IMPROVING THE IDENTIFICATION OF FATIGUE-RELATED CRASHES IN THE AUSTRALIAN CAPITAL TERRITORY

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June 2011

The Centre for Accident Research & Road Safety - Queensland

is a joint venture initiative of the Motor Accident Insurance

Contents

This research grant was made possible as the result of a funding grant by the NRMA-ACT Road Safety Trust and the Roads and Traffic Authority, New South Wales. This work has been prepared exclusively by the authors and is not endorsed or guaranteed by the Trust.

Executive Summary

It has been well established nationally and internationally that fatigue-related driving is an important contributory factor in fatal and serious injury crashes. The purpose of this report was to survey a large, representative sample of residents living in both the NSW and ACT to ask about their experience of fatigue and their involvement in fatigue-related crashes and incidents. This will provide valuable data about the number and characteristics of fatigue-related crashes and incidents of ACT residents. Specifically this study assessed the prevalence of incidents of fatigue-related driving for residents of NSW and the ACT, the characteristics surrounding the incident, if the report would fit within the NSW, QLD, or ATSB proxy definition or if it would fall outside of the proxy definition.

Participants included 1, 609 individuals which comprised 803 individuals from the Australian Capital Territory (ACT) and 806 individuals from New South Wales (NSW). The sample had an equal prevalence of males and females (ACT: male *n* = 402, female *n* = 401; NSW: male *n* = 403, female *n* = 403) with similarly equal numbers of individuals that were under 30 years of age and above 30 years of age.

The results revealed that a larger proportion of ACT residents (71.4%) than NSW residents (62.2%) reported having felt sleepy while driving in the last 5 years. In addition, a larger proportion of ACT residents (71.6%) than NSW residents (59.7%) continued to drive occasionally or always after having experienced symptoms of sleepiness. Further, the results showed that the majority of close calls and crashes for the NSW residents occurred in the state they were living in. In contrast, a large proportion of close calls and crashes of ACT residents occurred outside of the state they were living in. That is, approximately half of ACT residents reporting a close call incident (54.5%) stated that it occurred when they were driving in NSW. Further, 42.9% of the crashes reported by ACT residents occurred within the borders of NSW.

When the characteristics of the most recent event (either a close call or crash) were examined, it was found that the largest proportion of incidents (28%) occurred when commuting to or from work, followed by social activities (25.1%), holiday travel (19.8%), or for work purposes (10.1%). A comparison was made of ACT and NSW residents regarding the purpose of the journey and the proportions were approximately equivalent; although a larger number of NSW residents reported an incident when commuting to or from work than the ACT residents. Further, it was found that the largest proportion of incidents (20.8%) occurred less than five kilometres from the intended destination.

Further examination of incidents revealed that overall, the incidents and the details reported do not fit neatly within the NSW, QLD or ATSB proxy definitions for a fatigue crash. Further, of the responses received, only 45% of the participants stated that the police were involved as a result of the incident; whereas 55% stated that the police were not involved. This is suggestive that regardless of the proxy definitions, incidents resulting from sleepy driving remain under-reported, particular when they do not involve multiple vehicles or injuries.

The findings contained within this report suggest that a large number of ACT residents are driving whilst experiencing symptoms of sleepiness. In comparison to NSW residents, a significantly higher proportion of ACT residents reported feelings of tiredness whilst driving in the last 5 years. Additionally, a larger proportion of ACT residents reported they continued to drive occasionally or always after experiencing symptoms of sleepiness than NSW residents. It is speculated that the higher number of ACT residents feeling tired and continuing to drive place them at a greater risk of being involved in fatigue-related incidents than NSW residents. Directions for future investigations are suggested.

Introduction

An often understated problem, yet one of the most preventable causes of traffic incidents are the crashes that occur due to driver fatigue. It has been well established nationally and internationally that fatigue-related driving is an important contributory factor in fatal and serious injury crashes. Fatigued drivers are at an increased risk of injury and death. This ensues when the driver falls asleep at the wheel and crashes but also when sleepiness impacts on attention and reaction times during critical driving tasks. Most importantly, sleep-related crashes have been found to be more severe than other crashes, with higher fatally rates (Åkerstedt, 2000; Williamson, Sadural, Feyer, & Friswell, 2001). This is often resulting from high speed impacts with no indications of braking or evasive manoeuvres (Reyner & Horne, 1998b).

Prevalence of fatigue-related/sleepy driving incidents

The percentages of crashes that have been attributed to fatigue have varied across different studies. For example, in the United States driver sleepiness has been identified as a causative factor in one to three percent of all crashes (Lyznicki, Doege, Davis, Williams, & Fabrizio, 1998). In the United Kingdom, Horne and Reyner (1995) reported that 16% of all vehicle crashes were sleep related and 20% of motorway crashes were due to sleep. In more recent times there has been a consensus within the literature that the proportion of all vehicle crashes related to sleepiness is in the order of 20 per cent (Connor, et al., 2002; Garbarino, Nobili, Beelke, De Carli, & Ferrillo, 2001). Moreover, the study by Connor et al. (2002) provides the best evidence of the role of sleepiness in crashes. This stringent case controlled study found that the population attributable risk for sleepy driving was 19%. That is, if there was a cessation of all sleep-related crashes it would result in a 19% decrease in all crashes. While these figures are concerning, even more concerning is the number of motorists that put themselves at risk for falling asleep whilst driving.

A number of studies have described that a substantial proportion of motorists put themselves at risk of a fatigue related crash. Falling asleep at the wheel is usually preceded by feelings of increased sleepiness which are very noticeable to the individual (Horne & Reyner, 2001). Moreover, drivers in general have a good knowledge of the various factors influencing the risk of falling asleep while driving as well as the associated hazards (Nordbakke & Sagberg, 2007; Smith, Carrington, & Trinder, 2005). It appears that drivers are choosing to ignore symptoms of sleepiness, as studies conducted in America, Norway and Australia have found that many drivers have operated vehicles when feeling sleepy (National Sleep Foundation 2008; Nordbakke & Sagberg 2007; Smith, Carrington, & Trinder 2005). When asked why they continue to drive when sleepy, a Norwegian sample of drivers most frequently reported their reasons as being on a short trip, going to an appointment, and a desire to arrive at a reasonable time (Nordbakke & Sagberg 2007). A recent Australian study found that the primary reasons cited for driving when sleepy were ‘wanted to get to their destination’ and ‘being close to home’ (Armstrong, Obst,

Banks, & Smith, 2010). These findings are of concern, as fatigue-related crashes commonly occur close to the destination (Armstrong, Obst, Livingstone & Haworth, 2009). Furthermore, drivers may be less inclined to engage in fatigue countermeasures, such as stopping, if they are focusing on arriving at their destination as soon as possible and if their destination is close.

A concerning consequence of continuing to drive after increased feelings of sleepiness are short episodes of unintentional sleep onset during driving called micro-sleep events. These micro-sleeps pose concerns for sleepy drivers as performance decrements ensue during the time of the micro-sleep, particularly on curved sections of roads (Boyle, Tippin, Paul, & Rizzo, 2008). The typical signs being prolonged eyelid closures, slow rolling eye movements, reduced muscle tone (e.g., head rolling), relaxation of foot pressure on the accelerator, together with major driving incidents such as running into a vehicle in front, or weaving and/or drifting off the carriageway (Horne & Reyner, 2001).

