and explains why they were originally coded as ‘over the limit’.

The police stations where matches were possible were also reviewed. This revealed no pattern of any station or region where the ‘blood pending’ driver records in CAS are prevalent. The matched blood results included stations in small rural towns and large urban centres across the country. This indicates a widespread problem exists with blood results not being added to or updated in CAS and requires further investigation.

In summary, the failure to update blood results in CAS means many drivers involved in crashes that are potentially alcohol related are coded as 101 (alcohol suspected). Because the ‘101’ code is given to almost all drivers tested for alcohol, regardless of whether alcohol is suspected, this code is no longer being used to report on alcohol-related crash trends. This means alcohol-related crashes are likely to be under-reported since late 2018.

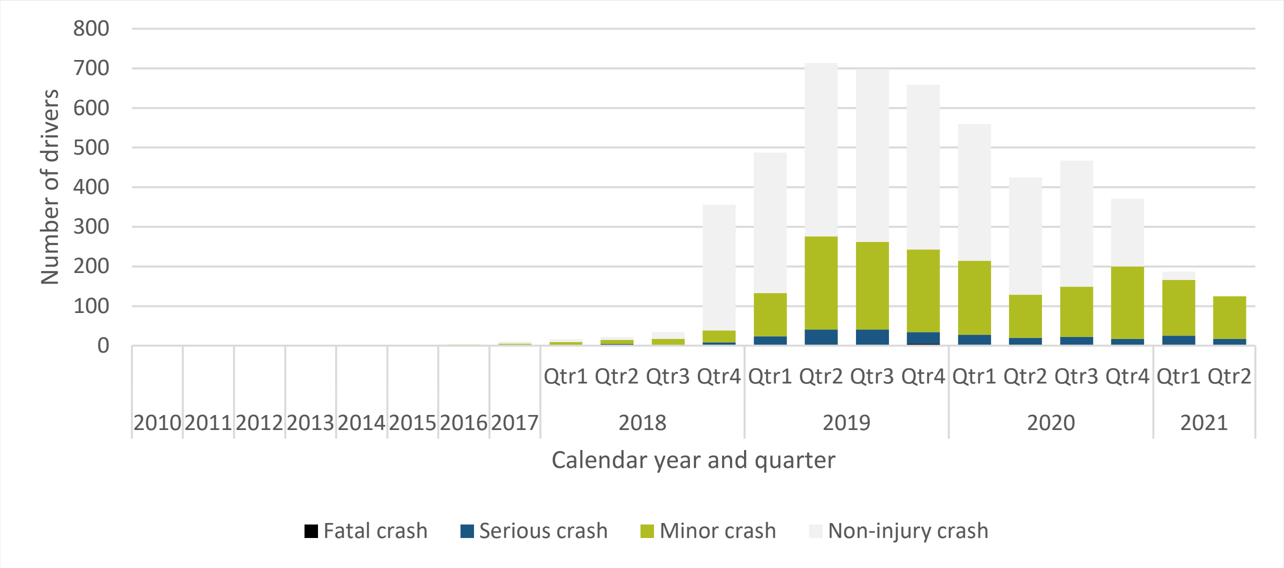
The analysis also showed it is possible to use the ESR dataset to check CAS driver and crash records. However, this required a manual matching process. It might be possible to automate the matching process should historic records need to be updated, but would be simplified if a common ESR case number was linked to the driver in CAS. Further investigation is required to determine why some blood results were missing in the ESR data, including how blood samples are tested for drugs versus alcohol.

Nearly two-thirds of drivers sampled from CAS, who were coded as ‘101’ (alcohol suspected) with an alcohol blood result of ‘blood pending’ and no breath result, returned blood results ‘under the limit’. Conversely, one-third of drivers returned a blood result ‘over the limit’. This shows how many crashes coded ‘101’ (alcohol suspected) with drivers who have blood pending were alcohol-related, however, the sample is not large enough to definitively estimate the degree of under-reporting due to this error.

7.3.2 Drivers with alcohol breath result: ‘breath refused’

Analysis of the CAS driver data also identified a large increase in drivers with an alcohol breath result of ‘breath refused’ and no evidence of a blood test from late 2018 onwards. Drivers with an alcohol breath result of ‘breath refused’ and no evidence of a blood test are coded in CAS as ‘103’ (alcohol test above limit or test refused). Figure 7.8 shows the number of drivers with an alcohol breath result of ‘breath refused’ across all reported crashes increasing substantially from late 2018 (5,047 drivers between quarter 4 2018 to quarter 2 2021).

Figure 7.8 Number of drivers with an alcohol breath result of 'breath refused' with no evidence a blood test was taken[20] (data extracted: 15 September 2021)



Looking at injury crashes between 2019 and 2020, 1,363 injury crashes occurred with at least one driver with both an alcohol breath result 'breath refused' and no evidence of a blood test being taken. Table 7.2 shows the screening and breath results for drivers involved in these crashes (excluding nil or null results). This shows that 1,319 drivers in this period had a 'negative' breath screening result, but also a contradictory alcohol breath result of 'breath refused'. Between 2019 and 2020, 1,487 drivers had an alcohol breath result recorded as 'breath refused'. This is a significant increase compared with previous periods, for example, between 2016 and 2017 only 19 drivers recorded an alcohol breath result of 'breath refused' with no evidence of a blood sample being taken.

Table 7.2 Comparison of 'alcohol breath result' and 'alcohol breath screening' for drivers involved in injury crashes coded as '101 (alcohol suspected), 2019 to 2020[21]

Alcohol breath screening	Alcohol breath result 'breath refused'	Alcohol breath result 'breath tested'	Total
Negative ('Screen [-]')	1,319	10	1,329
Positive ('Screen [+]')	107	21	128
Breath refused	61	–	61

Figure 7.8 and Table 7.2 show that, since late 2018, a significant number of drivers were coded with an alcohol breath result of 'breath refused', despite most returning a negative alcohol screening test. These drivers are coded as '103' (alcohol test above limit or test refused), therefore, the crashes they are involved in are considered alcohol-related, which contributes to alcohol involvement being over-reported.

[20] Blood test result 'null' or blank, 'not tested' or 'pending'.

[21] Ignoring 'nil' and 'null' results.

7.3.3 Interpreting alcohol-related crash data from 2019 onwards

In analysing the 2019 to 2020 data errors, it was found that CAS data could be used to determine alcohol-related crash trends from late 2018 onwards, at the time of writing. Any reporting of alcohol-related crashes and injuries for this period is unreliable due to a combination of many drivers' blood results not being updated (resulting in under-reporting of the '103' code) and drivers being incorrectly coded with an alcohol breath result of 'breath refused' (resulting in over-reporting of the '103' code).

The need to identify why these errors have occurred (and continue to occur), and to correct historic crash data collected during this period, is immediate. The errors in alcohol-related information in the CAS data started in late 2018 around the same time as updates to CAS enabled TCRs to be submitted from NZ Police directly into the CAS database. This suggests the error may be due to how TCRs are automatically translated into CAS, but further investigation is required to determine this.

7.3.4 An alternative method for estimating alcohol-related crashes

Methods have been developed in the United States of America for improving estimates of alcohol-related crashes, to compensate for gaps in the data.

To combat the issue of missing blood alcohol test results in its Fatality Analysis Reporting System (FARS), the National Highway Traffic Safety Administration's (NHTSA's) National Center for Statistics and Analysis has used predictive statistical methods to estimate missing BAC values. In 2002, it transitioned from a probability-based method to using Multiple Imputation, the methodology for which is outlined in Subramanian (2002). On average, FARS does not have 60% of annual BAC values, and this imputation method allows the missing data to be filled in. Multiple Imputation is a complex technique that is facilitated using statistical software.

As a simpler approach, proxy measures can be used. In the absence of complete data on driver alcohol impairment, a common proxy measure is the ratio between single-vehicle night-time (SVN) crashes and multiple-vehicle daytime (MVD) crashes. The validity of this measure has been confirmed by Voas et al. (2009). This approach has been used, for example, by Beck et al. (2018) to confirm a decrease in alcohol-related crashes in areas where a targeted enforcement programme had been applied. The method works based on the assumption that SVN crashes involve a high proportion of alcohol-related crashes as opposed to MVD crashes, which involve a low proportion.

Performing this analysis for all crashes (Figure 7.9) and injury crashes only (Figure 7.10) shows that the ratio of SVN to MVD has increased since 2015. However, this should be interpreted with caution in the absence of studies verifying the relationship between the SVN:MVD ratio and alcohol-related road trauma in the New Zealand context. It must be noted that the longer-term trends are not consistent between the two graphs. This is due to the number of injury crashes increasing faster than non-injury crashes, which could potentially indicate underlying issues in the completeness of non-injury crash data.

Figure 7.9 Ratio of single-vehicle night-time (SVN) to multiple-vehicle daytime (MVD) across all crashes, 2000 to 2020

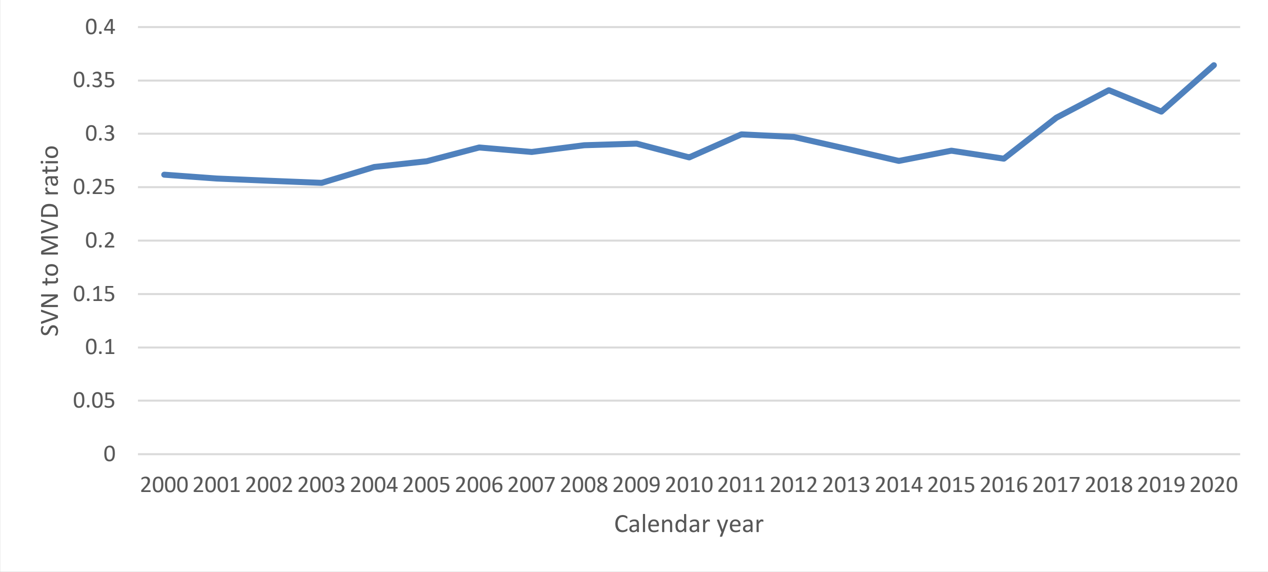
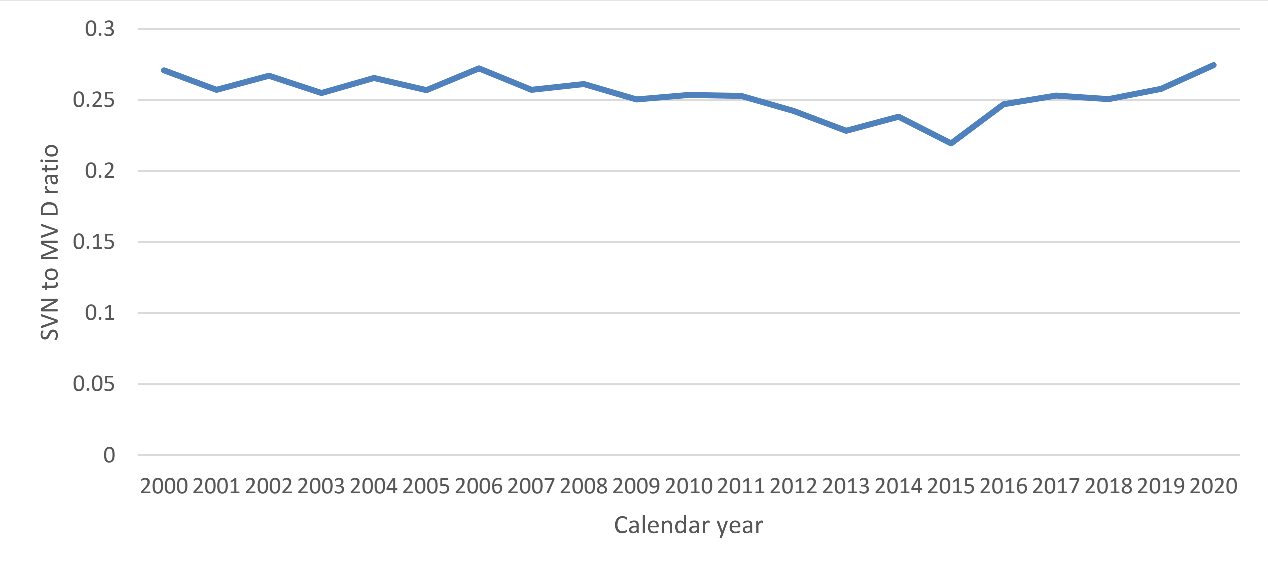


Figure 7.10 Ratio of single-vehicle night-time (SVN) to multiple-vehicle daytime (MVD) for injury crashes, 2000 to 2020



7.4 New Zealand Police breath test data

Detailed breath test data was provided to the project team by NZ Police in the form of quarterly breath test numbers across all devices (Dräger Alcotest 6510, 7510 and 9510) by NZ Police district dating back to 2008, and Dräger Alcotest 7510 breath test logs dating back to 2016.

The 7510 device records significantly more data for each test than the previous generation 6510 device, which is only capable of recording the total number of tests administered since it was last calibrated. In contrast, the 7510 device records the time, date and global positioning system (GPS) coordinates for each test along with a binned result, the test type, and whether the test was successful. The 7510 device can also be used to administer evidential breath tests and these results are also stored on the device.

The limitations of the 6510 devices mean data from these cannot be differentiated for:

- When a test has occurred. Police statistics report breath tests based on the date they were downloaded from the device rather than the date or time the tests were taken.
- Passive (sniffer) tests versus screening tests. All tests are counted together, meaning anyone who is subjected to a passive test followed by a screening test will appear twice in the overall figures.
- Successful tests versus aborted or erroneous tests.

Both the 6510 and 7510 devices were still active in the field in mid-2021 when the project team received the breath test data from NZ Police. Although the 7510 devices provide more detailed data than the 6510, for consistency, breath test counts from both continue to be counted as part of NZ Police's breath testing performance measure. The breath test measure reflects the total number of 7510 passive and screening tests by download date, including aborted or erroneous tests. This provides a basis for estimating the accuracy of all breath test data going back to 2008.

Analysis of the 7510 device data showed the following:

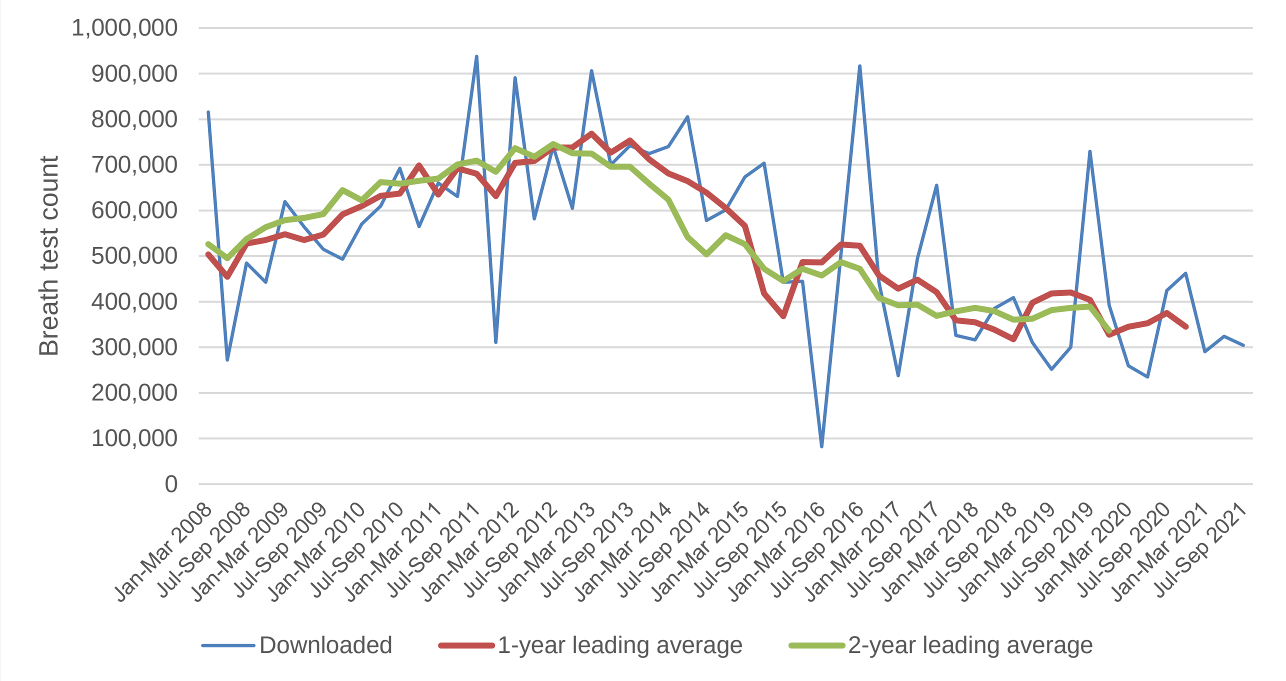
- The proportion of recorded breath tests being administered using the 7510 has grown steadily, from 8% in 2017/18, 16% in 2018/19, 48% in 2019/20, 73% in 2020/21 and 93% for the first two months of 2021/22. This still leaves 7% of tests being taken by the 6510 devices at the time the data was received in September 2021.
- Screening tests account for 5% to 8% of the total number of passive and screening tests administered.
- Aborted and error tests account for 0.1% to 0.5% of the total number of passive and screening tests administered.
- The breath test date can be up to two years before the date it was downloaded from the device, although most data is downloaded within a year of the actual test.

This suggests the annual breath test figures quoted in police annual reports could be up to two years out of date. However, the data limitations that affect the accuracy of the test counts are noted in these annual reports.

7.4.1 Breath testing trends

The flaws in the recording of quarterly breath tests limit the usefulness of investigating this data as a time series. However, knowing the approximate scale of the flaws allows for a rudimentary estimation of trends over time. Figure 7.11 shows the number of passive and screening breath tests downloaded by quarter along with the one- and two-year leading averages, which give a sense of when the breath tests were taken.

Figure 7.11 Passive and screening breath tests administered, by quarter, 2008 to 2021



Exploratory analysis indicates that the number of breath tests administered rose steadily, from nearly 500,000 per quarter in 2008 to a peak of nearly 750,000 per quarter around 2012 to 2013. This was likely followed by a relatively rapid drop off in test numbers through 2014 and 2015, and a steady but more moderate decrease in test counts since that point.

While the more detailed 7510 device data would ideally provide a better source for assessing trends in breath testing, this data is not yet complete enough to enable meaningful analysis. It is only since 2020/21 that the 7510 device has begun to account for most of the downloaded data, and the lag between test date and download date means it is likely to be several years before enough data is available. Based on the date of testing, 2019/20 and 2020/21 are the most complete years, with 540,220 and 842,388 records, respectively, but these are still well below the estimated 1.3 million to 1.7 million tests that occur annually.

7.4.1.1 Breath tests by time of day and day of week

Timestamps within the 7510 device data enable analysis of the time of day and day of week that breath tests are being administered. Because the 7510 device data is all post-2015, it is not possible to use it to verify whether the difference in offences being recorded between 2010 to 2014 and 2015 to the present is replicated in the breath test data. However, it is possible to compare the proportion of breath tests administered at different times of the week with the proportion of offences recorded at the same time for those years.