Several studies have shown that some drivers may not be able to make accurate decisions regarding their level of sleepiness and the subsequent impairment to driving performance (Horne & Reyner, 2001; Reyner & Horne, 1998b). More concerning is that the actual impairment is in most cases much worse than what the driver is aware of (Horne & Reyner, 2001). In addition many other crashes attributed to inattention or lowered alertness are likely to been related to increases in the individual's level of sleepiness. Sleepiness is linked to decrements in a number of factors critical to safe driving, including vigilance, reaction time, memory, psychomotor coordination, information processing, and decision making.

Taken together, this evidence emphasises the pervasive and problematic nature of fatigue and driving and that many drivers put themselves at risk of a fatigue related crash. Even though drivers acknowledge falling asleep as an important risk factor of road crashes, the severity of sleep-related crashes seems to be somewhat underestimated by drivers and this may prevent drivers from taking sleepiness and fatigue seriously (Smith, et al., 2005).

Characteristics of a fatigue-related/ sleepy driving crash

A substantial body of evidence has accumulated that suggest that a large proportion of fatigue related crashes occur in specific situation. That is, influences that have been repeatedly linked to fatigue-related crashes are: monotonous driving conditions, and circadian rhythm factors.

Monotony is a psychological construct and is equated as a reduction in alertness of the driver (Schmidt, et al., 2009). Monotony is defined with reference to the sensory stimulation that is elicited from the environment. That is, typically a driving situation that remains relatively unchanged or changes in a predictable way is said to be monotonous (Thiffault & Bergeron, 2003). Driving situations such as highway driving have repeatedly been found to involve greater instances of fatigue related crashes (Dobbie, 2002; Horne & Reyner, 1995; Sagberg, 1999). Moreover, monotonous

driving situations have been found to increase individuals' subjective and objective sleepiness (Reyner & Horne, 1998b; Schmidt, et al., 2009). Increases in subjective sleepiness have been shown to be a significant predictor of increased likelihood of having a severe or fatal crash (Åkerstedt, Connor, Gray, & Kecklund, 2008). Nonetheless, while monotonous driving situations have been related to increases in fatigue-related crashes the influence of circadian factors can increase the relative risk above that of monotonous driving situations.

The circadian rhythm is a biological process that is characterised by an increase in the propensity to fall asleep. There are two phases/periods of increased sleep propensity: the nocturnal period (12am-6am) and the diurnal period (2pm-4pm) (Carskadon & Dement, 1987). Though, it must be noted that the nocturnal period exerts a much greater influence to fall asleep than the late afternoon period (Dement, 2005; Johns, 2000).

A study conducted by Pack et al. (1995) investigated the characteristics of crashes that were solely attributed to the driver having fallen asleep. The results of this study demonstrated a strong relationship between the two circadian increases in sleepiness and higher frequencies of crashes. That is, the greatest number of crashes took place during the night time period of midnight to 7am, with the next highest period of crashes occurring during the mid-afternoon circadian 'dip' between 3pm to 6pm. In addition, approximately half of these sleep-related crashes involved individuals that were 25 years of age or younger.

A more recent study performed by Smith, Armstrong, Steinhardt, & Haworth (2008) sought to investigate early morning crashes in depth. This study utilised data from Queensland Transport's Road Crash Database between the years of 2000 to mid 2006 and included crashes of all severity levels across urban and non-urban areas. Additionally, crashes where the driver had any alcohol in their system were excluded. The results show that there were significant age and gender differences during the early morning crashes. Specifically, young males had an increased crash risk (more than six times the odds) for crashing during the time of 2 to 3am. This study clearly shows the increased crash risk during the nocturnal period of increased sleepiness due to the influence of the endogenous circadian rhythm.

Information provided from self-report data provides valuable and corroborating results to official crash statistics. Pennay (2008) assessed the characteristics of drivers who reported having fallen asleep and crashing. It was discovered that the largest proportion of sleep-related crashes occurred during the hours of midnight to 6am. In addition, this study also showed the influence of monotony with sleep-related crashes as approximately 70% of crashes occurred on either country roads (33%) or country highways (38%). Additionally, a study by Ingre, Kecklund, Åkerstedt, and Kecklund (2004) found that train drivers reported severe levels of sleepiness during early morning hours and also that the levels of sleepiness increased the longer the time between stops. This is suggestive of a dangerous interaction between circadian rhythm factors and monotonous situations.

While monotonous driving conditions and the influence of the body's circadian rhythm influences the likelihood of falling asleep whilst driving a number of other factors can contribute to increased sleepiness. These factors include sleep debt, shift work, prolonged work hours, time spent awake, time on task, type of road, risk taking behaviour, age and gender, sleep disorders, alcohol and other drugs, and familiarity with the road environment (Åkerstedt, 2000; Brown, 1994; Horne & Reyner, 2001; Johns, 2000; Lyznicki, et al., 1998). However, it must be noted that the causes of sleepiness while driving and driver fatigue are numerous and interact in complex ways. Nonetheless, there are several countermeasures to counteract driver sleepiness.

Countermeasures

It is of interest to determine what, if any, countermeasures drivers employ in order to reduce sleepiness or to be more alert when driving. The most common countermeasures include drinking coffee or energy drinks, directing cold air onto the face, listening to the radio, postural movements, taking brief naps and rest breaks. Many of these countermeasures have uncertain value for increasing alertness, and some provide only transient benefit (Anund, Kecklund, Peters, & Åkerstedt, 2008; Horne & Reyner, 1996; Reyner & Horne, 1998a). More concerning is that the majority of drivers prefer to employ the least effective countermeasures (Anund, et al., 2008).

The effectiveness of a countermeasure is a great concern and getting drivers to employ the most effective countermeasures is a pertinent objective. Some of the countermeasures that have been shown to be the least effective are making postural movements, listening to the radio, and directing cold air onto the face (Reyner & Horne, 1998a; Rogé, Pebayle, & Muzet, 2001). The best countermeasures to increase alertness include taking brief rest or nap breaks and drinking coffee or energy drinks (Horne & Reyner, 1996; Lyznicki, et al., 1998; Reyner & Horne, 2002). Moreover, a study by Reyner and Horne (1997) showed that combining the consumption of caffeine with a short nap had greater benefits for increasing alertness above those of the short nap or caffeine when used in isolation. Last, taking a short respite from driving effectively removes the sleepy driver from the road environment when they are potentially at dangerously low levels of alertness (Lyznicki, et al., 1998).

Regarding motorists preferences for countermeasures, Anund et al. (2008) found that the most common countermeasures drivers in Sweden used to reduce sleepiness or increase alertness included stop to take a walk (54%), turn on the radio/stereo (52%), open a window (47%), drink coffee (45%), and asking passengers to engage in conversation (35%). This is a concerning finding given that research shows the safest countermeasure is for an individual person to stop driving (Horne & Reyner, 1996; Lyznicki, et al., 1998; Reyner & Horne, 2002). A subsequent analysis by Anund et al. (2008) revealed that much of the sample engaged in alertness-enhancing activity while driving as well as stopping and drinking caffeine. Although, taking a nap was not a very commonly employed countermeasure, except for individuals who were professional drivers, had experienced of sleep-related crash or

felt severe sleepiness when driving. Similar findings have been obtained from a survey of Canadian drivers (Vanlaar, et al., 2008).

In Australia the preferences for countermeasures is somewhat different to those of other countries. Pennay (2008) found the vast majority of the sample (95%) reported that they would pull over and stop driving to counteract their sleepiness. Nonetheless a substantial number of drivers continue driving even after recognising the signs of sleepiness or fatigue (Nordbakke & Sagberg, 2007; Pennay, 2008). Reasons for continuing driving are many and varied and can include: poor understanding of fatigue-related crash risk; underestimating the shift from sleepiness to sleep; no history of fatigue-related events; deciding to ignore the warning signs; pressure to reach destination; and no perceived threat of penalty (Fletcher, McCulloch, Baulk, & Dawson, 2005). Additionally, the most frequently reported reasons for driving whilst sleepy or fatigued are: a short trip, appointments, and the wish to arrive at the destination at a reasonable hour (Nordbakke & Sagberg, 2007).

Proxy measures of fatigue/sleep related crashes

Apart from self-report of non-fatal crashes, a crash can only be judged as sleep-related indirectly, from subjective police reports or from proxy definitions. Assigning the primary cause of the crash to sleepiness is difficult as the nature of many crashes are often multifactoral (Shinar, 1978, 2007), and there is no objective and reliable test for measuring driver sleepiness (Pack, et al., 1995).

In response to identification of sleepiness as a causal factor in crashes, many jurisdictions now specifically identify ‘fatigue-related crash’. A number of papers have reported data on time-of-day of crash for fatigue attributed crash. In those cases, either an observer criteria have been applied (e.g. police at scene decision that fatigue was a contributing factor), or another data criterion has been applied (e.g. a single vehicle crash occurring on a rural, high speed road; see Horne & Reyner, 2001; Horne & Reyner, 1995).

A number of investigations (National Sleep Foundation, 2008; Pennay, 2008) have been conducted in which drivers have been surveyed regarding their experience of fatigue and their involvement in fatigue-related crashes. Most of these surveys have used a very narrow definition of fatigue, such as “falling asleep at the wheel” and so their results may be underestimates of the broad range of fatigue effects on crash involvement. In addition, many crashes that occur when the driver is suffering from sleepiness and has reduced reaction times would not be captured by this definition.

Given that there is no objective method for identifying the involvement of fatigue in crashes, as there is for alcohol, researchers and crash investigators therefore often rely upon evidence of erratic driving immediately prior to the crash, such as crossing the centre line, running off the edge of the road and the frequency of lane excursions as well as driver behaviour in the days leading up to the crash to indicate the involvement of fatigue. Police attribution of fatigue in crash reports is, in some

instances, the only data available for most traffic crashes. In some States (including Queensland, New South Wales and Western Australia), police check a box on the crash report form to indicate that fatigue was considered to be a contributing factor in the crash. The figures derived from such coding are considered to be an underestimate of the true number of fatigue-related crashes (Attewell, Lock, Dobbie, & Walker, 2001).

In response to concerns of underestimation of the contribution of fatigue to crashes by self-report and subjective police reports, several jurisdictions have developed proxy measures of fatigue-involvement that can be applied to all of the crashes in their databases. Appendix 2 contains the proxy definitions from New South Wales Roads and Traffic Authority, Queensland Transport, and Australian Transport Safety Bureau (ATSB) Proxy Definitions. In general, these proxy measures use characteristics that have been repeatedly found by research studies to be associated with fatigue to identify crashes that are likely to be fatigue-related. For example, research studies have shown that drivers are much more likely to fall asleep at the wheel between midnight and 6am (or 2am and 6am) and fatigue-related crashes are more likely to involve a single vehicle running off the road (Horne & Reyner, 1995; Pack, et al., 2006).

Whilst the proxy definitions have been shown to provide good estimates of the incidents of fatigue-related crashes (e.g., Dobbie, 2002) other studies have identified proxy definitions to be of limited value. A study by Crummy, Cameron, Swann, Kossmann, and Naughton (2008) employed the ATSB operational definitions for identification of a fatigue/sleep related crash (Dobbie, 2002). The ATSB definitions have been designed mainly by investigating the characteristics of fatal motor vehicle crashes in which fatigue was implicated as an important contributing factor by police, witnesses or coronial report (Attewell, et al., 2001). However, only 25% of Crummy et al. (2008) participants that had actually had a sleep-related crash were correctly identified by the ATSB proxy definition. Crummy, et al., (2008) concluded that the ATSB definitions on sleepy and fatigued driving were too lenient and would benefit from further expansion. This statement supports the position of Åkerstedt (2000) that proxy definitions are to rigid and typically underestimate the prevalence of sleep-related crashes.

A study conducted by (Armstrong, Smith, Steinhardt, & Haworth, 2008) investigated the characteristics of police reported fatigue/sleep related crashes in urban areas with speed zones of 60km/h or less. The results showed that a number of crashes due to fatigue resulted in fatalities or required hospitalisation of the driver. Additionally, it should be noted that all of the low speed crashes of this sample would have been excluded by the ATSB proxy definition, as it requires crashes to have occurred on roads with speed limits of 80 km/h or above. Last, given the data of this study it was suggested that proxy measures may be better suited to identifying the subset of (largely rural) fatigue-related crashes that involve falling asleep at the wheel than other crashes that may occur at less severe levels of fatigue (particularly in urban areas).

The current study

The current study will survey a large, representative sample of residents living in both the NSW and ACT to ask about their experience of fatigue and their involvement in fatigue-related crashes and incidents. This will provide valuable data about the number and characteristics of fatigue-related crashes and incidents of ACT residents. Specifically this study will assess the prevalence of incidents of fatigue-related driving for residents of NSW and the ACT, the characteristics surrounding the incident, if the report would fit within the NSW, QLD, or ATSB proxy definition or if it would fall outside of the proxy definition. It is proposed that this will allow for a truer rate of the extent of under-reporting of fatigue-related incidents that lie outside the proxy definition as well as provide a richer understanding of fatigue-related driving incidents.

Method

Participants

The participants included 1, 609 individuals that was comprised of 803 individuals from the Australian Capital Territory (ACT) and 806 individuals from New South Wales (NSW). The sample had an equal prevalence of males and females (ACT: male n = 402, female n = 401; NSW: male n = 403, female n = 403) with similarly equal numbers of individuals that were under 30 years of age and above 30 years of age. Participation in the study was voluntary and participants were free to withdraw from the study at any stage.

The only inclusion criteria was that participants were aged over 17 years of age, held a current drivers licence, and that they drove a motor vehicle (both private and work related) more than one hour per week. Due to the large geographic size of NSW compared to that of the ACT, sampling of the NSW participants was stratified according to the number of passenger vehicles (see Table 1) according to statistics from the Australian Bureau of Statistics (ABS) census, 31 of March 2007 (ABS, 2007).

Table 1

Stratification of participants from NSW based on the proportional passenger vehicles.

Location	Passenger Vehicles†	Proportional target	Completed
Sydney	2153250	506	437
Hunter	322093	76	76
Illawarra	212734	50	51
Richmond-Tweed	112757	26	30
Mid-North Coast	151986	36	37
Northern	80121	19	25
North Western	50662	12	25
Central West	85574	20	25
South Eastern	105140	25	25
Murrumbidgee	72374	17	25
Murray	49976	12	25
Far Out West	10486	2	25

† Passenger vehicle numbers taken from ABS Motor Vehicle census 31 March 2007

Materials

The Driving Fatigued Questionnaire (DFQ) utilised in the study was developed by the Centre for Accident Research and Road Safety – Queensland. The DFQ was thoroughly tested with two minor changes made to the DFQ during pilot testing. The final version of the questionnaire is included in Appendix A.

The DFQ is comprised of three sections, with questions relating to 1) demographics, 2) fatigue related driving incidents[1], and 3) general sleep health questions. The demographic section assessed age, gender, education level completed, employment details (e.g., shiftwork), and typical driving occurrences. The fatigue related driving incidents section assessed the prevalence of the sample's fatigue-related driving incidents, the usage of fatigue countermeasures, the characteristics which the incident occurred, and any contributing factors. Last, the general sleep health section sought to quantify individual's perceived quality of sleep, any associated sleep problems, average hours of sleep during the work week, feelings of fatigue during the day, and whether the individual has been diagnosed with sleep apnoea.