The proportion of tests that occurred in each three-hour time slice in each year from 2016 to 2020 were analysed. The profile of the earlier years (2016 and 2017) in the 7510 device dataset, which form only a small proportion of the total breath tests administered in those years, is similar to the profile for the later years (2019 and 2020), which account for a much greater proportion of the breath tests undertaken. This gives confidence that the distribution of tests in the 7510 device data is representative of the distribution across all tests.

7.4.2 Identifying compulsory breath testing (checkpoints)

Breath test records from the 7510 devices were investigated to determine whether they could be used to identify police alcohol enforcement checkpoints. Multiple tests undertaken across more than one device in a similar location at a similar date and time would indicate a checkpoint operation.

Although the 7510 devices are GPS-enabled, coordinates for the location of the breath test are not always recorded correctly and were found to be missing for about 20% of passive tests (430,670 out of 2,143,345). This did not appear to be due to malfunctioning devices. It was found that coordinates were often missing for tests done within seconds of another test on the same device where the coordinates were successfully recorded. It is possible the missing coordinates are because of the GPS connection being lost when the device is used through a vehicle window.

Investigation of the 7510 device data showed it could be used to identify checkpoints with reasonable accuracy, despite the missing GPS coordinates. Clear examples of checkpoints were found in the records where the same device was used for several dozen tests in rapid succession. In many cases, the device identification numbers and timestamps can be used to deduce whether a device was being used in a single location (eg at a checkpoint) or moving around as a part of mobile enforcement. Identifying checkpoints in this way depends on the tolerances set for how proximate tests should be in space and time to be counted as such.

Because the 7510 device does not yet account for all tests, and due to the delay in downloading test data from devices, the project team determined the dataset is not yet strong enough to do a checkpoint analysis. Tests that are unaccounted for in the data are unlikely to be evenly or randomly distributed. Rather, they are likely to come from specific police units. Any checkpoint analysis done on the current 7510 devices would therefore have clear gaps in certain parts of the country, limiting its usefulness.

It is considered that a checkpoint analysis based on 7510 device data would be both possible and useful in the future, when migration to the 7510 device is complete and sufficient time has passed for a complete year of data to have been fully downloaded from all devices. It is recommended migration to the 7510 devices be completed as soon as possible and efforts be made to download test data from the devices more frequently, because the robustness of the data is limited by its incompleteness, at the time of writing.

7.5 New Zealand Police offences data

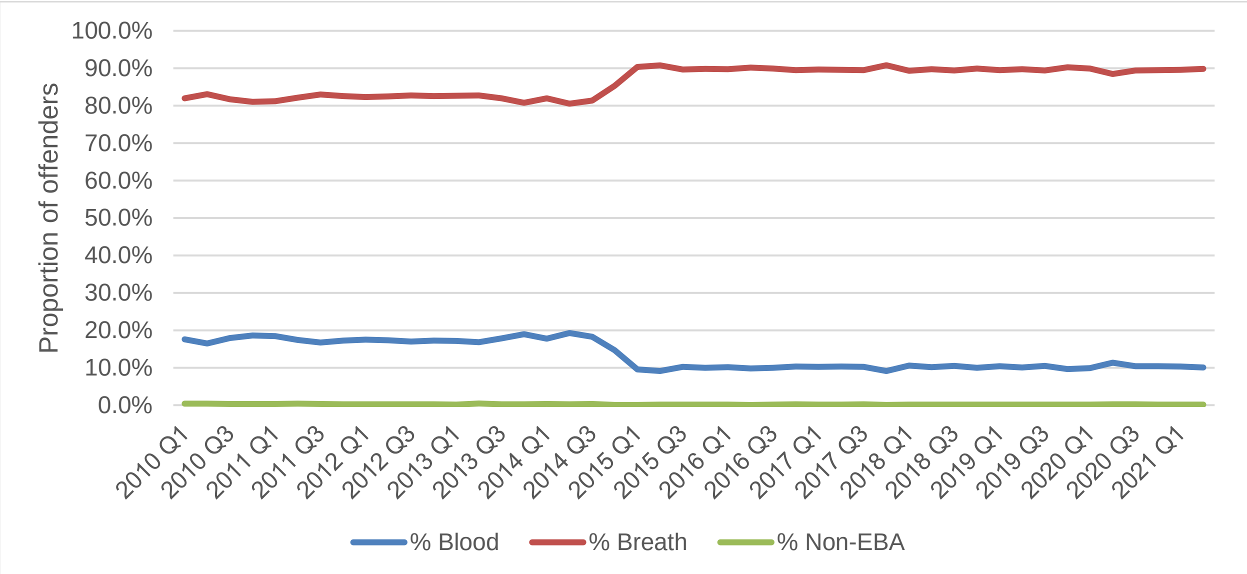
NZ Police provided the project team with more detailed data on alcohol driving offences from January 2010 to August 2021, including infringement-level offences. For privacy reasons, the data were binned against demographic variables (refer to appendix B schema) and exact BAC or BrAC measurements were removed. All offences were provided with a (binned) time and location and indicated the number of proceedings that came out of each offence, providing a link to the Ministry of Justice method of recording offences. This data therefore breaks down the offence data to a much greater level than that publicly available on the NZ Police website (discussed in section 4.3.1).

Because the detailed NZ Police data is based on offences rather than offenders, instances occur where a single offender has been charged with multiple offences. For this research, it is more useful to look at the number of occasions where offenders were charged with one or more offences, as opposed to the total number of offences recorded by officers. Secondary and tertiary offences have been filtered out, by identifying instances where non-identical offences have occurred at the same time and place by someone with the same demographic characteristics. Of the 294,116 offences, 1,997 (0.7%) were identified as likely secondary offences and 10 (0.003%) as likely tertiary offences. The additional offences generally relate to separate charges for recidivism (third or subsequent offences), zero-alcohol licence or interlock violation offences, or causing injury or death. In some cases, officers may withdraw a charge and then issue a new one, for instance, 'causing injury' can be replaced with 'causing death' if an injured victim subsequently dies.

7.5.1 Charges based on breath and blood testing

The detailed NZ Police offence records indicate whether drivers were charged based on excess alcohol in breath or blood or neither (for rare cases where charges were laid without a test). This allowed a time-series analysis to be performed looking at the proportion of offences based off a breath test versus those based off a blood test (see Figure 7.12). This shows that the proportion of offences based off each type of test is consistent over time. However, an abrupt decrease occurred in the proportion of blood tests (and a corresponding increase in the proportion of breath tests) between quarter 3 2014 and quarter 1 2015. This is when the Land Transport Amendment Act (No 2) 2014 came into force, and this data therefore corroborates the conclusions drawn from the ESR blood test data analysis in section 7.2.

Figure 7.12 Proportion of offence incidents by excess alcohol in breath or blood (EBA) or other, by quarter, 2010 to 2021



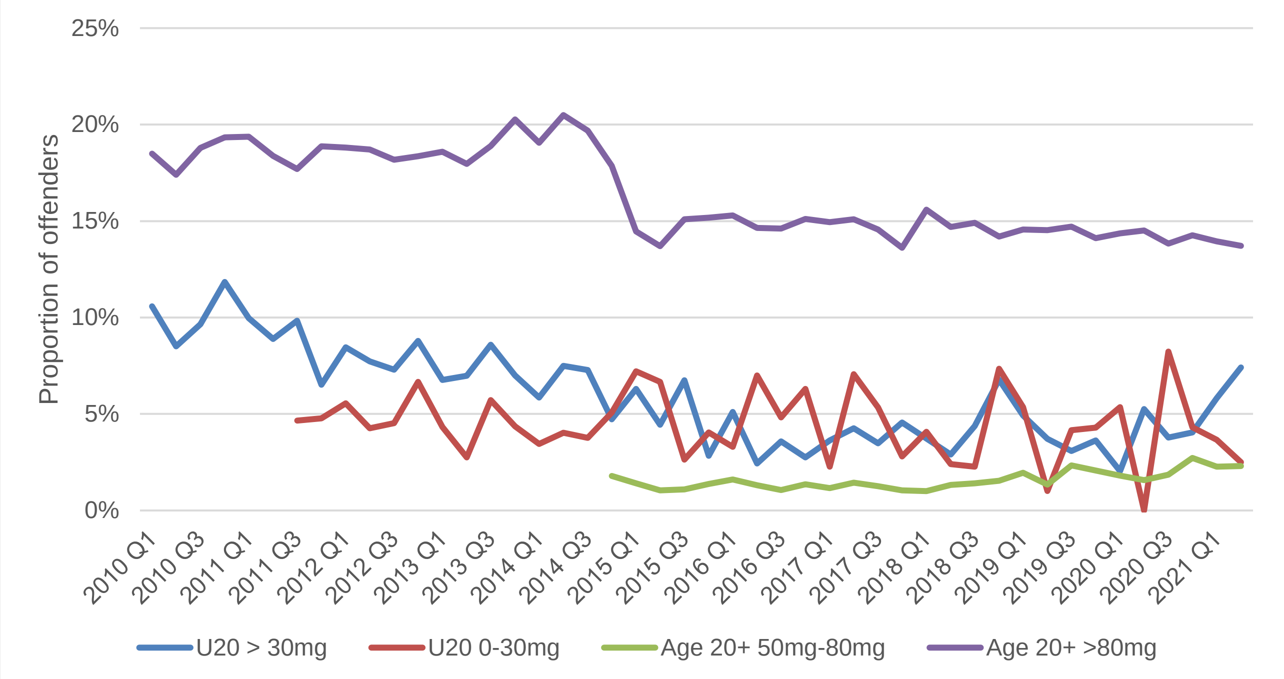
Between quarter 1 2010 and quarter 3 2014, 17.6% of offenders were charged based on a blood test. This drops to 10.1% of offenders between quarter 1 2015 to quarter 2 2021, a 43.0% reduction. In absolute terms, the number of offenders charged based on blood tests has reduced from an average of 1,153 per quarter to 615 per quarter. This clearly shows the change in legislation has resulted in fewer blood tests being done.

Figure 7.13 shows the proportion of offenders charged based on a blood test by the legal alcohol limit that has been exceeded, excluding zero-alcohol and interlock offences. Note that NZ Police alcohol driving offences may or may not be related to crashes. As established, crashes often necessitate the use of blood rather than breath testing and are more likely when drivers have a higher proportion of alcohol in their blood. Unsurprisingly, offenders exceeding the 80 mg/dl limit are much more likely to have been charged using blood test results. Between the periods before and following the 2014 Act, the proportion of blood tests did drop (from 18.8% to 14.5%, a 22.5% change), though this only accounts for part of the change.

The introduction of the 50 mg/dl to 80 mg/dl offence range also had a significant effect because only 1.5% of offenders in this range were given an infringement notice based on a blood test result. Drivers are less likely to be involved in a crash at this alcohol level and more likely to be dissuaded from choosing a blood test by the possibility of a $700 infringement fine as opposed to the $200 infringement for an offence in this alcohol band. A drop is also seen in the proportion of drivers charged with being above 80 mg/dl, suggesting the introduction of 2014 Act affected these drivers as well. A difference may exist in the behaviour of drivers who request a blood test without having been tested evidentially for breath, as opposed to those who have failed their evidential breath test but refuse the result in favour of a blood test. It has not been possible to investigate this, however, with the data available.

Among under-20-year-olds, no noticeable change is associated with the introduction of the 2014 Act, and no discernible difference can be seen between those charged with having alcohol in the 0 mg/dl to 30 mg/dl range versus those exceeding 30 mg/dl.

Figure 7.13 Proportion of offence incidents from blood tests, by limit exceeded, by quarter, 2010 to 2021

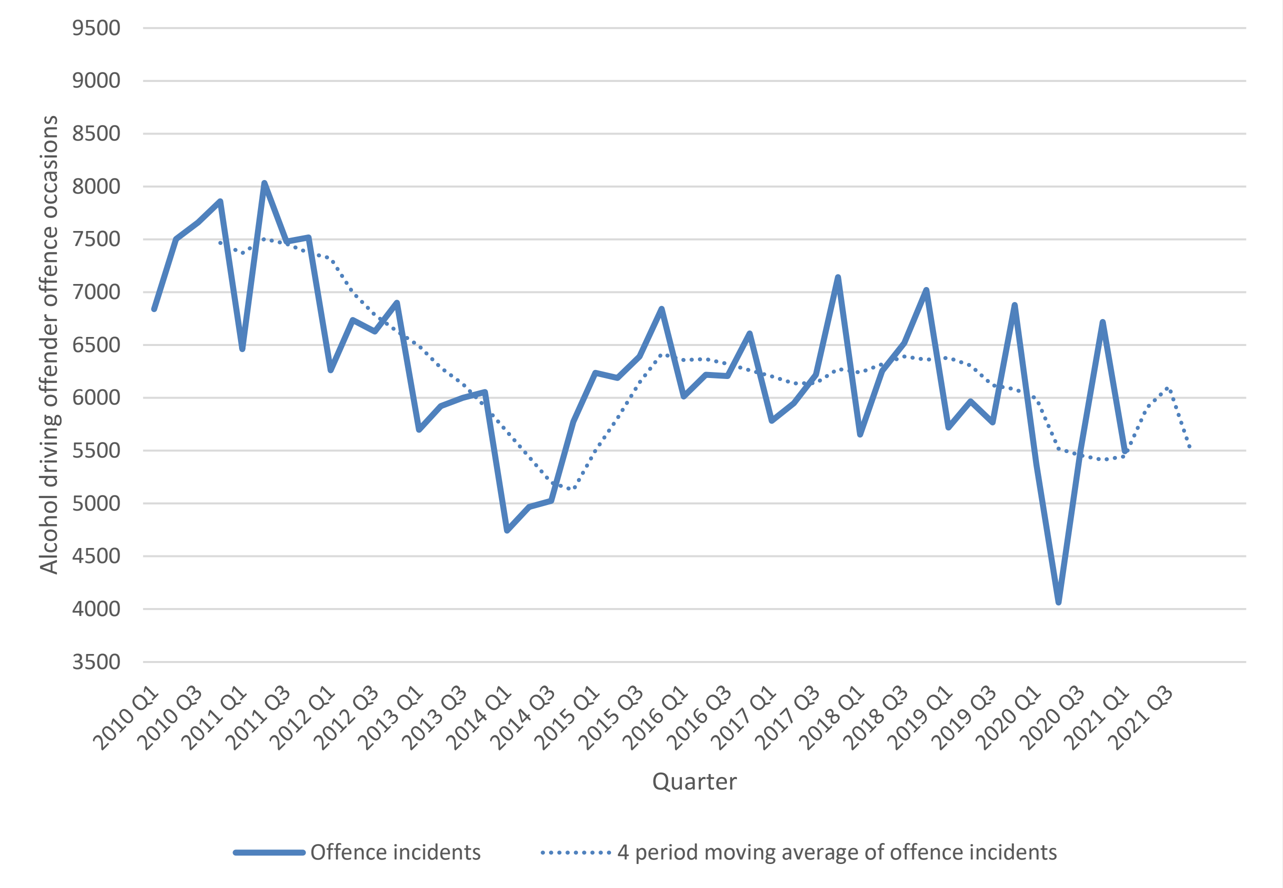


7.5.2 Offence trends

The summary and detailed offence data allow trends in the number of offences to be examined in terms of the number of offence incidents (ie removing secondary and tertiary offences). This is shown in Figure 7.14 for all offence categories. A trend is visible in offence numbers decreasing consistently between 2009 and 2014. After the 2014 Act came into effect, an immediate increase occurred in the number of offences, which stayed relatively steady until the beginning of the COVID-19 pandemic in early 2020.

It must be noted that the number of offences recorded is partially dependent on the level of enforcement activity, because only drink drivers who are caught will appear in the offence statistics. The offence trends must be considered in combination with indicators such as breath test numbers (discussed in section 7.4.1). This is further explored in the chapter 8.

Figure 7.14 Alcohol driving offence incidents, by quarter, 2010 to 2021



The detailed offence data allows this trend to be separated by the limit exceeded, and this is shown for under-20 drivers (Figure 7.15) and age 20-plus drivers (Figure 7.12). In the under-20 driver offences, the downward trend from 2010 to 2014 in the overall data is evident. After 2014, the number of under-20 driver offences stayed relatively steady until the beginning of the COVID-19 pandemic. In the age 20-plus driver offences, the downward trend is also evident from 2010 to 2014. From 2014, the number of offences involving drivers over the 80 mg/dl limit stays relatively steady, and, instead, it is offences against the new 50 mg/dl limit that increase. The number of offences against the 50 mg/dl limit is quickly established at around 2,000 offences per quarter and stays steady until the disruption of the COVID-19 pandemic in 2020.

Figure 7.15 Reported under-20 alcohol driving offence incidents by limit exceeded, by quarter, 2010 to 2021

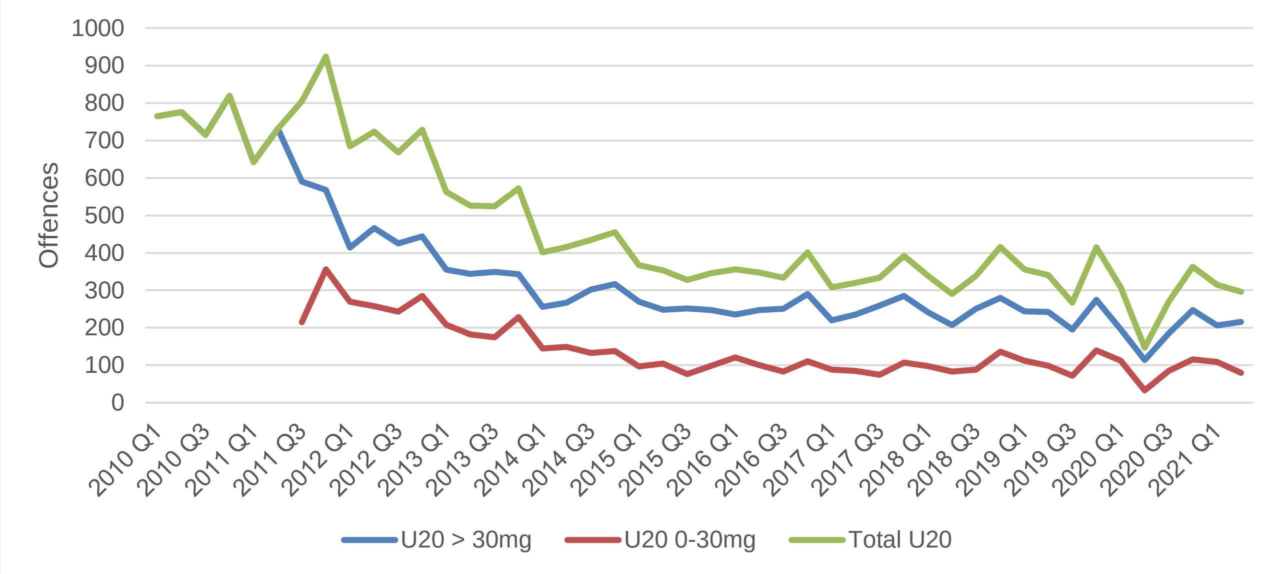
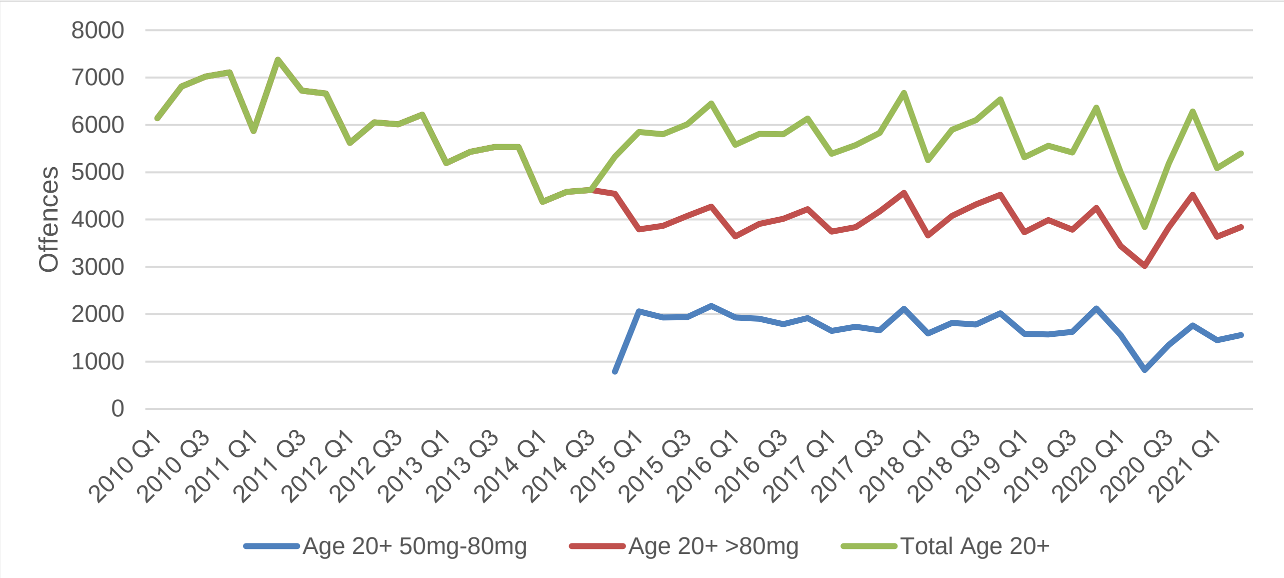


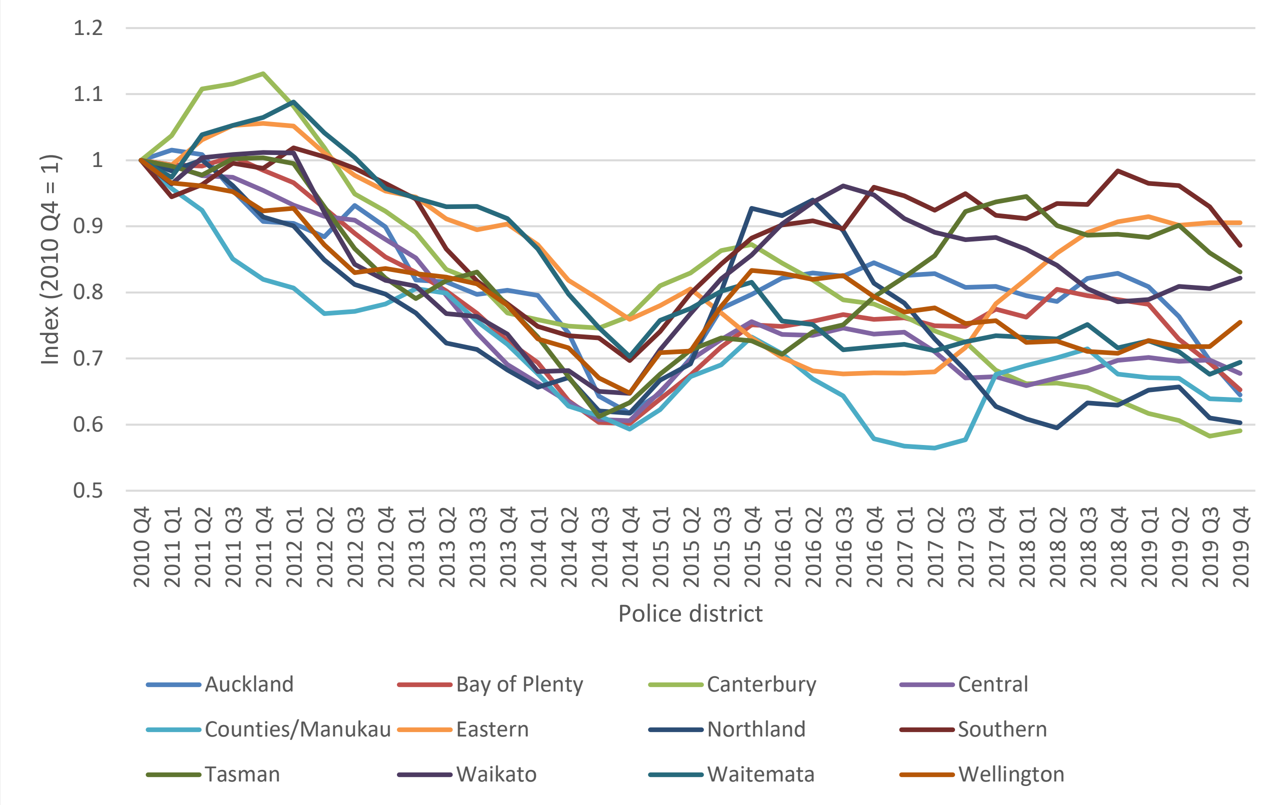
Figure 7.16 Reported age 20-plus alcohol driving offence incidents by limit exceeded, by quarter, 2010 to 2021



7.5.2.1 Offence trends by New Zealand Police district

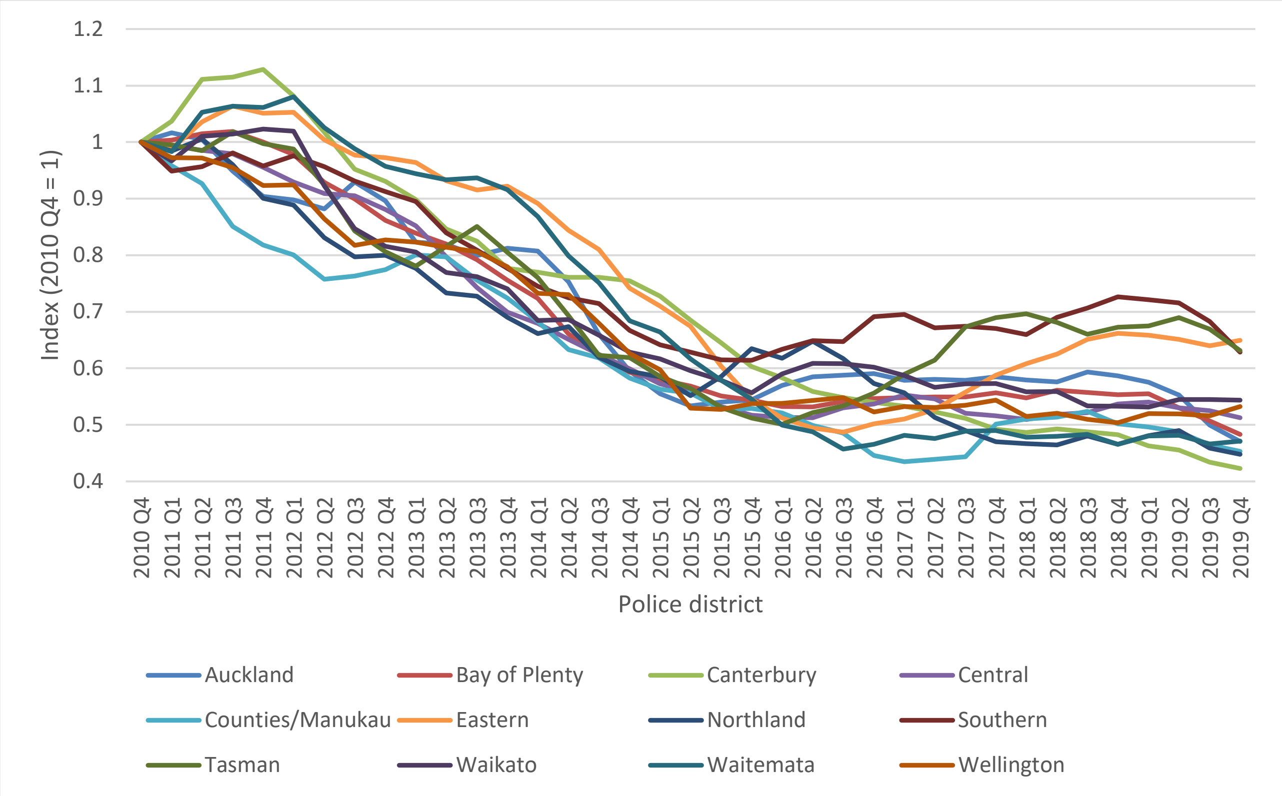
To determine whether the offence trends were a nationwide phenomenon, further analysis was done to look at the changes in offending rates within each Police district (Figure 7.17). Offending rates were adjusted for population growth using 2006, 2013 and 2018 NZ Census data at the Statistical Area 2 level. A four-quarter moving average was indexed to the end-2010 offence rate for each NZ Police district. This analysis shows the downward trend in offences between 2010 and 2014 occurred in every Police district, with the offending rates bottoming out in late 2014. Relative to 2010, the reduction ranged from 24.1% (Eastern Police District) to 40.7% (Counties Manukau Police District). Throughout 2015, offending rates then increase in line with the nationwide analysis, but from late-2015 onwards the trends diverge, with some Police districts returning to higher rates, others staying relatively low, and many showing considerable variation from quarter to quarter.

Figure 7.17 Indexed population-adjusted four-quarter moving average of offending rate by New Zealand Police district, 2010 to 2019



Looking only at the offenders who were charged with being over the 80 mg/dl limit removes the influence of the changes to legislation in 2011 and 2014 (Figure 7.18). The same trend is seen from 2010 to 2014 and extends into 2015. At a nationwide level, this offence category has been steady since 2015, and considerably less variation occurs in the post-2015 period than in Figure 7.17. However, some districts (eg Southern, Tasman, Eastern) reverted to a higher rate of offending after 2015, while others (eg Canterbury) maintained the downward trend.

Figure 7.18 Indexed population-adjusted four-quarter moving average of 80 mg/dl offending rate by New Zealand Police district, 2010 to 2019



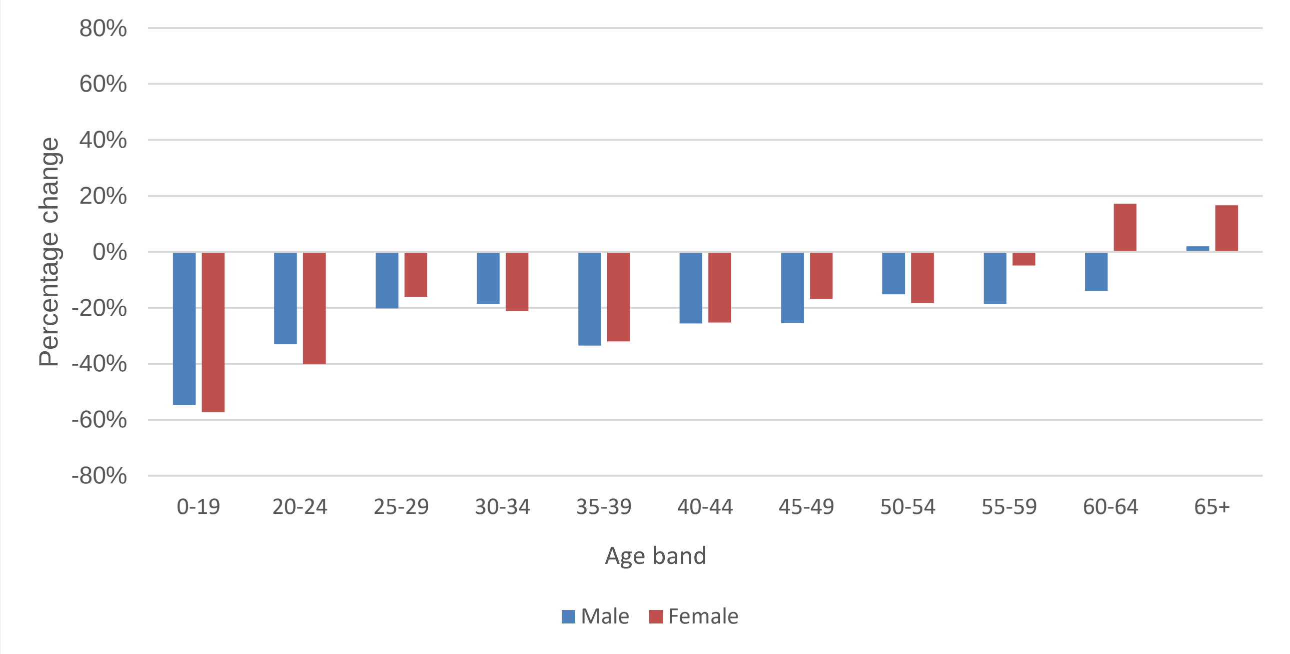
The relatively congruent nature of the trends in each Police district between 2010 and 2015 indicates the changes in offending rates in this period were a nationwide phenomenon. If this is the case, then the more diffused trends in the years following would suggest more localised police responses.

7.5.2.2 Offender trends by age and gender

Analysis based on age (binned into five-year groups) and gender shows a considerable change has occurred in the demographic profile of alcohol-related driving offenders.

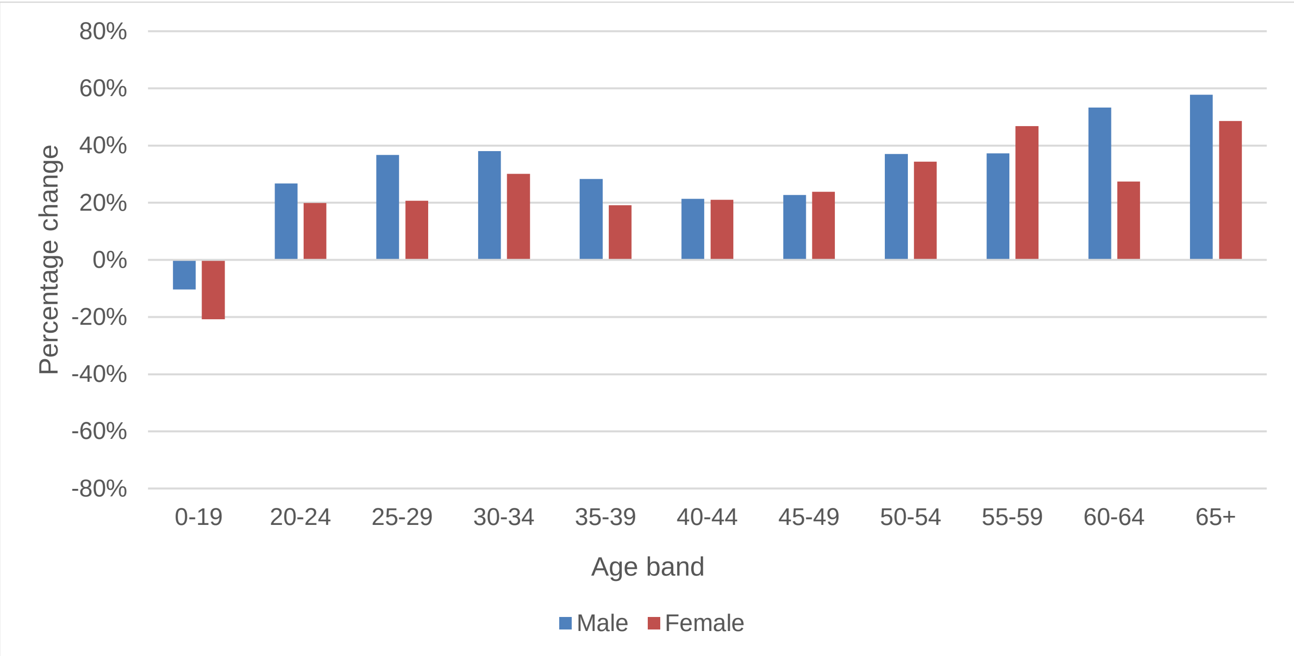
Between 2010 and 2014 (Figure 7.19), a reduction in offences was seen in almost every age and gender category. This was particularly driven by young drivers of both genders, who showed the greatest change, with fewer than half as many offenders of both genders in the under-20 age group. Minor increases did, however, occur in the number of offending females in the 60- to 64-year-old and 65-plus age groups.

Figure 7.19 Percentage change in offender type, by age band and gender, 2010 to 2014



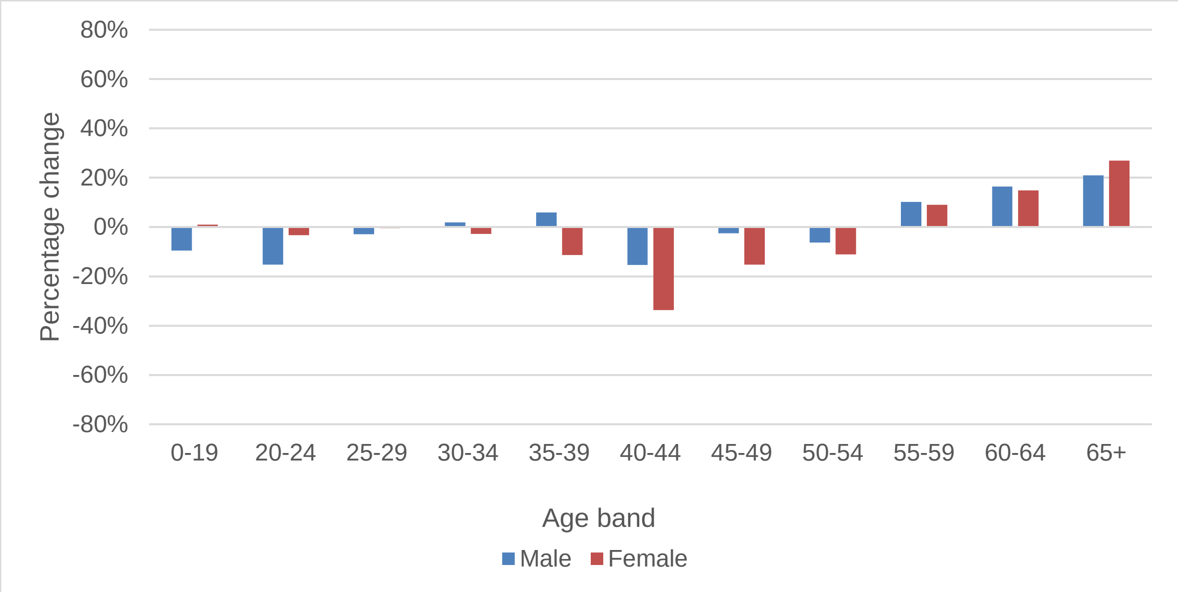
In the year before and after the 2014 Act (Figure 7.20), the increase in offences due to the new 50 mg/dl BAC is evident in all age groups except the under-20-year-olds who were unaffected by the change in legislation.

Figure 7.20 Percentage change in offender type, by age band and gender, 2014 to 2015



Between 2015 and 2019 (Figure 7.21), the flatness of the nationwide trend is shown by most age and gender categories having little change and many being indistinguishable from noise. Signs can be seen, however, of a further reduction in offences by young males, some reduction amongst the middle-aged (particularly females), and an increase in offending in both genders in the 55 to 59, 60 to 64 and 65-plus age brackets.

Figure 7.21 Percentage change in offender type, by age band and gender, 2015 to 2019



This analysis has not looked at changes that have occurred in the demographic breakdown of the overall population since 2010. It was also not possible to consider ethnicity because this was not included in the detailed offences data.

7.5.2.3 Offending by time of day and day of week

The time of day and day of the week that alcohol-related driving offences are likely to occur is an important consideration for targeting preventative education and enforcement. High-alcohol periods do not have a consistent definition in the literature and can vary across cultures. Sources generally cite high-alcohol periods as including 6 pm to 6 am on weekdays but starting earlier in the afternoon and ending slightly later in the morning over the weekend (Harrison, 1990). For this analysis, the offences data was banded against high- and low-alcohol periods informed by the literature and defined in Table 7.3. Because these have been determined from the literature rather than empirical evidence, the periods differ from the hours that NZ Police defines and targets as being high alcohol. NZ Police targeting of high-alcohol periods focuses on 4 pm Friday to 3 am Saturday and 4 pm Saturday to 5 am Sunday.