[1] Please note, the telephone interviews used the word 'accident' to refer to a sleepy driving crash/incident as pilot testing revealed this word was more likely to be used and understood by potential participants. However, the authors have used the word 'crash' throughout the report to refer to an incident where participants reported being involved in an accident.

Procedure

Following ethical clearance from the Queensland University of Technology research ethics committee, the collection of data relied on a telephone survey methodology via the independent data collection agency I-View. Participants were sourced via from the Association of Market and Social Research Organisations Random Digit Dialing system. The approach utilised relied on the Computer Assisted Telephone Interview (CATI) system by a team of 31 experienced interviewers which were specifically trained to conduct the data collection. The call routine that was employed for the current study was during Monday to Friday evenings calls were made between 16:30 and 20:30. Whereas on Saturdays and Sundays calls were made between 9:00 and 17:00. The response rate achieved for this study was 78.7%.

Results

It was found that a larger proportion of ACT residents (71.4%) than NSW residents (62.2%) reported having felt sleepy while driving in the last 5 years. In addition, a larger proportion of ACT residents (71.6%) than NSW residents (59.7%) continued to drive occasionally or always after having experienced symptoms of sleepiness. However, it must be noted that approximately the same proportion of ACT residents (15.9%) and NSW residents (15.7%) reported ever having a close call (i.e., a near-crash or crossing their designated lane). Table 2 shows the number of close call incidents reported by ACT and NSW residents.

Table 2

Number of close call incidents reported by ACT and NSW residents.

Number of close calls	Percentage of ACT residents	Percentage of NSW residents
1	54.5%	57.4%
2	27.3%	15.6%
3	9.1%	12.3%
4	3%	3.3%
5 or more	6.1%	5.9%

The crossover of incidents reported by ACT or NSW residents in other states or territories can be seen in Table 3. It was found that the majority of close calls and crashes for the NSW residents occurred in the state they were living in. In contrast, a large proportion of close calls and crashes of ACT residents occurred outside of the state they were living in. That is, approximately half of ACT residents reporting a close call incident (54.5%) stated that it occurred when they were driving in NSW. Further, 42.9% of the crashes reported by ACT residents occurred within the borders of NSW.

Table 3

Percentage of close calls and crashes occurring in other States or Territories.

State or territory where incident occurred	Percentage of ACT residents	Percentage of NSW residents
Close call		
NSW	54.5%	86.9%
ACT	34.1%	2.5%
Victoria	4.5%	.8%
Tasmania	.8%	0%
South Australia	.8%	.8%
Queensland	.3%	6.6%
Western Australia	0%%	.8%
Overseas	2.3%	1.6%
Crash		
NSW	42.9%	87.5%
ACT	52.4%	6.2%
South Australia	4.8%	0%
Queensland	0%	6.2%

Characteristics of sleep-related incidents

Regarding the characteristics in which the most recent incident occurred (either close call or crash) the largest proportion of incidents (28%) occurred when commuting to or from work, followed by social activities (25.1%), holiday travel (19.8%), or for work purposes (10.1%). A comparison was made of ACT and NSW residents regarding the purpose of the journey (see table 4) and the proportions were approximately equivalent; although a larger number of NSW residents reported an incident when commuting to or from work than the ACT residents. It was found that the largest proportion of incidents (20.8%) occurred less than five kilometres from the intended destination, followed by between five and 10 kilometres (16.9%), between 11 and 20 kilometres (13%), between 21 and 50 kilometres (12.1%), with the remainder occurring greater than 50 kilometres from the intended destination.

Table 4

Percentage of ACT and NSW residents and purpose of journey.

Purpose of Journey	Percentage of ACT residents	Percentage of NSW residents
Commuting to or from work	25%	31.1%
Social activities	26%	24.3%
Holiday travel	22.1%	17.5%
As part of work	10.6%	9.7%

Some interesting results were found when assessing how long the participant had been driving when the incident occurred. While the distributions were reasonably even, it must be noted that 11.1% of the incidents occurred less than 10 minutes into the journey and approximately half (49.8%) of the incidents occurred less than one hour into the commencement of the driving task.

Pertaining to the type of road environment where the incident occurred, the majority were reported as occurring on motorways with a speed limit of 100 to 110 km/h (42%); followed by country roads with a speed limit of 100 km/h (28%). That is, approximately two-thirds of reported incidents occurred on roads with a speed limit of 100 km/h or greater. However, it must be noted that a number of incidents occurred on roads in built up areas with a speed limit of less than 80 km/h (18.8%) and on local/neighbourhood streets with a speed limit of 50 km/h (11.1%).

Examination of time of day when the incident occurred was undertaken with the results shown in Table 5. During the early hours of 12am to 6am it found that 13.8% of incidents occurred during this period. However, surprisingly the largest amount of incidents occurred between 3pm to 6pm.

Table 5

Percentage of incidents occurring at various times of day.

Time of day	Percentage
12am-3am	6.2%
3am-6am	7.6%
6am-9am	12.5%
9am-12pm	9.2%
12pm-3pm	15.5%
3pm-6pm	23.2%
6pm-9pm	13.5%
9pm-12am	12.1%

Finally, when alcohol consumption was examined, it was found that only 8.2% of those who reported an incident had consumed any alcohol in the 12 hours prior to their involvement in a close call or crash. Additionally, 10.1% of those involved in an incident took a prescription medication in the previous 12 hours. However, none of the individuals reported that taking prescription medication makes them feel sleepy.

General sleep health

Regarding the participants perceptions of their sleep habits and health, 31.9% reported having mild problems in getting to sleep or staying asleep, whereas 5.1% reported having severe difficulties. The remainder of the sample (63%) reported having no difficulties getting to sleep or staying asleep. In addition, 69.6% of individuals reported feeling tired occasionally (53.4%) or frequently (16.2%) despite a full night's sleep. However, more concerning is that 39.1% of the sample reported getting less than seven hours of sleep each day in an average working week. A small percentage of the sample reported having been diagnosed with sleep apnoea (3.1%). Finally, 12.1% participants rated their quality of sleep as excellent, 41.1% rated it as good, 37.8% rated it as average, and 9% of the sample rated their sleep quality as poor.

Proxy definitions

Up to this point, the analyses in this report have combined close calls and crashes. As such, it was determined that only those who had reported being involved in a fatigue related crash would be analysed separately in order to determine whether the characteristics of the incident would fit within either the NSW, QLD or ATSB proxy definitions. Overall, only 37 participants (2.3%) stated that they had ever been involved in *"an accident meaning where the vehicle was damaged or someone got hurt or the police were called when you were driving because you were sleepy"* (range 1-3%). As there were such a small number of participants stating they had been involved in a sleepy driving crash, the decision was made to descriptively examine the cases on as many factors as possible but without using parametric tests of statistical significance.

Examination of the time of day and crash involvement revealed a similar pattern to that observed when close call incidents was also included in the analysis. Examination of table 6 reveals that the majority of crashes occurred between the hours of 9pm and midnight.

Table 6

Percentage of reported crashes occurring at various times of day.

Time of day	Percentage
12am-3am	9.5%
3am-6am	14.3%
6am-9am	14.3%
9am-12pm	4.8%
12pm-3pm	9.5%
3pm-6pm	14.3%
6pm-9pm	14.3%
9pm-12am	19%

n missing = 16.

Pertaining to the type of road environment where the crash occurred, the majority were reported as occurring on motorways with a speed limit of 100 to 110 km/h (55%) followed by roads in built up areas with a speed limit of less than 80 km/h (25%) and on local/neighbourhood streets with a speed limit of 50 km/h (20%).

When outcome of incident was examined, it was found that a head on crash with a stationary object was the most common, followed by side-swipe with stationary object.

Table 7

Outcome of crashes involving ACT and NSW residents.

Type of Road	Percentage
Collided with centre lane divider	10.8%
Collided with median strip	-
Had a head on crash with stationary object (such as tree or roadside furniture)	37.8%
Had a head on crash with another road user travelling in the opposite direction	-
Had a side-swipe crash with stationary object (such as tree or roadside furniture)	27.1%
Had a side-swipe crash with another road user travelling in same/opposite direction	13.5%
Had a rear-end crash	10.8%

Finally, examination of the crossover of incidents occurring outside of the State or Territory of residence was very low. It was found that the majority of reported crashes occurred within the drivers' state or territory of residence. See Table 8 for details.

Table 8

Percentage of crashes occurring in and out of State or Territory of residence.

State or territory where incident occurred	Percentage of ACT residents	Percentage of NSW residents
NSW	8.8%	55.9%
ACT	32.3%	2.3%

Overall, the incidents and the details reported do not fit neatly within the NSW, QLD or ATSB proxy definitions for a fatigue crash. Further, of the responses received, only 45% of the participants stated that the police were involved as a result of the incident; whereas 55% stated that the police were not involved. This is suggestive that regardless of the proxy definitions, incidents resulting from sleepy driving remain under-reported, particular when they do not involve multiple vehicles or injuries.

Discussion

The current study aimed to investigate fatigue-related crashes and incidents in a representative sample of ACT and NSW drivers, and in turn uncover the number and characteristics of fatigue-related incidents of ACT residents. From a sample of 803 ACT residents and 806 NSW residents, almost three-quarters of the ACT residents indicated that they had felt sleepy whilst driving in the last 5 years. Of these drivers, a high proportion (71.6%) reported that they continued to drive occasionally or always after experiencing symptoms of sleepiness. Of note, this is a higher proportion than reported in previous research (Reyner & Horne, 1998b; Vanlaar et al., 2008), however it serves to reiterate that sleepy or fatigued driving is a major road safety issue that still requires a great deal of empirical investigation.

The findings of this study suggest that a large number of ACT residents are driving whilst experiencing symptoms of sleepiness. In comparison to NSW residents, a significantly higher proportion of ACT residents reported feelings of tiredness whilst driving in the last 5 years. Additionally, a larger proportion of ACT residents reported they continued to drive occasionally or always after experiencing symptoms of sleepiness than NSW residents. It is speculated that the higher number of ACT residents feeling tired and continuing to drive place them at a greater risk of being involved in fatigue-related incidents than NSW residents.

Close calls and crashes

Approximately a sixth of the ACT and NSW residents reported having a close call whilst driving because they were sleepy. Previous research has shown that some drivers may not have an accurate perception of their level of sleepiness and the impact on their driving (Reyner & Horne, 1998b). Therefore, it is possible that drivers in this study who reported never having a close call due to sleepiness may have had a close call without identifying sleepiness as a contributing factor. That is, these

results may be an underestimate of the true number of close calls experienced due to sleepiness. However, it is noteworthy that a number of drivers did identify sleepiness as a contributing factor for their close calls. As such, one suggestion is that driver education programs focus on advance trip planning that incorporates adequate rest stops.

Although similar proportions of ACT and NSW residents reported involvement in at least one close call, the number of close calls experienced per driver varied between the states. One close call due to sleepiness was reported by over half of the ACT and NSW residents. However, two close calls were reported by almost twice as many ACT residents (27.3%) than NSW residents (15.6%). We speculate that for some drivers, experiencing close calls may not deter sleepy driving behaviour and may actually reinforce the behaviour. That is, drivers may not associate close calls and the possibility of future crashes. To support this contention, investigation into the perception of close calls and any deterrence effects would be beneficial. Investigation as to why ACT residents appear less deterred by experiencing a close call than NSW residents would also be beneficial.

It is positive to note that small proportions of ACT and NSW residents reported crashes due to driving whilst sleepy. However, as previously stated for close calls, the drivers may not have identified sleepiness as a contributing factor for crashes they have been involved in when sleepiness was a contributing factor. Notably, a slightly higher proportion of ACT residents (2.5%) than NSW residents (1.8%) reported a crash when driving whilst sleepy. This is notable when considered together with the finding that twice as many ACT residents than NSW residents reported having two close calls due to sleepiness. It is arguable that ACT residents appear less deterred than NSW residents to drive whilst sleepy, with possible explanations explored through the characteristics of the sleep-related incidents.

Characteristics of sleep-related incidents

The location of the sleep-related incidents reported by the participants displayed differences between the two jurisdictions. For ACT residents, just over half of the close calls occurred in NSW and approximately a third occurred in the ACT. In comparison, the majority of close calls reported by NSW residents occurred in NSW. Additionally, when considering sleep-related crashes, ACT residents reported that just over half occurred in the ACT and only a slightly smaller proportion occurred in NSW. Comparatively, the majority of crashes for NSW residents occurred in NSW. There may be a number of reasons why a large proportion of sleep-related incidents reported by ACT residents do not occur in their home state, such as purpose of journey and trip duration.

When considering the purpose of the journey, the largest proportions of sleep-related incidents occurred when commuting to or from work, followed by social activities, holiday travel and for work purposes. Similar proportions of ACT residents reported the incidents occurring when commuting to or from work (25%) and for social activities (26%), and only slightly less for holiday travel (22.1%). It is arguable

that commuting to and from work and travelling to social activities would be more likely to involve shorter distances and less likely to be on monotonous roads. Additionally, considering the small size of the ACT and the geographic location of the territory within NSW, it could be assumed that a large proportion of holiday travel of ACT residents occurs in NSW on motorways. However, investigating the occurrence of incidents on roads with different speed limits in conjunction with these findings provides greater insight.

Investigation into the type of road environment incidents occurred on demonstrated that approximately two-thirds of the sleep-related incidents occurred on roads with speed limits of 100 km/h or greater. This finding supports previous research that has found highway driving involves higher occurrences of sleep-related crashes (e.g. Dobbie, 2002; Horne & Reyner, 1995; Sagberg, 1999). This finding dispels the presumption that ACT residents mainly use roads with speed limits of less than 80km/h to commute to or from work or to go to social activities. That is, when the proportion of incidents that occurred whilst commuting or travelling to social activities is taken together with the proportion of incidents occurring on roads with speed limits greater than 100 km/h, it is likely that a number of ACT residents travelling on monotonous roads were travelling for the aforementioned reasons. Of note, almost a fifth of the incidents occurred on roads in built up areas with a speed limit of less than 80 km/h. This is not surprising as a high volume of drivers would be expected on these roads; drivers intending to drive on motorways would usually have to drive through built up areas initially, in addition to drivers whose journeys only require driving on these types of roads.

This study also investigated the journey length and distance from the intended destination of the drivers' most recent sleep-related incident. Notably, the largest proportion of incidents occurred less than five kilometres, followed by between five and 10 kilometres, from the intended destination. Taken together, these findings demonstrate that just over a third of the incidents occurred within 10 kilometres of the intended destination. These results suggest that a substantial proportion of the reported incidents occurred toward the end of the journey. This suggests that drivers may be more prone to feeling sleepy toward the end of a journey, however they may continue to drive due to the proximity of their final destination. The driver's attention may be distracted by thoughts of the destination rather than effectively completing the journey. As this is speculation, further research is needed to support this suggestion. Driver education based on these results may inform drivers of the increased vulnerability of sleep-related crashes toward the end of journeys.