Table 7.3 High- and low-alcohol periods

Day of week	High-alcohol periods	Low-alcohol periods
Monday to Thursday	12 am to 6 am (early morning) 6 pm to 12 am (evening)	6 am to 6 pm (daytime)
Friday	12 am to 6 am (early morning) 3 pm to 12 am (late afternoon and evening)	6 am to 3 pm (morning and early afternoon)
Saturday and Sunday	12 am to 9 am (morning) 3 pm to 12 am (late afternoon and evening)	9 am to 3 pm (late morning and early afternoon)

Table 7.4 shows a shift in the time and day of the week that offences were recorded between 2010 to 2014 and 2015 to 2019. A comparison of the average annual offences by time and day between these two periods yields many three-hour time slots where a statistically significant change has occurred with 95% confidence. That is where the corresponding ρ value < 0.05, meaning a 95% probability exists that the two populations are not equal. Broadly, this shows a decrease has occurred in offences recorded between 12 am and 6 am on high-alcohol days but an increase in those recorded in the afternoon and early evening (3 pm to 9 pm) on those same days. Evidence can also be seen of increases in offences in the daytime on low-alcohol days. However, it cannot be determined whether this is a reflection of a change in enforcement practices or in when drink driving is occurring.

Table 7.4 Average annual offences by time and day of week

Weekday and time	High-alcohol period?	Average 2010–14	Average 2015–19	Change (%)	Significance
Monday 9 am to 12 pm	No	26.8	41.3	+54.2	0.006
Monday 12 pm to 3 pm	No	38.6	56.3	+45.9	0.006
Monday 3 pm to 6 pm	No	94.8	117.5	+23.9	0.022
Monday 6 pm to 9 pm	Yes	183.0	244.2	+33.4	0.003
Tuesday 12 pm to 3 pm	No	50.8	71.7	+41.1	0.003
Wednesday 6 pm to 9 pm	Yes	458	601.0	+31.2	0.0002
Thursday 3 am to 6 am	Yes	237.4	155.3	–34.6	0.039
Thursday 3 pm to 6 pm	No	194.4	231.8	+19.3	0.040
Thursday 6 pm to 9 pm	Yes	700.4	903.8	+29.0	0.036
Friday 12 am to 3 am	Yes	1,281.0	839.0	–34.5	0.026
Friday 3 am to 6 am	Yes	460.2	217.8	–52.7	0.044
Friday 3 pm to 6 pm	Yes	176.0	225.7	+28.2	0.014
Friday 6 pm to 9 pm	Yes	1,060.2	1,349.7	+27.3	0.003
Saturday 12 am to 3 am	Yes	2,770.4	2,154.2	–22.2	0.048
Saturday 3 am to 6 am	Yes	906.8	664.3	–26.7	0.024
Saturday 3 pm to 6 pm	Yes	262	349.0	+33.2	0.002
Sunday 6 am to 9 am	Yes	386.8	256.7	–33.6	0.042
Sunday 3 pm to 6 pm	Yes	210.8	260.5	+23.6	0.002

The proportion of breath tests and proportion of offences recorded in each time slice and day of the week were also analysed to identify statistically significant relationships (ρ < 0.05) between tests and offences. This means a 95% probability exists that the proportion of breath tests and proportion of offences are not equal. The results are summarised in Table 7.5.

Table 7.5 Times of day and day of week with significantly different proportions of breath tests and offences

Time of day and day of week	Proportion of breath tests (%)	Proportion of offences (%)	Ratio of % offences to % tests
All early mornings (12 am to 6 am)	5.9	34.6	5.87
Sun / Mon / Tue late evening (9 pm to 12 pm)	1.7	3.9	2.35
Weekday daytime (6 am to 6 pm)	26.4	8.0	0.30
Wed / Thu / Fri early evening (6 pm to 9 pm)	20.6	11.8	0.57
Saturday afternoon to early evening (12 pm to 9 pm)	12.9	7.5	0.58

Other periods (Mon / Tues 6 pm to 9 pm; Wed / Thu / Fri / Sat 9 pm to 12 pm; Saturday 6 am to 12 pm; and Sunday 6 am to 9 pm) did not show a significant difference between the proportion of tests and proportion of offences occurring at those times.

The data indicates that police enforcement resources may not be optimally aligned, and results could possibly be improved by redirecting, for example, some daytime and early evening resources to later evening and overnight. NZ Police (2019) indicates that while overall breath test numbers have reduced in recent years, this is because of more efficient deployment of police resources that have targeted high-alcohol hours. The data above does not appear to evidence this targeting of high-alcohol hours, though, given the partial coverage of the breath test data, it is not yet possible to say conclusively whether this enforcement strategy has been reflected in practice or if it has been more effective than previous approaches. Further analysis of breath test data is necessary as more complete data becomes available.

8 Discussion

This chapter collates and summarises the key findings from all stages of the research. The discussion also integrates learnings from across each chapter of this report, addressing specific research objectives and other matters raised by the steering group during the research process. These learnings are aggregated and presented under the following questions:

- What are the trends in drink driving and alcohol-related crashes in New Zealand?
- What data already exists or is potentially available regarding drink driving and alcohol-related crash trauma?
- Why has alcohol-related crash trauma in New Zealand not decreased when blood alcohol limits have reduced?

8.1 What are the trends in drink driving and alcohol-related crashes in New Zealand?

Trends in alcohol-related crashes and injuries, breath testing and offences were examined in previous chapters and are summarised in this section. Where possible, explanations for these trends are provided based on the analysis, stakeholder perceptions and literature review undertaken in this project.

The focus of this research was on examining trends over the 2010 to 2020 period, although longer term trends were examined where relevant data was available. Over the decade, several changes were made in legislation around lower alcohol limits and interlocks, as well as to Police alcohol enforcement practice. This research has attempted to encapsulate the trends in the context of these changes.

Note that the trends shown are based on available datasets, some of which have errors, inconsistencies or other limitations. These are discussed in more detail in section 8.2. Where concerns exist about the quality of the data, they are clearly identified and considered in the interpretation of the trends.

8.1.1 Timeline of changes in drink-driving legislation

Understanding the timeline of changes in drink-driving legislation is critical to interpreting trends in alcohol-related crashes. These changes are described in detail in section 2.2 but are summarised here.

Changes to blood and breath alcohol limits were implemented on the following dates:

- **7 August 2011:** The Land Transport (Road Safety and Other Matters) Amendment Act 2011 introduced the zero-alcohol limit for drivers aged under 20 years. This introduced an infringement-level offence for drivers in this age range caught with a BAC of more than 30 mg/dl or BrAC of more than 150 µg/l.
- **1 December 2014:** The Land Transport Amendment Act (No 2) 2014 introduced reduced alcohol limits for drivers aged 20 and over. The BAC limit reduced from 80 mg/dl to 50 mg/dl BAC, and from 400 µg/l to 250 µg/l BrAC. This introduced an infringement level offence for drivers caught with a breath or blood alcohol level that exceeds the new limit but does not exceed the old limit.

Additional licence restrictions were also introduced for more serious offences as follows:

- **10 September 2012:** The Land Transport (Road Safety and Other Matters) Amendment Act 2011 introduced alcohol interlock licences as a sentencing option, and mandatory zero alcohol licences for drivers convicted of more than one drink-drive offence committed within five years.

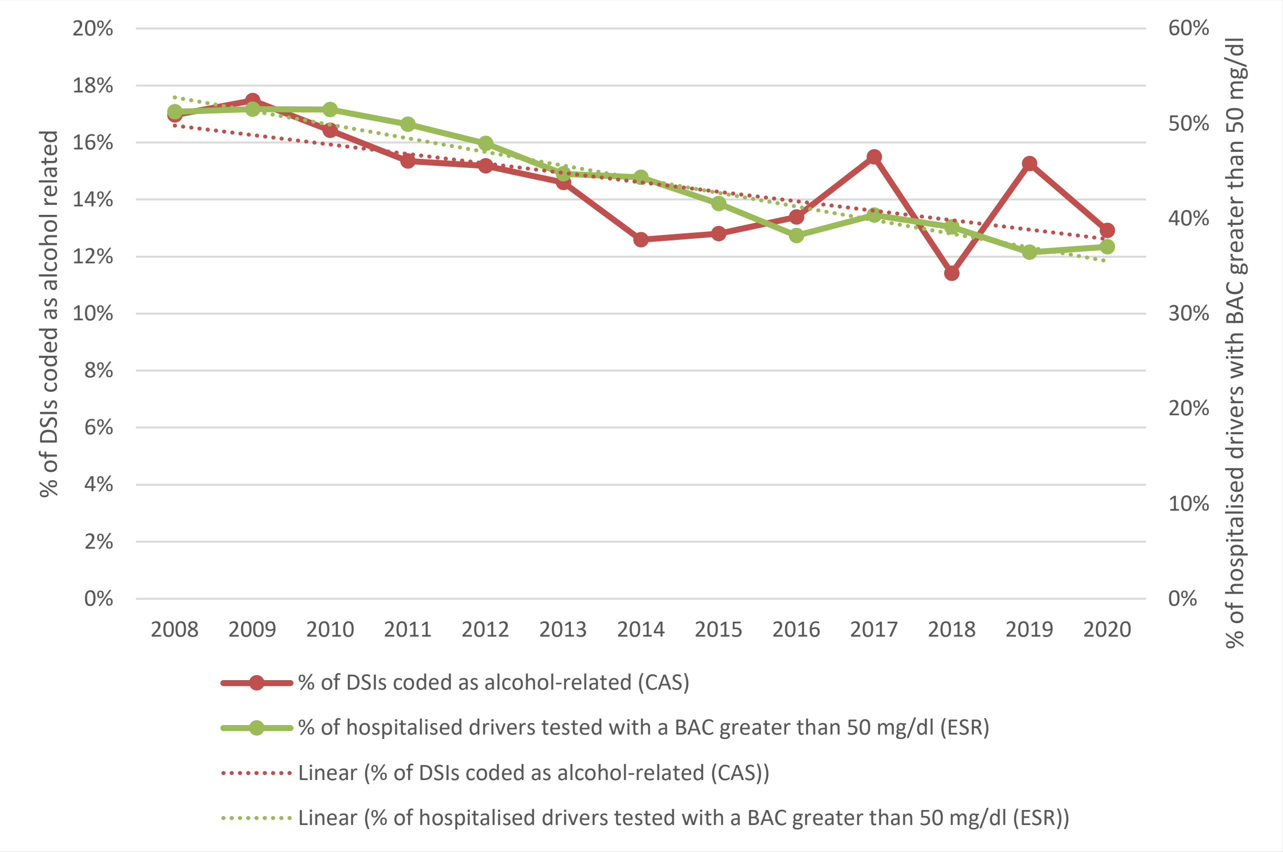
- **1 July 2018:** The Land Transport Amendment Act 2017 introduced mandatory alcohol interlock licences for repeat offenders (as described above) or first offences where a driver's alcohol level is above 160 mg/dl BAC or 800 µg/l BrAC.

8.1.2 Trends in fatal and serious injuries from alcohol-related crashes

Fatal and serious injuries from alcohol-related crashes are recorded in CAS, and the aggregated data informs the crash trends as they are reported by Waka Kotahi and the Ministry of Transport (see chapter 4 for examples). Detailed analysis of ESR blood test data in chapter 7 also identified trends in alcohol impairment for drivers in cases where they were killed or hospitalised due to a crash.

Figure 8.1 overlays the percentage of DSIs recorded as 'alcohol-related' in CAS with the percentage of hospitalised drivers with blood test results over the 50 mg/dl BAC threshold, with linear trendlines.

Figure 8.1 Percentage of alcohol-related deaths and serious injury and alcohol-impaired hospitalised drivers, 2008 to 2020



Note: BAC = blood alcohol concentration; CAS = Crash Analysis System; DSI = death and serious injury; ESR = Institute of Environmental Science and Research; mg/dl = milligrams per decilitre.

The percentage of alcohol-related DSIs, as reported in CAS, clearly trends downwards from 2008 to 2014, from a high of 17% to a low of 13% of total DSIs. The proportion of alcohol-related DSIs then increases slightly from 2014 to 2016, before fluctuating considerably between 2017 and 2020 (when compared with the previous periods).

Overall, a downward trend is evident from 2008 to 2020 in the proportion of reported serious road trauma in CAS where alcohol is identified as a crash cause factor. However, the fluctuations between 2017 to 2020, especially when compared with the previous eight-year period (2008 to 2016), require further investigation. A detailed analysis of the accuracy of CAS driver alcohol coding was undertaken in the data analysis phase of this research, with the results presented in section 7.3. The analysis findings suggest these fluctuations could be, in part, due to inaccuracies in how this alcohol-related data is coded. These findings are summarised in section 8.2; however, the following conclusions are relevant to the interpretation of alcohol-related crash trends:

- Alcohol-related driver coding in CAS is unreliable from late 2018 onwards due to separate under-reporting and over-reporting errors. While both errors are substantial, it is suspected these factors cancel each other out to some extent and so the number of alcohol-related crashes, fatalities and injuries appears to be broadly similar to previous years.
- It is unclear how the determination of 'alcohol test below limit' versus 'alcohol test above limit' is made in CAS. It appears to be primarily determined by comparing the driver's breath or blood alcohol reading to the legal alcohol limits at the time of the crash, considering the driver's age. This means the coding of drivers before and after the change in alcohol limits in December 2014 is not directly comparable for drivers aged 20 and over, with more drivers being coded as 'alcohol related' from 2015 onwards. This could partly explain the slight uptick in the percentage of alcohol-related DSIs in 2015 and 2016. Further analysis is required to determine the impact of this.
- NZ Police moved from paper to electronic TCRs in July 2016 and it is possible this change affected how Police recorded alcohol-related crash information. This coincides with the start of the fluctuating trend shown in Figure 8.1 from 2017 onwards, however, it is no more than speculation at this stage.

The ESR blood results datasets are independent of CAS so are a useful alternative for comparing against CAS data. The trend in the percentage of hospitalised drivers tested with a result over 50 mg/dl BAC is shown in Figure 8.1 and shows that:

- The percentage of hospitalised drivers with a BAC over 50 mg/dl has decreased over time, and this decreasing trend appears to be fairly linear.
- The ESR data has much less fluctuation, compared with the CAS-derived data.
- From 2008 to 2015, the trendline for the proportion of hospitalised drivers with a BAC over 50 mg/dl is above the trendline for the proportion of DSIs coded as 'alcohol-related', but this reverses from 2016 onwards. This seems to align with the change in legal alcohol limits in December 2014, which may have led to more drivers being coded with 'alcohol above limit', and therefore more DSIs being attributed to alcohol-related crashes from 2015 onwards.

While the ESR hospitalised driver blood data does not give an absolute measure of alcohol-related DSIs, it provides a consistent and useful proxy measure of alcohol-related crash trauma. Further discussion on the usefulness of this dataset is provided in section 8.2.

The study by Walton et al. (2020) investigated the increase in DSIs from 2014 to 2017 and identified alcohol-related crashes as a significant contributor to the increase in the overall crash rate, despite alcohol-related offences having fallen over the same period. However, this study depended on CAS data for its analysis, and any inaccuracies in the data will therefore have carried through into the analysis. It has not yet been confirmed whether 2017 CAS data has been affected by the change from paper to electronic TCRs, but if so it is possible an update of the Walton et al. (2020) study may show different results.

8.1.3 Trends in drink-driving enforcement: testing and offences

In addition to the changes in legislation, changes have also been made to alcohol-impaired driving enforcement by NZ Police within the past decade. Between 2009/10 and 2015/16, Police set a minimum performance standard of 2.7 million breath tests per year. This reduced to around 1.6 million to 2 million tests from 2016/17 to 2020/21. In 2019, NZ Police explained the reduction in annual breath test counts as a change in strategy, with more targeting to risk and more effort focused on hotspots and events, rather than on high volume traffic areas at random times (NZ Police, 2019). However, breath test and offences data do not make it clear whether this has in fact been achieved (see section 7.5.2.3).

8.1.3.1 Comparing breath testing and offences

Figure 8.2 combines alcohol-specific driving offences and breath test counts, reported by calendar year to align with how breath test counts are reported. Note that, as identified in section 7.4, breath test counts are reported based on the date they were downloaded from devices rather than the date the test was administered. The actual number of breath tests undertaken in each year may therefore deviate from the number shown in the figure. Breath test counts have been averaged for 2015/16 and 2016/17 due to changes in the calibration cycle.

Figure 8.2 Reported breath test counts and drink-driving offences (source: New Zealand Police Annual Reports 2010 to 2021, and New Zealand Police reported drink-driving offences)

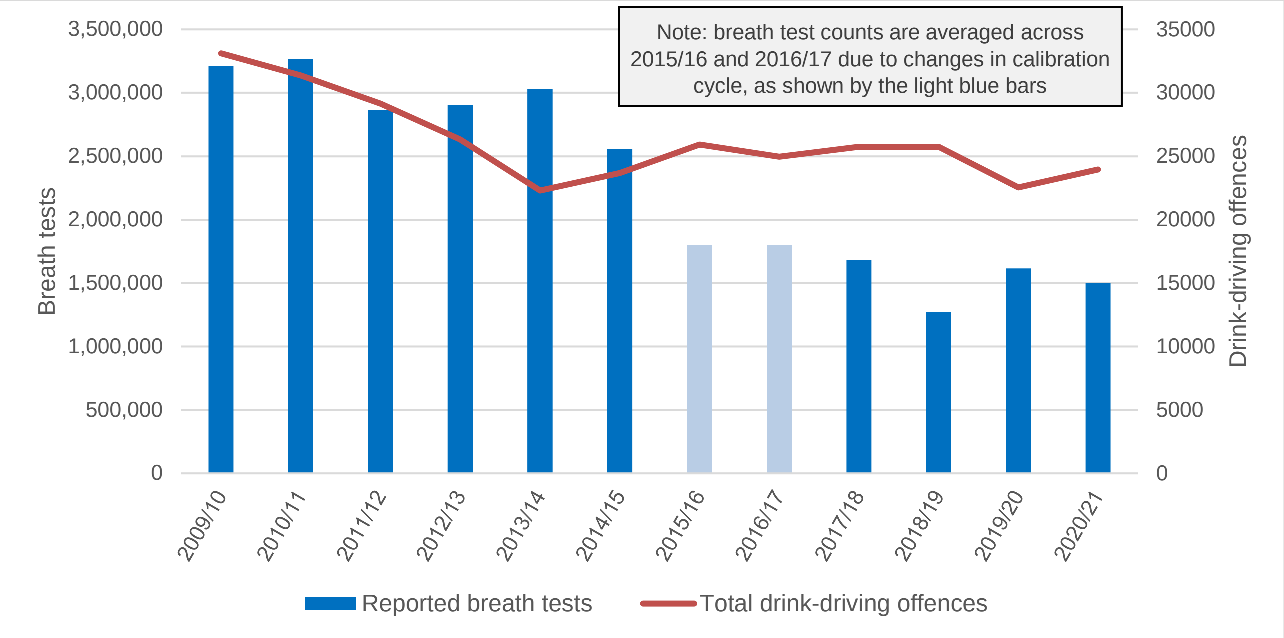


Figure 8.2 shows the following trends:

- A decline occurred in offences from 2009/10 to 2013/14, despite breath test counts remaining relatively steady, at around 3 million tests per year.
- A slight uptick occurred in offences from 2014/15 onwards, which aligns with the introduction of lowered legal alcohol limits for drivers 20 years and older in December 2014. As discussed in section 7.5.2, the increase in offences is primarily associated with the introduction of the 50 mg/dl to 80 mg/dl offence level, and the number of drivers exceeding the 80 mg/dl level does not appear to have increased.
- From around 2015/16 onwards, the number of offences stayed relatively steady, despite breath test volumes decreasing. This shows an increase in the number of offence detections per breath test.
- Testing and offence volumes in 2019/20 and 2020/21 decreased slightly, compared with previous years. This is at least partially due to the impact of the COVID-19 pandemic.

Broadly, these trends suggest that offence numbers were reducing when breath testing was at its highest but have now stagnated with breath testing at a lower level. While offence numbers do not appear to have increased with lower annual testing numbers, it is not clear whether the NZ Police strategy of more targeted testing has been successful or if it is offences that are going undetected due to reduced levels of testing.

8.1.3.2 Comparing breath test counts with minimum performance standards set by New Zealand Police

When comparing breath test counts with the minimum performance standards in the NZ Police's Annual Reports (Figure 8.2), it was found that NZ Police failed to meet these standards for five of the past seven financial years (2014/15 to 2020/21), despite these standards being set at a lower level than in previous periods (around 1.6 million to 2 million tests per year). By comparison, NZ Police met this standard every financial year from 2009/10 to 2013/14 when the minimum performance standard was constant at 2.6 million breath tests. This suggests that, in more recent years, breath testing has been under-resourced or not as heavily prioritised, a finding supported by stakeholder feedback that enforcement activity levels have decreased in recent years.