Even though a large proportion of incidents occurred toward the end of the journeys, it is interesting to also investigate the time into the journey that the incidents occurred. Of note is the finding that 11.1% of incidents occurred less than 10 minutes into the journey. It is less likely that these drivers would attribute sleepiness to driving for a long time or long distance than for journeys of a longer duration. Additionally, there would have only been a small time frame for the driver to experience the subjective symptoms of sleepiness. This suggests that sleep-related crashes do not only happen after driving for long periods, and embarking

upon journeys when sleepy may also be dangerous. Future research in a simulator could investigate levels of sleepiness and occurrences of sleep related incidents during short trip durations and could provide greater insight into this interesting finding.

A myriad of research has investigated the time of day that sleep-related incidents occur (e.g. Ingre et al., 2004; Pennay, 2008), with increases in sleep-related incidents during the two phases of increased sleep propensity in the circadian rhythm (Pack et al., 1995). Previous research has suggested that sleep-related incidents are most likely to occur in the nocturnal period between midnight and 6am (Pennay, 2008), thus sleep-related incidents were expected to be most prevalent during this time in this study. However, only 13.8% of incidents occurred between midnight and 6am, which was a comparable proportion to most other time periods. The diurnal period in the circadian rhythm cycle is between 2pm to 4pm and as such sleep-related incidents were expected to slightly rise during this period. Notably, in this study the largest proportion of incidents occurred between 3pm and 6pm, with just under a quarter of the incidents occurring during this period.

The number of incidents reported between midnight and 6am was not a large proportion of the incidents in this study, however, this study did not question participants on whether they ever drive between midnight and 6am. Thus, if any participants do not drive during this period there is no possibility of them having an incident between midnight and 6am. Additionally, it could be assumed that a greater proportion of the sample drive between 3pm and 6pm than between midnight and 6am. If this is so, it could explain the greater proportion of incidents occurring between 3pm and 6pm. That is, the higher instances of incidents reported here may be due to a greater volume of drivers on the road between 3pm and 6pm. Thus, interpreting these findings needs to be done within the context of the study as it may be wrong to infer that drivers are more likely to be driving whilst sleepy between 3pm and 6pm than midnight and 6am.

General sleep health

Subjective assessment of the participants' general sleep health can assist with providing insight into the occurrence of sleep-related driving incidents. Just under two-thirds of the sample reported no difficulties in getting to sleep or staying asleep. Additionally, most of the participants rated their sleep quality as good or average. This is positive as regularly obtaining good quality sleep should reduce the likelihood of feeling sleepy whilst awake and performing activities such as driving. Of note however, almost a third of the participants reported mild problems in getting to sleep or staying asleep. Additionally, a small proportion reported having severe difficulties getting to sleep or staying asleep.

People who report difficulties getting to sleep or staying asleep may be more prone to symptoms of sleepiness due to not obtaining an optimal level of sleep. It may be hypothesised that the finding of a third of the participants reporting they experience mild or severe difficulties getting to sleep or staying asleep indicates there are a

substantial number of drivers with increased potential of experiencing sleep related symptoms whilst driving. To support this contention, future research might explore the relationship between levels of sleep disruption and prevalence of sleep related symptoms whilst driving. Given the possibility that individuals may experience varying levels of sleep disruption during different periods of their lives, it is important to educate all drivers (not just those with current sleep disruption problems) of the effects of sleepiness on driving ability.

Additionally, of concern was the finding that over two-thirds of the sample reported feeling tired occasionally or frequently after a full night sleep. It is possible that even though they may get a full night sleep occasionally, on average they are not getting their required amount of sleep. This possible explanation is suggested as 39.1% of the participants reported getting less than seven hours of sleep each day in an average working week. It may be necessary to educate drivers about the effect of continuous partial sleep deprivation on their sleepiness levels and in turn their driving performance.

Finally, the incidents and the details reported by participants living in NSW and the ACT do not fit neatly within the NSW, Queensland or ATSB proxy definitions for a fatigue crash. Examination of the proxy definitions reveals that the NSW definition is the broadest, followed by the Queensland definition, and the ATSB definition is the strictest. Further, proxy measures are used for different purposes among the jurisdictions and by different organisations. The ATSB quite clearly states that the operational definition was not designed to measure the absolute number of fatigue-related crashes, but rather to serve as a reliable indicator that would be useful in monitoring these crashes and comparing trends over time or between regions (Dobbie, 2002).

Where to from here? Training and education approaches to preventing fatigue-related crashes

A large number of measures have been proposed or implemented in a number of jurisdictions with the aim of reducing death and injury from fatigue-related crashes. These measures are classified in Table 9 according to their aim: preventing fatigue, preventing crashes or reducing crash severity and whether they target the driver, vehicle or environment (see Haworth, 2003 for a description of these fatigue countermeasures). As the Table shows, educational programs (including advertising) generally aim to prevent fatigue.

Table 9

A classification of fatigue countermeasures (adapted from Haworth, 1990).

	PREVENT FATIGUE	PREVENT CRASHES	REDUCE CRASH SEVERITY
DRIVER	Education, Limitation of hours of work, Rest breaks		
VEHICLE	Radio, Ventilation, Reduction of vibration	Fatigue monitors, Enhanced stability control	Seat belts, air bags
ENVIRONMENT	Rest areas	Pavement treatments	Duplication, Better shoulders, Treatment of roadside hazards (trees and poles)

Educational programs (including advertising) can aim to inform, change attitudes or change behaviour (Elliott, 1993). Some of the specific goals of fatigue related educational programs are to:

- educate the public of the dangers of fatigue (increase knowledge)
- convince people that fatigue is an important road safety issue (change attitudes)
- get people to plan trips better (change behaviour)
- get people to stop driving if feeling tired (change behaviour).

When knowledge, attitudes and behaviour are measured, most public education campaigns are more successful in conveying information and changing attitudes than in altering behaviour (see Donovan, Jalleh, & Henley 1999; Rodriguez & Anderson-Wilk 2002). Delhomme et al. (1999) and Elliott (1993) concluded that crash reductions were larger for road safety campaigns:

- supported by other actions (road safety legislation, enforcement of the road rules, education, reward) than campaigns not supported by other actions
- based on an explicit theoretical framework (e.g. Attribution theory, Theory of deterrence, Theory of general and specific deterrence, Organisational behaviour modification)
- involving prior qualitative or quantitative research (to gain an understanding of the factors underlying the behaviour in the target audience).

Education is one approach to reducing death and injury from fatigue-related crashes. Research has revealed that audience recall of fatigue public education messages has generally been good, which suggests that education may be successful in informing drivers about the dangers of fatigue (Delhomme et al., 1999; Elliott, 1993). A number of suggestions are provided as to how education countermeasures can be enhanced with relation to fatigue-related driving. They include:

- Incorporating education and training as part of an overall approach to reducing fatigue-related crashes, rather than stand-alone measures.

- Incorporating the findings regarding BAC equivalents of hours awake into public education programs to highlight the seriousness of fatigue and provide a link to an accepted threshold level of risk and driving.

- Emphasising advance trip planning that also incorporates departure times and rest beaks rather than teaching drivers to stop when they feel tired as research has revealed that drivers who are fatigued are also impaired in their ability to accurately judge their level of fatigue (e.g., Reyner & Horne, 1998b).

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Appendix A

S1 Approximately, how many hours per week would you drive a motor vehicle, including both private and work use? On average, would you say you drive a motor vehicle:

a. less than 1 hour per week (average= 8 mins or less/day)
b. between 1 and 4 hours/wk (average=9 to 34 mins/day)
c. between 4 and 8 hours/wk (average=34 to 68 mins/day)
d. over 8 hours/wk (average=68mins/day)

S2 Record gender (do not read out)

1. male
2. female

S3. Just so that we can make sure that we are speaking to a cross section of the community, would you mind telling me how old you are?