While the sequence of events that led to NZ Police adjusting its approach to breath testing is not known, it is worth considering whether the lowering of the drink-driving limit in 2013 created an expectation that enforcement would continue at the same level as in previous years. It has been noted in the literature (see appendix C) that the actual alcohol limits are less effective at deterring drink driving than the expectation of being caught, which is primarily driven by drivers' perceptions of enforcement activity.

8.1.3.3 Trends in offences by blood alcohol and breath alcohol concentration, Police district, age band and gender

Chapter 7 included additional, exploratory analysis of detailed offence data provided by NZ Police. Key additional trends that were identified in that analysis follow.

Overall trend in alcohol-related offences

Excluding infringement charges for people aged 20 and over in the lower tier of offence, which were introduced in December 2014, offences have decreased overall between 2010 and 2020 (Figure 7.14). The number of offences per year then decreased most steeply between 2010 and 2015, then remained steady or slightly decreased between 2015 and 2020 (excluding the impact of the COVID-19 pandemic).

Trends by New Zealand Police district (indexed to population)

When indexed to population, and separated by NZ Police district, the following trends in offence rates were observed in Figure 7.17 and Figure 7.18:

- A clear downward trend in offence rates across every NZ Police district between 2010 and 2014.
- A consistent increase in offence rates from late 2014 to late 2015, consistent with the change in alcohol limits.
- From late 2015 onwards, trend lines for each NZ Police district are more scattered, with many districts showing considerable variation from quarter to quarter. Some districts (eg Southern, Tasman and Eastern) reverted to a higher rate of offending after 2015, while others (eg Canterbury) maintained the downward trend. The timing of this change in trend aligns with the time when NZ Police introduced lower breath testing targets and shifted towards targeting to risk. The variation in offence rates by district and between quarters suggests varied levels of resourcing in RBT across each district and over time, although it could also be due to regional variations in drink-driving patterns, with more effort placed on RBT in locations identified as 'higher risk' for drink driving compared with 'lower risk' locations.

Offences by age and gender

Trends in the number of offences by age band and gender were examined over three periods. Figure 7.19 compares changes between 2010 to 2014 (before the change in legal limit), Figure 7.20 compares changes between 2014 and 2015 (comparing the impact of the new alcohol limit), and Figure 7.21 compares changes between 2015 and 2019 (to examine longer-term trends following the change in alcohol limit).

- Between 2010 and 2014, the number of offences dropped across genders and almost every age band. The greatest reduction occurred amongst drivers under the age of 25, noting that the zero-alcohol limit for drivers under 20 was introduced in August 2011. The only category where the percentage change in offences increased was among females aged 60 and over.
- Comparing changes immediately before and after the change in alcohol limit for drivers aged 20 and over, a percentage increase occurred in offences across all age bands and genders, except for under-20-year-olds.
- Between 2015 and 2019, relatively little percentage change occurred across most age bands and genders. The larger percentage reduction in offences was observed among males aged under 25 (9% to 15% reduction) and females aged between 35 and 55 (11% to 34% reduction). The percentage change in offences increased for all drivers aged 55 or older, ranging from a 9% increase among females aged 55 to 59 to a 27% increase among females aged 65 or older.

Note the analysis of offence data only investigated percentage change in offences and not absolute offences by age or gender. For example, while the data suggests offending is increasing for people aged over 55 (especially females) this is a relatively smaller proportion of offences overall, compared with other age and gender groups. Drivers aged 30 and over are less likely than younger drivers to be fatally injured when under the influence of alcohol (Figure 2.1), and New Zealand and international research suggests men are more likely to report driving under the influence (Chou et al. 2006; Ministry of Health, 2015; Stephens et al., 2017).

A ‘targeting to risk’ approach should focus on those drivers more at risk of fatal or serious injury or more likely to be drink driving. However, the data is consistent with points raised in the stakeholder engagement around there being a perceived increase in alcohol consumption and drink driving among demographics that have been traditionally less at risk of these behaviours. Much deeper research could be done in this area to compare rates of drink-driving offending with rates of fatal and serious injuries among drivers under the influence of alcohol.

8.1.4 Trends in attitudes to drink driving and perceptions of enforcement

The Public Attitudes to Road Safety survey (Waka Kotahi, 2020a) provides insights into how people’s attitudes to drink driving, and their perception of enforcement, have changed over time. The latest survey was undertaken in 2020 and includes a comparison of results with those from 2016, the previous time the survey was undertaken. This comparison was used to understand trends in public attitudes between 2016 and 2020, and the comparison is referenced throughout this report (mainly in section 2.3, regarding drink-driving attitudes and perceptions, and section 4.4 regarding perceptions of enforcement). Further investigation into longer term trends could be undertaken using older survey data that was undertaken annually before 2016 and made publicly available by the Ministry of Transport (2016).

The following key statistically significant trends between 2016 and 2020 were observed:

- Fewer licensed drivers reported driving at least once during the past 12 months while slightly intoxicated, a statistically significant reduction from 18% to 12%. However, it is not known how the COVID-19 lockdowns in 2020 affected drinking and driving behaviour in the 12 months before May to July 2020 when the survey was undertaken. Assuming the reduction is over-estimated, this at least indicates that rates of driving while slightly intoxicated have not increased recently. It is unclear if rates of drink driving while heavily intoxicated have changed.

- Changes in perceptions of enforcement suggest fewer people are seeing or being tested at Police checkpoints and are finding it harder to predict where checkpoints will be. Conversely, a perception exists that people driving after drinking are *more* likely to be caught in the evening (6 pm to midnight). This aligns with changes in Police practices after 2016, where NZ Police reports taking a more targeted risk-based approach to impairment.

In addition, findings from the NZHS over the past 5 to 10 years indicate a slight increase in adult past-year drinkers between 2014/15 and 2019/20, but no observed change in the amount of hazardous drinking overall (as discussed in section 5.1). The literature review found that people with drinking problems or evidence of alcohol abuse are more likely to be in crashes (Fell et al., 2010; Shinar, 2017), and problem drinking is closely correlated with BAC in drivers killed in crashes (Baker et al., 2002). Considering the findings from both the literature and NZHS, it is reasonable to conclude no increase occurred in overall drink-driving rates between 2016 and 2020.

8.2 What data already exists, or is potentially available, regarding drink driving and alcohol-related road trauma?

Several datasets capture drink driving and alcohol-related crashes and injuries. These datasets are identified at different points in this report, primarily in chapter 3 (regarding New Zealand crash and blood alcohol data collection), chapter 4 (regarding breath testing and offence data) and chapter 7, where supporting datasets were analysed in more detail. See appendix A for references and links to all datasets identified in this report.

Four datasets were reviewed in detail, to determine their usefulness in understanding drink driving and alcohol-related road trauma. Table 8.1 briefly summarises the datasets, and these are described in more detail in the next section under the following sub-headings:

- How is this data collected?
- How is the data reported?
- How has collection and reporting changed over time?
- How robust is the data and what are the limitations and gaps?
- Opportunities to improve data collection and reporting.

Table 8.1 Datasets and data sources reviewed

Dataset or data source	Source(s)	Summary
Crash analysis system (CAS)	Waka Kotahi	CAS is New Zealand's authoritative repository of crash data. CAS includes several data fields indicating whether drivers were tested for alcohol (breath and/or blood), and the results of those tests. Data in CAS is used to track trends in crash deaths and injuries where alcohol was identified as a cause factor.
Blood tests	Institute of Environmental Science and Research (ESR)	ESR processes evidential blood samples for drivers and collects the test results in separate databases for: • fatal drivers • living drivers (split by hospitalised and non-hospitalised. Because blood tests are taken from almost all drivers injured or killed in a crash, this dataset also helps understand trends in driver impairment.
Breath tests	NZ Police	Breath test data is generated from Dräger 6510 and Dräger 7510 testing devices used by police officers for roadside breath testing. The 6510 devices only generate total breath test counts, which is the primary measure of alcohol enforcement activity used by NZ Police. The 7510 devices rolled out from 2015 provide richer breath testing data that could be used for more detailed analysis of drink-driving enforcement.
Alcohol-related driving offences	NZ Police	Data on offences provides insights into unsafe driver behaviour and helps in understanding the effectiveness of enforcement strategies. Both NZ Police and the Ministry of Justice track drink-driving offences. NZ Police issues infringement notices and prepares charges, whereas the Ministry of Justice prosecutes, convicts and penalises impaired drivers through the courts. As such, each agency generates and presents this data differently. Detailed data on alcohol-related driving offences was provided by NZ Police to the project team for this project. The Police offence data is considered to better represent the scale of drink driving than the Ministry of Justice data, because the latter records proceedings, of which zero to several can result from a single charge. Therefore, more effort was directed into analysing Police data sources over the Ministry of Justice offence data.

8.2.1 Alcohol-related crash data

8.2.1.1 How is this data collected?

NZ Police generates TCRs for all reported crashes. Almost all drivers involved in a crash are tested for alcohol by NZ Police, provided a police officer attends the crash.

Blood samples are collected from deceased drivers and injured drivers who are hospitalised. Non-injured drivers are breath tested at the roadside by the attending police officer (see section 8.2.3 for more information on breath test data collection). ESR processes blood samples for alcohol (and/or drugs, if requested by police) and issues the results to NZ Police, noting it can take up to a couple of weeks for results to be processed and returned.

When the police officer responsible for the TCR receives the results from ESR, they must complete the fields in the TCR regarding the blood test results. The officer also uses these results to help determine if the driver should be charged with an offence.

8.2.1.2 How is the data reported?

The information entered by police officers into TCRs is pushed into CAS as a crash record. The alcohol information provided by officers in the TCR is translated into alcohol cause codes when the crash record is processed in CAS. The three main cause factor codes for drivers are:

- '101' (alcohol suspected)
- '102' (alcohol test below limit)
- '103' (alcohol test above limit or test refused).

These codes are used to identify crashes and crash injuries that are 'alcohol related'. The codes are visible to approved CAS users, and most CAS users can view the additional six fields of alcohol-related information provided by police officers (described in more detail in Table 3.1). This information is then used to calculate, aggregate and report statistics around alcohol-related crashes, deaths and injuries. Aggregated statistics on alcohol-related crashes are publicly reported annually by the Ministry of Transport in its annual road safety statistics (Ministry of Transport, 2020).

8.2.1.3 How has collection and reporting changed over time?

Three major shifts have occurred in how crash data is collected and processed since 2010:

- **Before July 2016:** NZ Police prepared paper TCRs that were manually entered into CAS by the CAS coding team.
- **After July 2016:**
  - NZ Police shifted to preparing and submitting electronic TCRs using a digital application. This allowed police officers to create, complete, edit and submit TCRs in the field via the 'OnDuty' iPhone application, or in the office using a desktop application. The CAS coding team continued to manually enter the TCRs into CAS.
  - Changes in the TCR application also removed the ability for police officers to state where they suspected alcohol but it had not been confirmed through testing. 'Alcohol suspected' status is now reported whenever a driver is tested for alcohol, regardless of whether alcohol was genuinely suspected as a cause factor, and these drivers are coded in CAS with '101' (alcohol suspected).
- **From 20 February 2019:** updates to CAS enabled TCRs to be automatically pushed through as crash records into CAS with minimal oversight from the CAS team. The update also allowed CAS team members to return TCRs to the attending officer for updating or correction if an inconsistency or error was discovered.

8.2.1.4 How robust is the data and what are the limitations and gaps?

Crash data in CAS is widely regarded as a reliable source of authoritative data on crashes and crash factors in New Zealand. However, the use and interpretation of crash data must always take into account both how crash recording and coding has changed over time, as well as potential human or system errors in the collection and processing of this data.

Compared with the international jurisdictions examined, New Zealand is good at testing drivers involved in crashes for alcohol. Testing of drivers is routine for any driver identified as being directly involved in the crash, however, many other jurisdictions leave testing to the discretion of the police officer. Unlike New Zealand, in NSW and Victoria, Australia, their respective police forces do not attend reported non-injury crashes, therefore, an opportunity to test and potentially discover an alcohol driving offence is missed.

Stakeholders identified several areas of concern in how alcohol-related data is recorded in CAS, and these were investigated in detail (see section 7.3 and elsewhere). Identified errors and limitations are summarised below, and the factors that have (or could have) led to these errors and limitations are assessed. Opportunities to improve data collection and reporting to minimise the impact of data error are also provided.

Change in how ‘alcohol suspicion’ is recorded and coded

The change in recording and coding of ‘alcohol suspicion’ in July 2016 meant it was no longer possible to monitor trends in crashes where alcohol is suspected after that date. Before the change, only drivers who were suspected by police of being influenced by alcohol were coded ‘101’ (alcohol suspected). From July 2016, all drivers tested for alcohol are automatically coded ‘101’ (alcohol suspected) regardless of the test result or whether the attending officer had a genuine suspicion of alcohol involvement. This could be particularly misleading to CAS users who may interpret ‘alcohol suspected’ as confirmation that alcohol was a likely, if not proven, cause factor.

The loss of ‘alcohol suspicion’ is also unfortunate because it was useful for identifying crashes where alcohol is *likely* to be a factor but was unable to be proven. However, CAS users can still query alcohol-related crashes based on whether a driver was proven to be over the legal limit (cause code ‘103’ (alcohol test above limit or test refused)).

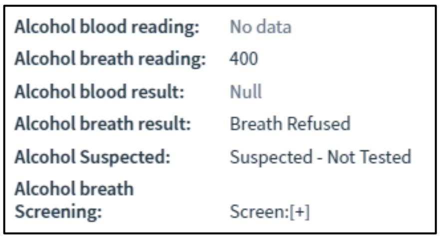
Changes in alcohol limits affect the coding of drivers ‘above’ or ‘below’ the limit

It is not clear from CAS how ‘alcohol test below limit’ and ‘alcohol test above limit’ are determined from the alcohol-related information in the TCR. This appears to be coded by comparing the driver’s breath or blood alcohol reading to the legal alcohol limit at the time of the crash, considering the driver’s age and licence restrictions (if any). This means cause codes before and after the change in alcohol limit in August 2011 (zero limit for drivers under 20 years of age) and December 2014 (reduced limit for drivers aged 20 and older) are not directly comparable, which affects the reporting of alcohol-related DSIs. For example, the lowered limit may account for some of the increase in alcohol-related DSIs observed between 2015 compared with 2014 (as discussed in section 8.1.2).

Contradictory information regarding driver alcohol suspicion, testing, readings and results

Six different alcohol-related information fields for drivers are visible to most CAS users. However, these can sometimes display contradictory alcohol-related information. Figure 8.3 provides an example showing a driver who was not tested for alcohol and who refused a breath test but returned a positive breath screening result and an alcohol breath result of ‘400’.

Figure 8.3 Example of contradictory alcohol-related information in the Crash Analysis System (CAS) (screenshot from CAS)



Alcohol blood reading:	No data
Alcohol breath reading:	400
Alcohol blood result:	Null
Alcohol breath result:	Breath Refused
Alcohol Suspected:	Suspected - Not Tested
Alcohol breath Screening:	Screen:[+]

This type of error does not seem to affect the cause factor coding, but it may confuse CAS users and their interpretation of the information available, especially because no metadata is available to explain how each field is interpreted.

Drivers incorrectly flagged with an alcohol breath test result ‘breath refused’

Analysis of the CAS driver data identified a large increase from late 2018 onwards in drivers with an alcohol breath result of ‘breath refused’ and no evidence of a blood test (Figure 7.8). Between 2019 and 2020, 1,487 drivers had an alcohol breath result ‘breath refused’, compared with just 19 drivers in 2016 and 2017. Drivers with an alcohol breath result ‘breath refused’ are coded in CAS as ‘alcohol test above limit or test refused’, so the crashes they are involved in are considered alcohol related. This means alcohol-related crashes and DSIs are being over-reported if, as suspected, these drivers have not in fact refused a breath test.

Blood results not updated

From quarter 4 2018 onwards, a large increase also occurred in the number of drivers with an alcohol blood result of ‘blood pending’. This was analysed and reported in section 7.3.1 (Figure 7.7), which showed 2,589 injury crashes occurred in 2019 and 2020 where the role of alcohol as a cause factor is potentially undetermined based on blood results, including almost 1,100 fatal or serious crashes in 2019 and 2020. If the involvement of alcohol is not separately confirmed by a breath test, these drivers are coded ‘101’ (alcohol suspected), resulting in the number of alcohol-related crashes where alcohol is confirmed being under-reported from late 2018 onwards.

To estimate the degree of under-reporting, a sample of these drivers (across 100 injury crashes) was compared with the raw ESR blood dataset, using the driver’s age and the time and location of crash to match the driver to the blood result. Of the 88 drivers who could successfully be matched to the ESR dataset, around two-thirds returned blood results ‘under the limit’, and one-third returned a blood result ‘over the limit’. This gives an indication of how many crashes coded ‘101’ (alcohol suspected) with drivers who have blood pending were alcohol related, noting that the sample of drivers reviewed is not large enough to estimate with confidence the degree of under-reporting across the entire dataset.

Summary of errors and data limitations

Table 8.2 summarises the errors and limitations described above, highlighting how these affect the interpretation of alcohol-related crash data in CAS. The reason(s) or suspected cause(s) of the error or limitation are also identified and are discussed in more detail in the section that follows.

Table 8.2 Interpretation of limitations and errors in Crash Analysis System (CAS) alcohol-related crash data

Limitation or error	Period affected	Impact on the interpretation of alcohol-related crash data for CAS users	Reason or suspected cause
Change in the recording and coding of ‘101 alcohol suspected’	Before or after July 2016	Cause code ‘101’ (alcohol suspected) should not be used to identify potential alcohol-related crashes from July 2016 onwards, due to a change in how this is reported and coded.	Change in crash reporting system
Changes in alcohol limits affect the coding of drivers ‘above’ or ‘below’ the limit	Before or after August 2011 (zero limit for drivers aged under 20) Before or after December 2014 (lowered limit for drivers aged 20 and older)	Drivers are coded as ‘above’ or ‘below’ the limit based on the limit at the time of the crash. This should be considered when comparing alcohol-related crashes and deaths and serious injuries (DSIs) before and after the alcohol limits changed, for example, in December 2014 when lower limits were introduced for drivers aged 20 and over. This factor could partly explain the increase in alcohol-related crashes and DSIs from December 2014 onwards, compared with previous periods.	Change in alcohol limits

Limitation or error	Period affected	Impact on the interpretation of alcohol-related crash data for CAS users	Reason or suspected cause
Contradictory information regarding driver alcohol suspicion, testing, readings and results	–	Contradictory alcohol-related information on drivers is shown in the CAS application and could confuse CAS users. CAS users should therefore rely on the cause codes for identifying alcohol-related crashes, rather than the ‘raw’ driver alcohol information.	Human error and inadequate data validation
Drivers incorrectly flagged with an alcohol breath test result ‘breath refused’ and Blood results not being updated in CAS	From quarter 4 2018 onwards	From late 2018 onwards, the coding of drivers as ‘103’ (alcohol test above limit or test refused) is simultaneously: • Over-reported due to a large increase in drivers inaccurately coded with a breath result ‘breath refused’. • Under-reported due to a large increase in drivers whose blood results have not been updated in CAS, and therefore alcohol cannot be confirmed as a cause factor. It is suspected that the over-reporting and under-reporting balance out to some extent, giving the appearance that alcohol-related crashes and DSIs are within expected ranges for 2019 and 2020, compared with previous crash periods. Any reporting of alcohol-related crashes and injuries for this period is unreliable due to these errors.	Software or system error(s) following the system update that enabled CAS crash records to be automatically generated from TCRs

Potential reasons for crash data collection (input) errors

Information about crashes is collected by police officers by observing the crash scene, taking statements, and undertaking or arranging tests and analyses to determine crash cause factors and whether an offence was committed. The police officer inputs this information into the TCR using predefined fields, and this relies on the officer entering information accurately and without error.