S3a (*ask if refused age)* Which of the following age groups do you fall into?

1 under 17 (terminate)
2. 17-29
3. 30-39
4. 40-49
5. 50-64
6. 65-79
7. 80+
8. Refused (*terminate)*

If R under 17, ask to speak to person 17 or over

S4 Can I confirm your post code? *(assign to region – check quotas)*

FATIGUE QUESTIONS

Q1. In the last 5 years, have you ever felt sleepy while you were driving?

1 YES
2 NO

Q2. In the last 5 years, have you ever felt these symptoms while you were driving?

A	Yawning	Never	Occasionally	Always
B	Frequent eye blinks	Never	Occasionally	Always
C	Difficulty keeping eyes open	Never	Occasionally	Always
D	Difficulty in concentrating on driving	Never	Occasionally	Always
E	Needing to change position frequently	Never	Occasionally	Always
F	Slower reaction to traffic events	Never	Occasionally	Always
G	Increased variation in speed	Never	Occasionally	Always
H	Dreamlike state of consciousness	Never	Occasionally	Always
I	ANYTHING ELSE (WRITE RESPONSE)	Never	Occasionally	Always

Q3. In the past 5 years, how often have you continued to drive after noticing symptoms of sleepiness?

1 Never
2 Occasionally
3 Always

If person responds with NO to Question 1, NEVER to A, B, C, D, E, F, G, H, and NEVER to Question 3 – GO TO QUESTION 26.

Q4. On ANY occasion when you have you have felt sleepy when driving, what HAVE you DONE to make yourself feel MORE alert?

MULTIPLE RESPONSES IN EACH CATEGORY PERMITTED
PROMPT IF NECESSARY and PROBE FOR CLARITY

1. A STOPPED THE VEHICLE
2. AA AND GOT OUT OF CAR
3. AB AND CHANGED DRIVERS
4. AC AND HAD SOMETHING TO EAT
5. AD AND HAD SOMETHING TO DRINK
6. AE AND HAD A NAP
7. AF HAD A SLEEP SOMEWHERE AND CONTINUED AFTER A FEW HOUR (OR NEXT DAY)
8. AG AND REFRESHED SELF (E.G., SPLASHED WATER ON FACE/BODY)

9. B CONTINUED DRIVING
10. BA AND HAD SOMETHING TO EAT
11. BB AND HAD SOMETHING TO DRINK

12. BC AND TURNED ON THE RADIO/STEREO
13. BD AND INCREASED THE VOLUME ON THE RADIO/STEREO
14. BE AND SANG OUT LOUD
15. BF AND TALKED TO SELF
16. BG AND TALKED TO PASSENGER
17. BH AND INCREASED THE TEMPERTURE IN THE VEHICLE
18. BI AND DECREASED THE TEMPERATURE IN THE VEHICLE
19. BJ AND WOUND DOWN WINDOW OF VEHICLE
20. BK BUT DROVE VEHICLE SLOWER
21. BL BUT DROVE FASTER/MORE ACTIVELY
22. C CONSUMED CAFFEINE
23. CA COFFEE/TEA
24. CB WATER
25. CC GURANA/CAFFINE DRINK (E.G., RED BULL OR V)
26. CD ENERGY DRINK (E.G., GATORAIDE)
27. CE CHOCOLATE
28. CF NO DOZE TABLET
29. D NOTHING
30. E OTHER (SPECIFY)

Q5. Have you ever had a 'close call' – *meaning a near-accident when you were driving or if you drove outside of your designated lane* because you were sleepy?
1. YES
2. NO – GO TO QUESTION 6

Q5A. How many times have you had a 'close call' when driving because you were sleepy?
(WRITE RESPONSE)

Q5B. How long ago was your most recent close call when driving because you were sleepy?

1. Less than 6 months
2. 6 to 12 months
3. 12 to 18 months
4. 18 to 24 months
5. 24 to 36 months
6. 3 to 5 years

>>
7. LONGER THAN 5 YEARS AGO SPECIFY_____

NOTE – IF LONGER THAN 5 YEARS AGO, RECORD RESPONSE AND MAKE NOTE OF IT AT QUALIFIER SECTION.

Q5C. In which State/Territory were you living in at the time of the most recent close call?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. WAS LIVING O/S

Q5D. In which State/Territory did the close call occur?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. HAPPENED O/S

Q5E. What type of vehicle were you driving at the time of the most recent close call?

1. A standard car
2. A motorcycle
3. Ute
4. Van
5. A four-wheel drive
6. A heavy vehicle (such as a truck or bus that you need a heavy vehicle licence to drive)
7. Other Specify

Q5F. What was the outcome of the close call? READ OUT CODES – M/R ALLOWED

1. Startled awake
2. Drifted/ran off the road
3. Crossed Centre Line on road
4. Wandered/drifted into other lane
5. Wandered/drifted off onto shoulder
6. Had another driver sound horn at me
7. Other (Please Specify)_____
8. Nothing – DO NOT READ OUT

Q6. Have you ever had an accident meaning *where the vehicle was damaged or someone got hurt or the police were called* when you were driving because you were sleepy?

1. YES
2. NO – GO TO QUALIFIER SECTION

Q6A. How many times have you had an accident when driving because you were sleepy?
(WRITE RESPONSE)

Q6B. How long ago was your most recent accident when driving because you were sleepy?

1. Less than 6 months
2. 6 to 12 months
3. 12 to 18 months
4. 18 to 24 months
5. 24 to 36 months
6. 3 to 5 years

>>

7. LONGER THAN 5 YEARS AGO SPECIFY _____

NOTE – IF LONGER THAN 5 YEARS AGO, RECORD RESPONSE AND MAKE NOTE OF IT AT QUALIFIER SECTION.

Q6C. In which State/Territory were you living in at the time of the most recent accident?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. WAS LIVING O/S

Q6D. In which State/Territory did the accident occur?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA

7. NT
8. QLD
9. HAPPENED O/S

Q6E. What type of vehicle were you driving at the time of the most recent accident?

1. A standard car
2. A motorcycle
3. Ute
4. Van
5. A four-wheel drive
6. A heavy vehicle (such as a truck or bus that you need a heavy vehicle licence to drive)
7. Other specify

Q6F. What was the outcome of the accident? READ OUT CODES M/R ALLOWED

1. Collided with centre lane divider
2. Collided with median strip
3. Had a head on crash with stationary object (such as tree or roadside furniture)
4. Had a head on crash with another road user travelling in the opposite direction
5. Had a side-swipe crash with stationary object (such as tree or roadside furniture)
6. Had a side-swipe crash with another road user travelling in same/opposite direction
7. Had a rear-end crash
8. Other (Please Specify)_____
9. Nothing – DO NOT READ OUT

QUALIFIERS HERE

If respondent answered NO to questions 5 and 6 – then go to question 26.

If respondent answered more than 5 years ago to questions 5B AND 6B – then go to question 26.

Otherwise - interview is to confirm that either the close call or the accident was the MOST recent experience. For example – if the close call happened 18 months ago, but the accident occurred less than 6 months ago – the interviewer would confirm that the accident is the MOST RECENT experience.

If the MOST RECENT experience for the close call and the accident was the same, then all questions herein are to use the word accident as the incident description.