Stakeholder feedback suggests three potential reasons exist for why alcohol-related crash information might be inputted incorrectly (or omitted entirely) by a police officer at the data input stage:

1. The TCR application appears to allow officers to enter contradictory alcohol-related information. For example, Figure 8.3 shows that ‘Suspected – Not Tested’ can be recorded, despite breath screening results and numeric breath readings being provided (assuming this information was correctly translated from the TCR into CAS). If designed well, the TCR application should either prevent contradictory information being entered, or alert officers when contradictory information is detected and require them to correct it. For example, the error shown in Figure 8.3 could be prevented using dependent fields, where the ‘alcohol reading’ and ‘alcohol results’ fields are only visible and editable when the user first selects ‘Suspected – Tested’. The remaining fields would be hidden if the user selects ‘Suspected – Not Tested’.
2. Blood test results are received from ESR within a week or two after a crash. This requires a police officer to open, update and resubmit the TCR in the desktop application. Because police officers are usually most interested in the blood test results for prosecution purposes, they may neglect to update blood results in the TCR, especially if the BAC is below the legal limit and therefore of little interest to Police for prosecution purposes. It was also suggested that officers are less familiar with the desktop application

(compared with the iPhone application), and some are unsure about how to update TCRs and resubmit them correctly.

3. At the time of writing, police officers are not trained in creating and completing TCRs. New officers learn to fill out TCRs on the job from more experienced colleagues. This risks imperfect knowledge being passed on and subtleties being missed. Officers may also not understand the importance of accurate crash reporting, and how these reports are used by policy makers and road safety professionals.

Note that these reasons were identified by stakeholders based on their personal observations. The researchers have not accessed the TCR application to review it directly. Therefore, these observations have not been validated by the research team but serve as a starting point for further investigations.

Regarding blood test results, it is noted that the responsibility for entering alcohol-related information into TCRs sits with NZ Police. However, ESR also processes and collates blood test results (as discussed in section 8.2.2). It is understood ESR also shares blood test result reports (in bulk) with NZ Police and possibly also Waka Kotahi. At the time of writing, however, it is unknown if this bulk report data is used to update blood test results in TCRs or in CAS.

For comparison, in NSW, blood test results are shared directly between the state testing laboratory and TfNSW, with TfNSW then matching this data to the driver record using a unique ID. This removes the need for police officers to reopen and update the crash record later, ensuring blood test results in the crash data are updated accurately and in a timely manner. It is worth investigating how this approach could be used in New Zealand to improve alcohol-crash reporting.

Potential reasons for ‘breath refused’ and ‘blood pending’ errors (late-2018 onwards)

The breath refused and blood pending errors are found in alcohol-related crash records from late 2018 onwards, which broadly aligns with the last major update to CAS (around February 2019) and enabled TCRs to be automatically pushed through to CAS. Therefore, it is suspected these errors are a result of this system update, potentially due to one or more of the following factors:

- Less oversight by the CAS team – errors are less likely to be caught and corrected before entering CAS.
- Translation error(s) – fields are not being interpreted and translated correctly between the TCR application and CAS.
- Inadequate data validation – quality control processes are not catching errors in TCRs or in the translation process.

Another reason for the errors could be an underlying issue with how TCRs capture alcohol-related information, or a widespread problem with police officers incorrectly entering data into TCRs. Potentially, these errors were then only ‘daylighted’ following the system update.

Metadata and the amount of alcohol-related information accessible to CAS users

Several stakeholders raised concerns about the accuracy of alcohol-related crash coding in CAS, which is worrying because this data is used widely by researchers investigating alcohol-related road trauma. It is also difficult to interpret alcohol-related driver information and understand how it relates to the driver-related alcohol-cause codes.

At the time of writing, little metadata is available on alcohol-related information in CAS, in particular:

- Information is limited describing how to interpret the six driver alcohol fields (Table 3.1).
- While some information is available on the impact of the change in coding for ‘101’ (alcohol suspected’), it was not easy to find and would not be obvious to occasional CAS users.

- It is unclear how the alcohol fields translate into the alcohol cause factors (‘101’, ‘102’ and ‘103’), especially how ‘above limit’ and ‘below limit’ are determined.
- No reference is made to any known or suspected errors in alcohol-related crash data.

Without this information, researchers and policy makers using alcohol-related crash data may draw incorrect conclusions, which could potentially affect the degree to which interventions seeking to discourage drink-driving behaviour are prioritised and funded.

In addition, at the time of writing, CAS allows users to view the raw breath and/or blood alcohol results for drivers. By comparison, in Australia, the Victoria and NSW crash reporting systems only flag drivers and crashes as ‘alcohol-related’ and provide no additional alcohol-related information. Both states intentionally restrict what alcohol-related data users can see, with access to driver breath and blood alcohol readings heavily restricted for privacy and health reasons.

Ignoring the underlying errors identified in the alcohol-related crash data, and provided adequate metadata is available, the cause codes alone should be sufficient for most CAS users to determine whether a driver was impaired by alcohol and, therefore, if a crash is alcohol related. Researchers seeking more detailed data could be given access to the raw data on a case-by-case basis, or given aggregated data, for example, by banding alcohol-impaired drivers by BAC and BrAC, or by offence level. This would bring New Zealand in line with current practices in Victoria and NSW.

8.2.1.5 Opportunities to improve data collection and reporting

The following opportunities to improve alcohol-related data collection and reporting are identified from the discussion above and formatted here as recommendations:

1. Review the TCR application to identify improvements in the user interface that would improve the quality and accuracy of alcohol-related crash data collection by police officers.
2. Improve the training of police officers in the completion of TCRs, highlighting the importance of accurate and reliable crash data and how it is used by other agencies.
3. Investigate the cause of the driver ‘breath refused’ and ‘blood pending’ errors, observed from late 2018 onwards. This should include reviewing data translation and data validation processes. Efforts should focus on correcting these errors at the same time (and the affected crash and driver data) so confidence in the quality of alcohol-related crash data from late 2018 is restored.
4. Develop metadata for CAS users on the interpretation of alcohol-related data, including documenting changes in crash coding over time, describing how cause codes are determined, and noting any known or suspected errors in the data.
5. Consider and investigate a new data-sharing approach to updating blood test results in crash records using test data provided by ESR instead of NZ Police. This would improve the accuracy and timeliness of updating blood alcohol data and simplify crash reporting processes for police officers.
6. Consider restricting the visibility of alcohol-related driver data for most CAS users, especially the raw blood and breath test results.
7. Consider removing the cause code ‘101’ (alcohol suspected) for crashes that occurred after the system update in 2016, given that this is coded against all drivers tested for alcohol regardless of whether alcohol was suspected.

8.2.2 Blood test data

8.2.2.1 How is data collected and how has this changed over time?

ESR is responsible for providing all forensic toxicology blood testing to NZ Police, including testing for the presence of alcohol and drugs. Blood samples are collected from deceased drivers by the coroner. They are taken by a medical officer from living drivers who are hospitalised after a crash, or if requested by the driver (either following a positive breath test or if a breath test is refused). Samples from living drivers are taken by a medical officer on behalf of NZ Police.

The process of collecting and processing blood samples does not appear to have changed over time. However, the number of evidential blood tests taken annually dropped by about half following the introduction of the 2014 Act. In addition to lowering the legal limit for drivers aged 20 and over, the 2014 Act also introduced a larger infringement fine ($700 as opposed to $200) for drivers who request a blood test following a breath screening test, if they are found to be within the lower tier of offence (exceeding 250 μg/l but not exceeding 400 μg/l). Police officers are required to inform drivers that this higher fee may be applied. It appears this change has discouraged drivers from electing a blood test after a failed breath screening test.

8.2.2.2 How is the data reported?

Blood test results for individual drivers involved in a crash are supplied by ESR to NZ Police and the coroner (if necessary). The results are used to determine whether alcohol was a factor in a crash and if an offence occurred. Evidential blood tests for drivers tested following a roadside stop are also supplied to NZ Police.

ESR issues monthly reports on blood tests results to be stored in a central database hosted by NZ Police. ESR also recently started issuing reports to the CAS team at Waka Kotahi, but it is not known if these are being used to update or correct individual crash reports.

The ESR blood test results are not publicly available or publicly reported in any form.

8.2.2.3 How robust is the data and what are the gaps?

ESR maintains two internal databases of blood sample test results, one for deceased and one for living individuals. Records identify whether the individual is a driver or other road user, and the living database further divides them into hospitalised and non-hospitalised drivers. The driver records were extracted from these datasets and provided to the project team for further analysis, as detailed in section 7.2.

General findings and limitations of the blood test data, based on the analysis in section 7.2, are as follows:

- Many fields are manually entered by ESR personnel, and obvious errors in crash date and time were identified as a result. The date and time received, however, is system generated and so more reliable. This timestamp is generally close to the crash date, because blood samples are legally required to be sent to ESR within seven days of being taken.
- The data in each database spans several different versions, and data fields are not necessarily the same across each version to the next.
- It is possible some records belong to passengers or other road users, like cyclists and pedestrians, because previous ESR analysis indicates some individuals may have been mislabelled.

Limitations specific to each dataset are described in Table 8.3 for deceased drivers and Table 8.4 for living drivers.

Institute of Environmental Science and Research fatal driver blood data

The ESR fatal driver database contains records for most drivers who have died after a crash since 2004, except for those where it was not possible to collect a blood sample or those who were living when their blood sample was submitted to ESR.

Table 8.3 Overview of Institute of Environmental Science and Research fatal driver blood results dataset

	Description
Period available	Available from July 2004 onwards.
Description	The data was provided in four separate datasets: • mid-2004 to mid-2008 • mid-2009 to 2012 • 2013 to 2018 • 2019 to 2020. Each dataset includes: • district or police station (varies by dataset) • date of crash (missing for mid-2009 to 2012) • time (missing for mid-2009 to 2012) • age • gender • blood alcohol result.
Limitations or gaps	• In some circumstances, it may not be possible to take blood from a deceased driver, for example, if the body was badly damaged due to fire. • The dataset does not include drivers who were hospitalised initially but died later. Any evidential blood sample taken from these drivers is recorded in the living driver database instead. • The dataset provided for the period July 2009 to December 2012 did not include sample or testing dates (affecting 648 records), so the data for this period has a gap, although values can be averaged across the period, as shown in Figure 7.2 and Figure 7.3.

Institute of Environmental Science and Research living driver blood data

The living driver dataset includes both hospitalised and non-hospitalised drivers:

- ‘Hospitalised drivers’ were hospitalised (and tested) after a crash.
- ‘Non-hospitalised drivers’ had an evidential blood test after refusing a breath test. This includes both drivers uninjured following a crash and drivers tested after being stopped by NZ Police for non-crash-related reasons.

Table 8.4 Overview of Institute of Environmental Science and Research living driver blood results dataset

Factor	Description
Period available	Available from July 2003 onwards.
Description	The data was provided in three separate datasets: • 2004 to 2010 • 2011 to November 2015 • December 2015 to June 2021. Each dataset includes: • district, city and/or police station (varies by dataset) • case or sample number (varies by dataset) • date and time received • date and time sampled • type of test (hospital, non-hospital) • driver date of birth (from December 2015 onwards) • blood alcohol result.
Limitations or gaps	• The driver's date of birth (which allows their age at the time of the crash to be calculated) was only provided in the December 2015 to June 2021 dataset. • For non-hospitalised drivers, there is no way of knowing whether the blood test was collected following a crash or from a driver who NZ Police suspected was drink driving. • The changes brought in by the 2014 Act discouraged non-hospitalised drivers from requesting an evidential blood test. This resulted in a large drop in non-hospitalised test results in the 0 mg/dl to 80 mg/dl range from 2015 onwards (Figure 7.5). A smaller, but noticeable, reduction occurred in test results of more than 80 mg/dl. Care therefore needs to be taken when interpreting test counts and results returned before and after this date.

8.2.2.4 How useful is this dataset and what are the opportunities to improve data collection and reporting?

The hospitalised driver dataset is much larger than the fatal driver dataset and provides for more robust analysis. Ideally, the fatal and hospitalised datasets would be combined for analysis, but the 2009 to 2012 gap in fatal crash dates prevented this.

Because the non-hospitalised driver dataset does not identify whether the driver was involved in a crash, it cannot be used to analyse the BAC of non-injured drivers. In addition, the analysis of the proportion of offenders charged by blood versus breath alcohol (Figure 7.12) shows that evidential blood tests make up a small percentage (10%) of total alcohol-impaired driving offences, therefore, the breath test data is more useful in understanding trends among drivers stopped by NZ Police.

Based on this assessment, the hospitalised driver blood results are the most useful blood dataset for understanding trends in BAC among injured drivers. As shown in Figure 8.1, the trend in the percentage of drivers with blood tests over the legal limit is similar to the percentage of alcohol-related DSIs (to total DSIs) over time.

A query of the CAS data between 2010 and 2020 indicates that seriously injured and minorly injured drivers make up 69% and 17%, respectively, of all drivers involved in fatal and serious crashes. Assuming blood samples from all seriously injured and most minorly injured drivers are tested at hospital, about 80% of all drivers involved in fatal or serious crashes could be represented. Based on this, it is recommended further research is undertaken to explore the potential use of ESR hospitalised driver data as an additional supporting indicator of alcohol-related crashes.

Overall, the alcohol blood results data is generally reliable. However, it could be improved through better integration of datasets across database versions.

8.2.3 Breath test data

8.2.3.1 How is data collected and how has this changed over time?

Most drivers are breath tested for alcohol after a crash. Drivers can also be tested for enforcement purposes either as part of RBT or MBT. Breath testing is a three-stage process:

1. *Passive test* – to determine the presence of alcohol in the driver's breath
2. *Screening test* – to determine the level of impairment against the lower and upper legal limits. If a driver tests within the infringement (lower) range, they are issued with an infringement.
3. *Evidential test* – if the screening test indicates the driver's breath is within the upper tier of offence, they are required to take an evidential test to confirm BrAC, and this can be used as evidence of an offence in court.

The devices used for breath testing at the roadside are either the Dräger Alcotest 6510 or the Dräger Alcotest 7510. Different types of devices dominated at different periods between 2010 to 2020.

The 6510 device was introduced in 2006 as the sole device for passive and screening tests, with evidential tests being performed on more sophisticated devices located at police stations or on MRSBs. This device has been phased out from about 2016 onwards, being replaced by the newer 7510 device, which in 2021, accounted for at least 90% of breath tests performed in New Zealand. The data from these testing devices is downloaded about once a year when the device is calibrated, but more frequent downloads are expected with the roll-out of new cradles.

The data generated from the 6510 and 7510 devices varies, as detailed in Table 8.5.

Table 8.5 Comparison of breath testing devices and data 2010 to 2020

	Dräger Alcotest 6510	Dräger Alcotest 7510
Period used	The sole device in use from 2006 to 2015. Phased out from about 2016, although devices are still in use	First introduced in 2015 and progressively rolled out, and now make up most of the devices in use
Description	Used for passive and screening breath testing of drivers at the roadside	Used for passive, screening and evidential breath testing of drivers at the roadside
Relevant data provided	• Number of tests performed (since last download)	• Police district • Date and time of test • Type of test (passive, screening, evidential) • Test location (GPS lat/long) • Test status: (dependent on test type, but could include 'valid', 'aborted' or some other type of error) • For passive tests: pass/fail • For screening tests: test class (pass, under 250, 250+ over, over 400) • For evidential tests: breath reading

	Dräger Alcotest 6510	Dräger Alcotest 7510
Limitations or gaps	• Only records the total number of tests performed (passive or screening) • Cannot distinguish between passive or screening tests • Cannot distinguish between valid versus aborted tests	• GPS coordinates may not accurately record the location and were missing in around 20% of passive tests analysed

8.2.3.2 How is the data reported?

NZ Police publishes total breath test counts in its annual reports, reporting every financial year against its internal performance standard. Its annual reports from 2015 onwards also include an indicator on the 'median breath alcohol for people caught exceeding the limit' for offences where an evidential breath test was undertaken. It is not clear what purpose this indicator serves. Enforcement activities are likely to have a disproportionate effect on low-level offending, whereas high-level offending can be more difficult to change because it can involve entrenched behaviour associated with heavy episodic drinking, recidivism and alcohol use disorders. It is therefore feasible that improvements in enforcement could result in the median BrAC measurement increasing as low-level offending falls away and high-level offending forms a greater proportion of the dataset. Intuitively, this measure is problematic, because a successful drink-driving programme is likely to prevent low-level offending more than high-level offending, meaning the median BrAC could increase even if enforcement is successful.

8.2.3.3 How robust is the data and what are the gaps?

Limitations specific to the data generated from each type of testing device are described in Table 8.5. General observations about the devices and this type of data include:

- It is impossible to determine whether a breath test was undertaken following a crash or as part of enforcement activity.
- Test data is downloaded annually from most devices, meaning a gap of up to a year can occur between when the test was taken and when the data for the test is downloaded and available for analysis. This means reported test counts lag actual test counts for a given reporting period. Gaps of up to two years were observed between test and download dates in the 7510 dataset provided by NZ Police.
- The roll-out of the 7510 device was phased and 6510 devices are still in use. Therefore, the additional data provided by the 7510 device does not provide the complete picture of breath testing in New Zealand, limiting the insights that can be drawn from the more detailed data it generates.

8.2.3.4 How useful is this dataset and what are the opportunities to improve data collection and reporting?

The 7510 devices provide a much richer data source on breath tests, compared with older devices, however, their incomplete roll-out and the time lag between test date and download date limit their current usefulness for understanding trends over time. Both these limitations should be minimised with the proposed roll-out of cradles, which improve download frequency, and as the older devices are completely phased out in coming years. The incomplete roll-out will also delay the possibility of future time-series analyses.

This data cannot be used to understand trends in alcohol-related crashes or injuries, because it is impossible to distinguish between roadside breath tests taken from drivers at a crash scene versus those taken as part of day-to-day enforcement activities. Breath test data is, however, the primary source of data for monitoring and is therefore a critical dataset for tracking the performance of NZ Police against agreed testing performance standards. Ample opportunities are available for further research into the potential use of the

7510 device data to improve reporting on enforcement activities, and for understanding the impact of breath testing in discouraging drink driving and therefore reducing alcohol-related road trauma.

8.2.4 Data on alcohol-related driving offences

8.2.4.1 How is data collected and how has this changed over time?

Both NZ Police and the Ministry of Justice collect and hold data relating to alcohol-related driving offences as part of the judicial process. This has not changed over time, although the range of offences and sentencing options reported depend on the legislation in place at the time the offence occurred.

Table 8.6 compares data collected by each agency.

Table 8.6 Comparison of alcohol-related driving offence data held by NZ Police and Ministry of Justice

	NZ Police	Ministry of Justice
Description	NZ Police collects data on charges and infringement notices generated for offences related to driving under the influence of alcohol	The Ministry of Justice collects data on ‘driving under the influence’ offences prosecuted through the courts, including charges, convictions and sentencing ‘Driving under the influence’ includes: • driving causing death (when under the influence of alcohol or drugs) • driving under the influence of alcohol or other substances • exceeding the prescribed content of alcohol or other substance limit
Data collected	• Number of alcohol-specific driving offences • Number of infringement notices and total monetary amount in infringement fees issued by: – region and Police district – alcohol limit (under 20 years of age and 20 years of age and over) • Number of proceedings by*: – Police district and police station – blood or breath – prescribed offending threshold (the limit exceeded or breach of alcohol interlock, zero alcohol licence) – repeat offending (third and subsequent offence) – offence description – offender gender – offender age band	For ‘driving under the influence’ charges: • charges by court and charge outcome • people charged: – by court and charge outcome – by gender, ethnicity and age group • people convicted: – by court and most serious offence – by number of previous convictions – by gender, ethnicity and age group For alcohol interlock orders: • people who received an alcohol interlock order, by gender, ethnicity and age group
Limitations or gaps	Offenders could be charged with more than one alcohol-related driving offence relating to a single event, although this is relatively rare (less than 1% of offences)	Charges and convictions for ‘driving under the influence’ do not distinguish between alcohol or drugs (other substances), so it is impossible to disaggregate alcohol- and drug-related offences

*Not publicly available, but made available to the project team in aggregated form.

8.2.4.2 How is the data reported?

Both NZ Police and the Ministry of Justice annually report statistics on alcohol-related or impaired driving offences. Detailed data on offences can be requested from NZ Police for research purposes.

8.2.4.3 How robust is the data and what are the gaps?

Data on offences is robust because it is generated from the legal system, which requires data to be collected to an evidential standard.

A review of the NZ Police alcohol-related offences data was undertaken in chapter 4 (using publicly available data) and chapter 7 (using more detailed data provided by NZ Police). Exploratory analysis included examining changes in offender types (age and gender) and is reported in section 8.1.3.

The following gaps or limitations were identified in NZ Police and Ministry of Justice data:

- NZ Police disaggregates alcohol-related offences from drug-related offences, whereas the Ministry of Justice combines these as 'driving under the influence' offences.
- The offences reported by NZ Police include infringements and charges, whereas the Ministry of Justice data only covers charges pursued through the courts (above the infringement level).
- Not all charges brought by NZ Police result in court proceedings, while others result in multiple proceedings. Therefore, the number of charges in the NZ Police dataset of offences will not match the number of charges documented by the Ministry of Justice.
- It is not possible to identify crash-related alcohol offences in either dataset because the offences listed may or may not be related to crash events.
- The Ministry of Justice reports on the ethnicity of offenders (in addition to age and gender), but ethnicity was not provided in the detailed Police dataset because it was not possible to disaggregate ethnicity data to the level requested.

8.2.4.4 How useful are these datasets and what are the opportunities to improve data collection and reporting?

Offence data is not directly linked to alcohol-related crashes, although some offences would have arisen because of a crash.

Both the data available from NZ Police and the Ministry of Justice are valuable to aid understanding of alcohol-related driving offences, though they approach the issue from different perspectives. For example, the NZ Police data is better for understanding total alcohol-related offences (charges and infringement notices), whereas the Ministry of Justice provides data on sentencing and alcohol interlock orders.

Further analysis of these datasets could be undertaken to compare data on alcohol-related driving offenders against data on drivers involved in alcohol-related crashes (in CAS). This could indicate, for example, whether enforcement activities are targeting the types of drivers (age and gender) typically involved in fatal and serious alcohol-related crashes.

8.2.5 Other alcohol-related driving and injury data

ACC collects data on claims and claimants for injury resulting from a crash. Data on the claimant (such as ethnicity, age and gender) and the severity of the injury (in terms of treatment costs and entitlements) is generally better quality than that provided in CAS, because in CAS, these are based on judgements made by the police officer completing the TCR. Demographic information against ACC claims is self-reported, and the final cost and duration of treatment can be a better indicator of the severity of injury (see section 3.3).

While ACC claims data can be used to identify crash-related injuries, it cannot be used to determine whether alcohol was a factor in the crash. ACC can link claims data to crashes in CAS, relying on the alcohol coding in CAS to determine if the crash was alcohol related. Provided the alcohol-related data in CAS is accurate (which, as noted, is not always the case), this data can be used to enrich the crash data. For example, it has been used previously to quantify the health-related cost of alcohol-related crashes at a regional level (Helen Clark Foundation, 2021).

At the time of writing, ACC is also investigating a possible alcohol 'flag' attached to emergency department admissions that can be matched to ACC claims through the Stats NZ IDI.

8.3 Why has alcohol-related crash trauma in New Zealand not decreased when blood alcohol limits have reduced?

Road safety policy makers and researchers have observed that alcohol-related road DSIs did not reduce following the reduction of alcohol drink-driving limits for drivers aged 20 and over in December 2014. In fact, a considerable and immediate increase occurred following this change.

This research project explored this issue by:

- Reviewing alcohol-related crash data and identifying trends in alcohol-related DSIs between 2010 and 2020.
- Identifying and investigating factors related to drinking driving and alcohol-related crashes.

As the project progressed, and with support and feedback from the project steering group, the researchers focused on:

- Investigating the quality of alcohol-related crash data, to determine if changes in data collection processes have affected the number of alcohol-related DSIs being reported.
- Investigating how self-reported alcohol consumption patterns and drink-driving behaviour have changed over time.
- Examining whether the penalties for alcohol-related driving offences are effective enough to change driver behaviour, particularly for the lower tier of offence (51 mg/dl to 80 mg/dl BAC and 251 µg/l to 400 µg/l BrAC) that was introduced in December 2014.
- Reviewing trends in NZ Police enforcement practices.

This section summarises the research findings across these focus areas.

8.3.1 Quality of alcohol-related crash data

If the intention of reducing the alcohol limits in December 2014 was to reduce alcohol-related DSIs by discouraging drink driving, this was not the change observed in the data. As summarised in section 8.1.2, the percentage of reported DSIs from crashes involving alcohol trended downwards from 2008 to 2014, increased between 2014 to 2017, then fluctuated between 2017 and 2020. One possible explanation for this 'unexpected' trend is that the alcohol-related crash data is either incorrect or incomparable between different years due to changes in crash data collection and reporting processes.

Section 8.2.1 summarises how alcohol-related crash data is collected, processed and reported, including the changes that occurred between 2010 and 2020. This identified concerns about the quality of alcohol-related crash data, in particular:

1. From late-2018 onwards: two separate data errors appeared that simultaneously over-estimate and under-estimate the number of alcohol-impaired drivers. This is due to a large increase in drivers with an alcohol breath test result 'breath refused', coupled with a large increase in the number of drivers with

‘blood pending’ where the involvement of alcohol remains underdetermined. An evaluation of the impact of these errors in sections 7.3.1 and 7.3.2 suggests the errors are considerable, and so alcohol-related crash data from late 2018 onwards is unreliable.

2. When the legal alcohol limit changed, it appears the coding of drivers with an alcohol test above the limit (cause code ‘103’) or below the limit (cause code ‘102’) also changed. Drivers coded below the limit before the change would be coded above the limit after the change, if the level of offending fell within the lower tier of offence for over-20-year-olds (51 mg/dl to 80 mg/dl BAC or 251 µg/l to 400 µg/l BrAC). While this error was not assessed in depth, it indicates that alcohol-related crashes and injuries reported after December 2014 will be over-reported when compared with the period before December 2014.

As described in section 8.1.2, blood results from ESR were used to calculate the percentage of hospitalised drivers with a BAC of more than 50 mg/dl over time. The analysis results (Figure 8.1) show an almost continuous and steady reduction in the percentage of alcohol-impaired hospitalised drivers between 2010 and 2020. The steepest reduction occurred between 2014 and 2016, which is either side of the date the lower limits for drivers 20 years and older were introduced. Assessment of this data found that, despite minor data entry errors, it is usable and reliable, and much more reliable than the alcohol-related crash data from 2018 onwards.

Using a BAC of 50 mg/dl as a threshold for assessing alcohol impairment, if the number of hospitalised drivers with a BAC of more 50 mg/dl is decreasing (proportionally) this suggests the number of serious alcohol-related crashes and injuries is also decreasing, especially because seriously injured drivers represent nearly 69% of all DSIs, and hospitalised drivers could account for nearly 80% of all drivers involved in fatal or serious crashes.

The original research question ‘why has alcohol-related crash trauma in New Zealand not decreased when blood alcohol limits have reduced?’ presumes that alcohol-related road trauma increased following the introduction of the lower limit in December 2014, but analysis has confirmed this is not likely to be the case. Based on hospitalised driver blood results, and considering the issues with the quality of alcohol-related crash data (particularly late 2018 onwards), it is possible the proportion of alcohol-related fatal and serious crashes did reduce after the change in alcohol limit, despite the alcohol-related crash data indicating otherwise. It is not known, however, to what extent the changes observed in the hospitalised driver blood data can be attributed to the reduced alcohol limits. The errors in the crash data need urgent fixing to see whether the trends observed in the hospitalised driver blood results are born out in the corrected crash data.

Walton et al. (2020) determined that alcohol was one of the primary contributors to the increase in New Zealand’s road toll between 2013 and 2017. However, this was based on CAS data that may have included crashes incorrectly coded as alcohol related. While alcohol may not be as significant a contributor as suggested by this research, it remains that the rate of annual road fatalities did increase from 2013 to 2017, though has since reduced. If the underlying CAS data-quality issues can be improved, it may be worth repeating the study to see if different conclusions emerge.

8.3.2 Alcohol consumption patterns and drink-driving behaviour

As noted in section 8.1.4, the percentage of licensed drivers who reported driving while slightly intoxicated in the past 12 months dropped 6% between 2016 and 2020. Although the findings from the 2020 survey could have been affected by the nationwide COVID-19 lockdown in early 2020, this suggests that rates of low-level drink driving have reduced and not increased over this period. It is unclear from the report *Public Attitudes to Road Safety* (Waka Kotahi, 2020a) if rates of drink driving while heavily intoxicated have changed over this time.

The literature suggests that people with drinking problems or evidence of alcohol abuse are more likely to be involved in crashes (Fell et al., 2010; Shinar, 2017), and that problem drinking is closely correlated with BAC in drivers killed in crashes (Baker et al., 2002). The findings from the NZHS over the past 5 to10 years indicate a slight increase in adult past-year drinkers between 2014/15 and 2019/20, but no observed change in the amount of hazardous drinking overall (as discussed in section 5.1). Considering the findings from both the NZHS and in the literature, it is reasonable to conclude that rates of more hazardous drink-driving behaviour have not changed significantly between 2015 and 2020.

In summary, a significant change does not seem to have occurred in adult drinking patterns and drink-driving behaviour. Further analysis of changes in public attitudes to drink driving before the December 2014 change in limits could, however, help understand how the legislative changes affected people's driving behaviour and attitudes. It may be that behaviour and attitudes were already changing before the change in the legislation, particularly because it followed the earlier introduction of zero alcohol limits for drivers under the age of 20. Further analysis could also be undertaken to examine changes in alcohol consumption among different population sub-groups.

8.3.3 Legislation: blood alcohol concentration thresholds and penalties for alcohol-related offences

New Zealand's BAC threshold for the general population matches the WHO best practice threshold at 50 mg/dl and is better than the WHO threshold for young / novice drivers of 30 mg/dl (WHO, 2018b).

Internationally, the literature review found that lowering the legal BAC limit resulted in significant reductions in alcohol-related crashes and fatalities in many jurisdictions, although this trend was not observed in some countries, for example, when Scotland reduced the BAC limit from 80 mg/dl to 50 mg/dl in 2014, and when Denmark reduced its limit in the same way in 1998. This suggests while reducing alcohol limits can result in fewer alcohol-related road deaths, it is not guaranteed and other factors exist that could reduce the impact of this intervention.

Fines for lower-level offences are lower in New Zealand compared with the other countries examined (except potentially in countries where fines are linked to income and ability to pay). New Zealand is also less likely to disqualify drivers for similar lower tier first offences, using demerit points as a deterrent instead of immediate disqualification.

The literature reviewed suggests fines do not have a strong deterrent effect and that disqualification periods are a more effective short-term countermeasure. Therefore, current penalties could potentially be strengthened (fines and demerit points for lower-tier offences) to increase the deterrent effect.

8.3.4 Enforcement

Two New Zealand sources (Howard, 2021; Walton et al., 2020) suggest that changes in drink-driving enforcement could be a reason why alcohol-related crash rates have not reduced as expected. However, because errors identified in the crash data make it difficult or impossible to compare alcohol-related crash trends from before and after the change in legal limits, this conclusion could be incorrect, or at least should be reviewed.

Regardless, as described in section 8.1.3, breath testing and offences data can be analysed to identify general trends in enforcement activity. This analysis identified two notable changes in enforcement processes around the time the alcohol limits were reduced for drivers aged 20 and over:

- The number of breath tests performed annually reduced from around 3 million tests per year between 2009/10 and 2014/15 to around 1.5 million per year between 2015/16 and 2020/21. This also aligns with a reduction in NZ Police's performance standard for breath testing from 2016/17 onwards, explained as part of a strategy of increased ‘targeting to risk’. This strategy has been successful for offence detection, with the number of drinking offences remaining relatively constant at 25,000 per year annually between 2015/16 to 2020/21, despite the reduction in the number of breath tests being performed.

- NZ Police achieved its minimum performance standard for breath tests every year between 2009/10 and 2013/14 but failed to meet this standard in five out of seven of the following years (2014/15 to 2020/21). This suggests breath testing has been under-resourced in recent years and supports the perceptions reported by Walton et al. (2020) and Howard (2021).

New Zealand’s current RBT rate (0.33 tests per capita) is lower than Victoria (0.38 tests per capita) and New South Wales, Australia (0.57 tests per capita), but is higher than two other comparable international jurisdictions where RBT rates are reported (Ireland and Finland).

The *Road to Zero Action Plan 2020–2022* (Ministry of Transport, 2019b) includes an action to ‘prioritise road policing’, including prioritising monitoring, evaluation and reporting over the three-year period. The action plan set an intervention target of 2 million breath tests in 2019/20 increasing to 3 million breath tests in 2020/21. Neither target was achieved, but this could be attributable to periods during the COVID-19 pandemic where RBT was paused for health and safety reasons.

Overall, the current enforcement strategy has been effective at increasing the offence detection rate, but it is difficult judge whether the current enforcement strategy is being effective in reducing alcohol-related DSIs. The failure to meet RBT targets in recent years suggests RBT has been under funded or not prioritised.

8.3.4.1 Monitoring and reporting of alcohol-impaired driving enforcement

The primary indicator used by NZ Police for publicly reporting on enforcement activities is the number of breath tests per calendar year. As summarised in section 8.2.3, breath test counts are reported based on when they were downloaded from devices rather than when they were administered. NZ Police endeavours to download test records from individual breath testing devices annually, although analysis of these records showed gaps of up to two years between test dates and the data download date. This means reported test numbers can be drawn from various times over the previous two years, which erodes the data’s effectiveness at accurately reflecting trends.

Both the Controller and Auditor-General (2013; 2015) and Howard (2021) assert that NZ Police needs to improve its assessment and reporting of alcohol-related road safety enforcement activities. Improved monitoring and reporting would enable shortfalls in enforcement activity to be prioritised and more quickly addressed.

Howard (2021) suggests the following additional indicators should be monitored and reported monthly:

- Percentage of annual RBT target achieved by month.
- Monthly targeted and actual general deterrence RBTs (by MRSB and mobile car operations) and specific deterrence RBTs by mobile car operations to be deployed in high-alcohol hours.
- Monthly actual general deterrence RBTs (by MRSB and mobile car operations) and specific deterrence RBTs by mobile car operations to be deployed in high-alcohol hours.

Monthly RBT targets and reporting would allow enforcement trends to be assessed more effectively than was possible at the time of writing. It would enable test numbers to be monitored throughout the year to ensure consistent enforcement across each district and allow projected shortfalls to be identified and addressed. For NZ Police to be able to report on these indicators, breath testing data would need to be downloaded more frequently from the Dräger Alcotest devices. This would require the roll-out of hardware (cradles) and supporting systems for data collection and aggregation. The full roll-out of the 7510 devices would need to be achieved and the old 6510 devices fully withdrawn, thereby establishing a complete dataset. Classifying RBT by MRSB versus mobile car operations is also desirable but cannot be determined from current breath test datasets. Further research into improving the collection of breath testing data and methods for tracking different types of enforcement activities is recommended.

9 Conclusions and recommendations

The purpose of this research was to examine how ‘fit for purpose’ alcohol-related crash data is and to study trends in such crashes over the past 10 years and their connection with other factors and datasets. The research objectives were to:

- review relevant international literature
- identify significant attitudinal and behavioural factors related to alcohol and crashes
- identify existing and potential forms and sources of alcohol-related crash data and describe their fitness for purpose
- explain the strengths and limitations of the New Zealand data and what can legitimately be inferred from it, including what new data and testing may be required
- examine trends in crashes where alcohol was identified as a factor and explore the relationship between these trends and other relevant changes that occurred in New Zealand over the same period
- make recommendations regarding new approaches to data collection, combination, analysis and use.

This research project addressed the objectives by:

1. Reviewing New Zealand, Australian and international literature to identify data collection and reporting practices and factors that contribute to alcohol-related crashes. This included reviewing data collection methods, alcohol-related crash trends and enforcement practices among comparable international jurisdictions.
2. Engaging with stakeholders from relevant New Zealand agencies and organisations to understand how alcohol-related crash and drink-driving enforcement data is collected and how this has changed over time. The stakeholders also helped the research team identify other potential sources of alcohol-related crash and enforcement data and provided insights into current crash trends and drink-driving behaviour.
3. Undertaking exploratory analysis of selected datasets made available to the project team, as well as further investigation into the coding of alcohol-related crashes in CAS. This helped establish the usefulness and limitations of the data available for understanding trends in drink driving and alcohol-related road trauma, focusing on trends observed over 2010 to 2020

The research addressed a knowledge gap around recent trends in alcohol-related crashes and what insights the underlying data can reveal. A particular focus was on exploring alcohol-related crash trends following the change in legislation reducing alcohol limits for drivers aged 20 years and over in 2014.

Findings across the three stages were collated in chapter 8, where many conclusions and recommendations are identified. This section focuses on the more important significant conclusions and recommendations requiring action.

The last major change in drink-driving legislation occurred in December 2014, dropping the alcohol limit for drivers aged 20 and over to 50 mg/dl, in line with international best practice. It was expected that the rates of alcohol-related DSI would continue to decrease after the legislative change, but this was not observed in the crash data. The proportion of alcohol-related DSI as a proportion of total DSI (as reported from CAS) dropped steadily between 2010 and 2014, but then increased between 2014 and 2016 and fluctuated considerably from 2017 to 2020. Either the reduced alcohol limits were not effective at reducing alcohol-related DSI, or a change occurred in how alcohol-related crash data was collected and reported that made it impossible to compare crash data between periods.

New Zealand is good at testing drivers for alcohol after a crash occurs, when compared with other jurisdictions. However, errors and inconsistencies occur in how this data is reported in CAS. Two significant errors detected in the CAS data from late 2018 onwards resulted in the two main alcohol-related cause codes being inaccurate for many drivers (‘102’ (alcohol test below limit) and ‘103’ (alcohol tests above limit or test refused)). These alcohol cause codes cannot currently be used for reporting alcohol-related crashes and injuries. Additionally, the change in the alcohol limit itself affected the coding of drivers as ‘above’ or ‘below’ the limit, meaning the coding of drivers before and after the change in alcohol limit is not directly comparable.

Several reasons for errors in the CAS data were identified from discussions with stakeholders and by reviewing the alcohol-related crash data. These errors are discussed extensively in section 8.2.1 and include human data entry errors, application design issues, and system updates affecting how data is translated between the NZ Police TCR application and the Waka Kotahi CAS system.

A dataset of blood test results for drivers provided by ESR was analysed to investigate trends in the BAC of drivers whose blood was tested after a crash or for enforcement purposes. The hospitalised driver dataset captures the BAC of an estimated 80% of drivers involved in fatal and serious crashes. Analysis of this data showed the percentage of hospitalised drivers with a BAC over 50 mg/dl decreased overall between 2014 and 2020, indicating the proportion of fatal and serious crashes with alcohol as a cause factor has continued to reduce since the change in alcohol limit, despite crash data suggesting the reverse trend occurred.

The project also explored trends in breath testing and enforcement activity to determine what impact changes in enforcement practices could have had on the effectiveness of the new alcohol limits. Around 2016 onwards, NZ Police was more targeted in its enforcement strategy, resulting in fewer breath tests being undertaken while the number of offences being detected annually remained relatively steady.

NZ Police reduced its performance standard (KPI) for breath tests to align with this strategy, however, it failed to meet the minimum performance standard in five of the seven years between 2014/15 and 2020/21 (noting that the impact of the COVID-19 pandemic reduced breath testing activity in 2019/20 and 2020/21). While the change in enforcement strategy was effective at increasing the offence detection rate, it is difficult to judge whether the current enforcement strategy is being effective in reducing alcohol-related DSIs. The failure to meet RBT targets in recent years suggests RBT has been under funded or not prioritised.

While breath test counts are a core measure of impaired-driving enforcement activities, newer breath testing devices (the Dräger Alcotest 7510) rolled out from about 2015 onwards can provide much richer information on breath testing activity, including date and time stamps, location coordinates, test results and the type of test performed. Once the roll-out of these devices is complete, and with hardware in place to enable more frequent data download, data generated from the 7510 devices will offer new opportunities for analysing and reporting more frequently on enforcement activities. This will help NZ Police in targeting high-risk drivers, locations and time periods. It will also allow more frequent reporting of testing counts so that under-performance against test targets can be more readily detected and corrected.

As part of the international comparison and literature review, the research also investigated how New Zealand’s alcohol limits and penalties compare with similar jurisdictions, and against best practice. It was found that the current penalties, particularly for lower level first offences, may not have had a strong deterrent effect, potentially diluting the impact of reducing the alcohol limit for drivers aged over 20.

In summary, this research project reinforced the importance of high-quality alcohol-related crash data to inform decision making, strategies and tactics aimed at reducing alcohol-related road trauma. Several alcohol-related crash datasets and enforcement datasets were identified and reviewed, responding to the knowledge gap around recent trends in alcohol-related crashes. It is anticipated this will give researchers and policy makers an improved understanding of these datasets and inspire further research into the relationship between legislation, enforcement and alcohol-related crash trauma.

9.1 Recommendations

Recommendations to improve the collection and reporting of alcohol-related crash and enforcement data are as follows:

- Review the NZ Police TCR application to identify improvements in the user interface that would improve the quality and accuracy of alcohol-related crash data collection by police officers.
- Improve the training of police officers in the completion of TCRs, highlighting the importance of accurate and reliable crash data and how this is used by other agencies.
- Investigate the root cause of the driver ‘breath refused’ and ‘blood pending’ errors observed from late 2018 onwards. This should include reviewing data translation and data validation processes. Efforts should focus on quantifying and correcting these errors (and the affected crash and driver data) so confidence in the quality of alcohol-related crash data from late 2018 is restored.
- Develop metadata for CAS users on the interpretation of alcohol-related data, including documenting changes in crash coding over time, describing how cause codes are determined, and noting any known or suspected errors in the data.
- Consider and investigate a new data-sharing approach to updating blood test results in crash records using test data provided to Waka Kotahi by ESR instead of NZ Police. This would improve the accuracy and timeliness of updating blood alcohol data and simplify crash reporting processes for police officers.
- Review the visibility of alcohol-related driver data in CAS against privacy legislation and determine whether some data should be further restricted, especially the raw blood and breath test results.
- Consider removing the cause code ‘101’ (alcohol suspected) for crashes that occurred after the system update in 2016, given this is coded against all drivers tested for alcohol regardless of whether it was suspected.
- Support measures by NZ Police to improve the frequency of downloading and reporting breath test counts and undertake further investigation into how additional measures, such as RBT by MRSB versus mobile car operations, are quantified and reported.
- Support NZ Police in continuing to attend non-injury crashes, to maximise the completeness of the CAS data.
- Consider cleaning erroneous sample dates and other human errors in the ESR datasets to improve data analysis.
- Investigate the reasons behind the decreasing number of annual breath tests administered by NZ Police and why targets have not generally been met in recent years. Waka Kotahi and NZ Police should work together to develop an approach that meets New Zealand’s road safety goals and is achievable for NZ Police.

It is noted that some of these recommendations could also be applied to drug-related data collection, given this involves a similar process for testing drivers and reporting test results.

Potential areas for future research are as follows:

- Undertake further analysis of the NZ Police detailed data on breath testing (date, time and location of tests) and detailed offences data (age and gender of offenders), to investigate the degree to which enforcement activities are targeting high-risk locations as well as drivers who are most at risk of being involved in an alcohol-related crash. This would also provide further evidence of high-alcohol hours in New Zealand and how targeting of enforcement activities could be improved.

- Undertake further research into longer term trends on self-reported attitudes to drink driving and the perception of enforcement (before 2016), to better understand how attitudes and perceptions shifted around 2014 to 2016 when the legal alcohol limits were reduced.
- Support ongoing efforts by ACC to investigate the usefulness of a possible emergency department 'alcohol' flag in the Stats NZ IDI.
- Undertake further research into best practice around alcohol limits, drink-driving penalties and driver licensing, to determine whether further legislative changes should be recommended.
- Undertake further research into analysis of breath test data from the 7510 devices, to identify RBT checkpoints. This data could then be used to evaluate the effectiveness of checkpoints by location and time of day, enabling better targeting of future checkpoints.
- Identify and review previous New Zealand research that has used CAS data coding for 'alcohol suspected', 'breath refused' and 'blood pending', to determine whether their conclusions might be affected if corrected CAS data was used.

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Appendix A: Alcohol-related data and report sources

All the publicly available datasets in New Zealand identified in this report, are summarised below.

Dataset or report	Source	Type or format	Update frequency	URL
Public attitudes to Road Safety	Ministry of Transport	Report and tables	Annually from 2020	https://www.nzta.govt.nz/resources/public-attitudes-to-road-safety/
		Tables	Annually until 2016	https://www.transport.govt.nz/assets/Uploads/Report/PublicAttitudesToRoadSafetySurvey.zip
Crash analysis system (CAS)	Waka Kotahi	Crash database and web application	Current, although fatal and injury crashes more up-to-date than non-injury crashes	https://nzta.govt.nz/safety/partners/crash-analysis-system/
Safety – annual statistics (alcohol and drugs)	Ministry of Transport	Online dashboard (Tableau dashboards with download options)	Web dashboards updated annually (from 2017)	https://www.transport.govt.nz/statistics-and-insights/safety-annual-statistics/sheet/alcohol-Puand-drugs
Road safety outcome reports	Waka Kotahi	Spreadsheet	Quarterly until 2019, then one additional report in 2020 (superseded by the Ministry of Transport safety – annual statistics	https://www.nzta.govt.nz/resources/road-safety-outcomes/
Reported annual breath test counts	NZ Police	KPI in Annual Report	Annually	https://www.police.govt.nz/about-us/publications/corporate/annual-report
Reported median breath alcohol for drivers caught exceeding the limit	NZ Police	KPI in Annual Report	Annually from 2015	https://www.police.govt.nz/about-us/publications/corporate/annual-report
Road policing driver offence data (alcohol and drug offence data)	NZ Police	Tables	Updated quarterly from 2009	https://www.police.govt.nz/about-us/publication/road-policing-driver-offence-data-january-2009-september-2021
Driving under the influence charges and offences	Ministry of Justice	Tables	Quarterly	https://www.justice.govt.nz/justice-sector-policy/research-data/justice-statistics/data-tables/

Dataset or report	Source	Type or format	Update frequency	URL
NZ Health Survey (NZHS)	Ministry of Health	Data explorer (dashboards with data download options)	Annual since 2011	About: https://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/surveys/new-zealand-health-survey Annual Data Explorer (2020–2021): https://minhealthnz.shinyapps.io/nz-health-survey-2020-21-annual-data-explore
Hospitalisations and mortality wholly attributable to alcohol	Ministry of Health (National Minimum Dataset)	Healthspace dashboards (alcohol-related harm)	Last updated 2018	https://healthspace.ac.nz/health-topics/alcohol-related-harm Note the underlying data is sourced from Ministry of Health, but was analysed for visualisation on the Healthspace website by Environmental Health Intelligence New Zealand at Massey University
Alcohol available for consumption	Statistics New Zealand	Data downloads via the Stats NZ Infoshare website	Annually	http://infoshare.stats.govt.nz/ (Under 'Industry sectors')
Alcohol affordability index	Health Promotion Agency	Reported within the Trends in affordability of alcohol report	One-off, issued in 2018	https://www.hpa.org.nz/research-library/research-publications/trends-in-affordability-of-alcohol-in-new-zealand
Register of alcohol licences	Ministry of Justice	Table	Updated regularly (at least quarterly)	https://www.justice.govt.nz/tribunals/arla/register-of-licences-and-certificates/

Appendix B: Banding (aggregation) schema of alcohol-related data for data analysis stage

<table>
<tr><th>Data attribute</th><th colspan="2">Banding</th></tr>
<tr><td>Date</td><td colspan="2">• Calendar year
• Month and quarter
• Day of week</td></tr>
<tr><td>Time</td><td colspan="2">Three-hourly: 0000 to 0259 through 2100 to 2359</td></tr>
<tr><td>Age</td><td colspan="2">• 19 years and under
• 20–24 through 60–64
• 65 years and over</td></tr>
<tr><td>Ethnicity (where available)</td><td colspan="2">• NZ European
• Māori
• Pacific peoples
• Asian
• Other</td></tr>
<tr><td>Alcohol concentration</td><td>Blood alcohol (mgs per 100ml)
• 0–30
• 31–50
• 51–80
• 81–100
• 101–120
• 121–140
• 141–160
• 161–180
• 181–200
• 201–240
• 241+</td><td>Breath alcohol (µg per 1L breath)
• 0–150
• 151–250
• 251–400
• 401–500
• 501–600
• 601–700
• 701–800
• 801–900
• 901–1000
• 1001–1200
• 1201+</td></tr>
</table>

Appendix C: Best practice in drink-driving enforcement

While undertaking the research report, the research team identified material relating to best practice in drink-driving enforcement. Because this is tangential to the purpose of the report, it has been summarised here.

C.1 Context

The Global Road Safety Partnership[22] identifies six pillars for reducing alcohol-related crashes in its *Drinking and Driving* road safety manual for decision-makers and practitioners (2007):

1. Strong political commitment to prevent drink driving.
2. Legislation clearly identifying illegal driving blood alcohol concentration levels and penalties for drink driving offences.
3. Implementation of good practice.
4. Strong and well-publicised enforcement campaigns.
5. Public education to change attitudes to drinking and driving.
6. Strict and swiftly enforced penalties for those breaking the law.

It summarises these by stating that ‘the public must know why drinking and driving is both unsafe and anti-social, be aware that there are laws in place, perceive a high risk of being caught if they break the law, and know that if they are caught, there will be a heavy price to pay’ (p. 18).

C.2 Random breath testing

Over the past decade, a large amount of research was undertaken in several Australian states to identify methods of improving enforcement of drink-driving laws. The recommendations from this research focus primarily on expanding random breath testing (RBT) as the most effective method of deterring drink-driving behaviour. Many recommend that enforcement should be targeted to focus on ‘high-alcohol’ times, which do not have a consistent definition in the literature but generally include 6 pm to 6 am on weekdays but starting earlier in the afternoon and ending slightly later in the morning over the weekend.

The Australian Institute of Criminology recommended in Terer and Brown (2014) that RBT should be used to breath test a higher proportion of drivers every year, though it could not specify what proportion exactly should be targeted. The report suggests strategic deployment for cost efficiency and the use of smaller RBT units that can be easily relocated for use in rural areas and for preventing avoidance of checkpoints by using back roads. RBT checkpoints should be viewed as an opportunity for NZ Police to improve the public’s satisfaction by using a script that is oriented towards procedural justice (eg fairness). The report also suggests that publicity campaigns should be coordinated with RBT enforcement, and in rural areas they should be oriented towards influencing the decision to drive to establishments that serve alcohol in the first place. In terms of penalties, it is suggested that licence disqualification needs to be consistently applied and that ignition interlock use should be increased amongst repeat offenders.

[22] The Global Road Safety Partnership is an organisation hosted by the International Federation of Red Cross and Red Crescent Societies that helps national governments and international non-governmental organisations to work together on road safety.

In Victoria, New South Wales, Newstead et al. (2020) demonstrated similar findings, suggesting that alcohol enforcement should deliver a large number of tests from RBT. Testing should be targeted to areas where alcohol has been found to be a frequent factor in crashes or frequently identified in previous testing of drivers. In South Australia, Wundersitz and Woolley (2008) recommend the combination of RBT and mobile breath testing as being the most effective. In rural areas, mobile breath testing is recommended as the most effective form of enforcement. It is suggested RBT is effective when operated early in the evening (6 pm to 10 pm) to discourage drink driving altogether, and later in the evening (midnight to 2 am) to target when most drink driving occurs. The research also recommends increasing testing on a per capita basis and coordinating enforcement activities with mass media campaigns.

Howard (2021) suggests good enforcement practice for deterrence at roughly one test per licensed driver or rider in a jurisdiction. Enforcement activities should include both general and specific deterrence but focus mostly on the general deterrence aspects (primarily through highly visible checkpoints accompanied by publicity campaigns).

Best practice research shows a common theme of high enforcement levels going hand-in-hand with extensive advertising campaigns. However, not all advertising is equal (Shinar, 2017). All drink-driving advertising focuses on either delivering information about the legal consequences of drink driving or on the personal health consequences. To be effective, however, advertising cannot only inform but must also be aimed at changing driver attitudes to drink driving. This can be less straightforward, especially when media campaigns end up being poorly designed due to a lack of expertise and shortage of funding. Advertising around drink driving faces several challenges. It needs to be heard amongst all the other information already being delivered to the public, and then somehow change attitudes and behaviour. For every person who has seen the message, fewer will remember it, and amongst those, fewer will change their behaviour. By pursuing effective advertising alongside appropriate levels of enforcement, the likelihood of actual behavioural change is increased.

Compulsory breath testing is the most visible type of drink-driving enforcement for the public. Its high visibility increases the perceived risk of being caught. Evidence suggests it is effective at reducing crashes and deaths and serious injuries, with a 50% increase in breath tests resulting in a reduction of fatalities and fatal crashes of 3% to 4.5% (Ministry of Justice, 2017a). Its efficacy, however, is maximised when combined with other approaches, including education and public information campaigns. As noted by Shinar (2017), enforcement in the absence of media and other motivational approaches only changes behaviour and not attitudes. Evidence indicates that compulsory breath testing is less effective at deterring recidivism because these drivers are less responsive to drink-driving countermeasures than the general population (Ministry of Justice, 2017a).

C.3 Penalties

Penalties should deter people from driving when their blood alcohol level is above the legal limit. The deterrence theory behind this is pervasive in New Zealand and international law. The theory operates on the presumption that offending behaviour will decrease as the certainty of apprehension, severity of punishment, and swiftness of punishment increase (Freeman et al., 2016). This is considered to work on two levels. First, the effect on the overall population, referred to as ‘general deterrence’, depends on well-publicised consequences for drink driving and visible enforcement. Penalties therefore have a role in preventing drink driving in people who would otherwise drink drive if no regulations were in place preventing it. Because the public expects serious offences like drink driving to be subject to a proportional level of punishment, penalties are also essential for maintaining public trust in the justice system.

The second goal of deterrence theory is ‘specific deterrence’, which aims to prevent offenders from repeating the behaviour. The studies into personality traits of drink drivers, and particularly recidivist ones, however, suggest many may be less affected by more severe penalties than others. The perception of the risk of being caught and severity of punishment are subjective judgements that will be assessed differently, depending on the individual. The research shows that the relationship between the perceived penalty severity and self-reported offending behaviour is low. The best predictor of future drink driving in offenders is a history of drink driving. For those who have underlying drinking problems, penalties for offences may not provide the needed motivation and treatment to change their habits. Current penalty regimes may not be addressing the underlying causes of offending behaviour (Freeman et al., 2006).

C.4 Fines

All drink-driving offences in New Zealand include the possibility of a fine being levied. At the low end of the scale, infringement fees are set by the Land Transport Act 1998 at $200, while the courts have the option of imposing fines of thousands of dollars for more serious offences. Internationally, this situation is hardly unusual. Fines represent the most used criminal sanction in Australia and the United Kingdom and are even more common where traffic and motor vehicle regulatory offences are concerned (Weatherburn & Moffatt, 2011).

Despite fines being so common, the evidence does not suggest they have a strong deterrent effect. In a study in New South Wales across all types of driving offences, Moffatt and Poynton (2007) found little evidence of marginal deterrent effects from court-imposed fines on offenders and that the most consistent predictors of reoffending were individual attributes of drivers. Weatherburn and Moffatt (2011) looked specifically at drink driving and found no significant deterrent effect from higher fines across a substantial variation in the amounts imposed by magistrates. This is supported by research in the United States of America, where Wagenaar et al. (2007) found that only six out of twenty-six states that implemented mandatory minimum fine policies showed a significant decrease in single-vehicle night-time crashes, which are the most likely type of crash to be alcohol related. The study concludes ‘some, but not strong evidence’ exists that fines either alone or in combination with other sanctions deter drink driving and reduce the occurrence of fatal crashes.

C.5 Licence disqualification

Conversely, licence disqualification periods are a highly effective short-term countermeasure against drink driving. In Australia, they have been effective at reducing crash and offence rates during the disqualification period by nearly two-thirds (Siskind, 1996; Watson et al., 2017). Disqualification shows positive effects across all age groups and genders, for first-time and repeat offenders, and for low- and high-range blood alcohol concentration offences. Siskind (1996) finds that offending rates drop as drivers get further into the disqualification period, though Watson et al. (2017) also highlight the swiftness of punishment as being an important factor in achieving a maximal deterrent effect. This is supported by work in the United States of America suggesting the effectiveness of licence suspension or disqualification is more strongly affected by the speed at which the punishment is applied rather than its severity (Wagenaar & Maldonado-Molina, 2007).

The study by Watson et al. (2017) found the influence of licence disqualification extends beyond the disqualification period, though this effect is less than that observed while under disqualification and it is unclear how long the effect would last.

C.6 Alcohol ignition interlocks

Alcohol ignition interlocks are increasingly being used internationally as a more rehabilitative (rather than punitive) approach to drink driving. When properly implemented, they allow drink-driving offenders to continue driving while reducing the likelihood of them driving drunk. Research in Australia shows high-risk drivers are generally supportive of enforcement strategies that do not remove their ability to drive, such as alcohol ignition interlocks, as opposed to clinical interventions or relicensing requirements aimed at changing their drinking behaviour (Bishop et al., 2017).

Because a drink-driving offence needs to have been committed before an interlock order can be issued, this intervention targets drivers who are (or are likely to be) reoffenders. The devices are effective at preventing drink driving while installed but evidence is mixed on whether they prevent reoffending once they have been removed, particularly because interlocks do not appear to change drinking behaviour in the long term (Ministry of Justice, 2017b).

Finding alcohol interlocks to be highly effective when installed, Austroads (2015) proposes it is worth considering expanding the interlock programme to include all offenders, all probationary / novice drivers, and all commercial fleet drivers. To be done efficiently, it is suggested interlock requirements would need to be assigned as part of driver licensing, rather than done exclusively through the justice system. Such a system would face legislative and funding hurdles but would ultimately be highly effective in decreasing the number of alcohol-related crashes and deaths and serious injuries.

The Ministry of Justice (2017b) notes a weakness with the alcohol interlock programme is the cost of hiring a device and having it installed and removed, though a subsidy is available for low-income drivers. If offenders choose not to enter the programme, then their licence remains disqualified. This option may be preferred by some drivers as compared with the near certainty of detection under the interlock programme. Driving without a licence offers the possibility of continued undetected drink driving. It is unclear what proportion of drivers with the option of entering the alcohol interlock programme chose to remain disqualified, or what proportion end up reoffending.

C.7 Other approaches

Recently, the Ministry of Justice piloted *Te Whare Whakapiki Wairua* – the Alcohol and Other Drug Treatment Court – in Auckland and Waitākere. These courts are an alternative to imprisonment for people whose offending is driven by alcohol and/or drug substance use disorders. They integrate Māori cultural practices into their processes, to provide a more culturally appropriate treatment model. An important part of treatment is the use of transdermal alcohol monitoring (TAM) anklets (also known as sobriety tags) to monitor the presence of alcohol in sweat. Ministry of Justice analysis (2019) has found that participants who graduated the Court were less likely to reoffend in the following two years, and, when they did reoffend, it was likely to be less serious. Participants also experienced improved wellbeing in their relationships, health and future opportunities. A third court was opened in Hamilton in 2021.

TAM anklets are used extensively in the United States of America to deter alcohol offenders from drinking, being present in most states (McKnight et al., 2012). It is not entirely clear, however, whether they reduce recidivism or merely delay it. Tison et al. (2015) observe that individuals ordered to be fitted with alcohol-monitoring devices are likely to represent the most serious offenders, impeding comparison with less-serious offenders who are not fitted with the devices. A review by Fell and Scolese (2021) found evidence that TAM is an effective strategy in treating drink-driving offenders and reducing recidivism. Along with New Zealand, TAM technology has been piloted in the Netherlands and United Kingdom. Following two successful pilots, courts in England and Wales have obtained the power to ban alcohol-related offenders from drinking and order them to wear TAM anklets for up to 120 days. It remains to be seen what effect this measure will have.