Read aloud to participant…Now thinking of your most recent experience which was the [INSERT "close call" or "accident" DEPENDING ON WHICH IS MOST RECENT] you just described…

Q7. What was the purpose of your journey? [S/R]

1. Commuting to or from work
2. As part of work
3. Social activities
4. Shopping
5. Holiday travel
6. Voluntary and community activities
7. Active leisure (such as exercise or sport)
8. Child care
9. Education
10. Personal care
11. Passive leisure (such as traveling to borrow a book or DVD)
12. Other

SPECIFY_____

Q8. What was the intended length of your journey? [READ OUT] [S/R]

1. Less than 5 kms
2. Between 5 and 10kms
3. Between 11 and 20 kms
4. Between 21 and 50 kms
5. Between 51 and 80 kms
6. Between 81 and 100kms
7. More than 100kms but less than 200kms
8. More than 201kms but less than 300 kms
9. More than 301kms

Q9. How far away were you from your destination? [READ OUT] [S/R]

1. Less than 5 kms
2. Between 5 and 10kms
3. Between 11 and 20 kms
4. Between 21 and 50 kms
5. Between 51 and 80 kms
6. Between 81 and 100kms
7. More than 100kms but less than 200kms
8. More than 201kms but less than 300 kms
9. More than 301kms

Q10. How long had you been driving? [READ OUT] [S/R]

1. Less than 10 minutes

2. 10 minutes or more but less than 30 minutes
3. 30 minutes or more but less than 1 hour
4. 1 hour or more but less than 2 hours
5. 2 hours or more but less than 3 hours
6. 3 hours or more

Q11. On what sort of road environment did the [CLOSE CALL/ACCIDENT] occur? [READ OUT] [S/R]

1. Local/neighbourhood street with a default urban speed limit of 50km/h
2. Built up area with buildings and street lights and with a speed limit greater than 50km/h but not exceeding 80km/h
3. On a Motorway – large road (usually more than 2 lanes in each direction) designed to move a lot of traffic quickly. Usually with a 100 or 110km/h speed limit
4. Two-lane (one lane in each direction) country road, usually with a 100km/h speed limit

Q12. On the day of the [CLOSE CALL/ACCIDENT], approximately what time did you wake up? check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

Q13. What was the approximate start time of your journey? check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

Q14. What was the approximate time of the [CLOSE CALL/ACCIDENT]? check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

Q15. Was the incident reported to the Police?

1. Yes
2. No
3. Unsure

Q16. Were any charges laid by the police AGAINST YOU AS THE DRIVER ? (e.g., negligent driving, undue care and attention etc)? PROMPT IF NECESSARY

1. Yes
2. No
3. Unsure

Read aloud to participant…Still thinking of your most recent experience which was the [INSERT "close call" or "accident" DEPENDING ON WHICH IS MOST RECENT]

Q17. Had you consumed any alcohol in the 12 hours prior to the incident occurring?

1. Yes – Go to QUESTION 18.
2. No Go to QUESTION 20.
3. Unsure - Go to QUESTION 20.
4. Refused - Go to QUESTION 20.

Q18. How much alcohol had you consumed in the 12 hours prior to the incident occurring? WRITE RESPONSE and go to QUESTION 19.

Record verbatim

Q19. How much of this alcohol was consumed in the hour prior to the incident occurring? WRITE RESPONSE

Record verbatim

Q20. Had you taken any prescription medication in the 12 hours prior to the incident occurring?

1. Yes - Go to QUESTION 21.
2. No Go to QUESTION 23
3. Unsure Go to QUESTION 23
4. Refused Go to QUESTION 23.

Q21. Was this prescription medication taken in the hour prior to the incident occurring?

1. YES - Go to QUESTION 22
2. NO - Go to QUESTION 22.
3. Unsure – - Go to QUESTION 22
4. Refused Go to QUESTION 22

Q22. Does taking this prescription medication make you feel sleepy or less alert?

1. YES Go to QUESTION 23.
2. NO Go to QUESTION 23.
3. Unsure Go to QUESTION 23.
4. Refused Go to QUESTION 23.

Q23. Had you taken any over the counter medication in the 12 hours prior to the incident occurring?

1. Yes - Go to QUESTION 24.
2. No Go to QUESTION 26

3. Unsure Go to QUESTION 26
4. Refused Go to QUESTION 26

Q24. Was this over the counter medication taken in the hour prior to the incident occurring?

1. YES - Go to QUESTION 25
2. NO - Go to QUESTION 25.
3. Unsure – - Go to QUESTION 25
4. Refused Go to QUESTION 25

Q25. Does taking this over the counter medication make you feel sleepy or less alert?

1. YES Go to QUESTION 26.
2. NO Go to QUESTION 26.
3. Unsure Go to QUESTION 26.
4. Refused Go to QUESTION 26.

GENERAL SLEEP HEALTH QUESTIONS

Q26. Do you have difficulty getting to sleep or staying asleep? [PROMPT] [S/R]

1. Yes - mild problems
2. Yes - severe difficulty
3. No

Q27. Do you feel tired during the day, even after a full night's sleep? [PROMPT] [S/R]

1. Yes occasionally
2. Yes frequently
3. No

Q28. How would you rate the quality of your normal sleep? [PROMPT] [S/R]

1. Poor
2. Average
3. Good
4. Excellent

Q29. Has your doctor told you that you have sleep apnoea?

1. Yes
2. No

Q30. In an average working week, how many hours sleep do you get each day?

1. Less than 5hrs
2. 5 or more hours but less than 6hrs
3. 6 or more hours but less than 7hrs
4. 7 or more hours but less than 8hrs
5. 8 or more hours but less than 9hrs
6. 9 or more hours but less than 10hrs
7. 10 or more hours

Q31. On an typical day, what is you usual waking time? check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

GENERAL DRIVING QUESTIONS

Q32. Have you ever had a 'close call' – *meaning a near-accident when you were driving or if you drove outside of your designated lane FOR ANY REASON OTHER THAN BEING SLEEPY?*

1. YES
2. NO – GO TO QUESTION 33

Q32A. How many times have you had a 'close call' *FOR ANY REASON OTHER THAN BEING SLEEPY?*

(WRITE RESPONSE)

Q32B. How long ago was your most recent close call when driving *FOR ANY REASON OTHER THAN BEING SLEEPY?*

1. Less than 6 months
2. 6 to 12 months
3. 12 to 18 months
4. 18 to 24 months
5. 24 to 36 months
6. 3 to 5 years

>>

7. LONGER THAN 5 YEARS AGO SPECIFY_____

Q32C. In which State/Territory were you living in at the time of the most recent close call?

1. NSW
2. ACT

3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. WAS LIVING O/S

Q32D. In which State/Territory did the close call occur?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. HAPPENED O/S

Q32E. What type of vehicle were you driving at the time of the most recent close call?

1. A standard car
2. A motorcycle
3. Ute
4. Van
5. A four-wheel drive
6. A heavy vehicle (such as a truck or bus that you need a heavy vehicle licence to drive)
7. Other SPECIFY_____

Q33. Have you ever had an accident meaning *where the vehicle was damaged or someone got hurt or the police were called* when you were driving *FOR ANY REASON OTHER THAN SLEEPY?*

1. YES
2. NO – GO TO QUESTION QUALIFIER

Q33A. How many times have you had an accident when driving *FOR ANY REASON OTHER THAN SLEEPY?*

(WRITE RESPONSE)

Q33B. How long ago was your most recent accident when driving *FOR ANY REASON OTHER THAN SLEEPY?*

1. Less than 6 months
2. 6 to 12 months

3. 12 to 18 months
4. 18 to 24 months
5. 24 to 36 months
6. 3 to 5 years

>>

7. LONGER THAN 5 YEARS AGO, SPECIFY_____

Q33C. In which State/Territory were you living in at the time of the most recent accident?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. WAS LIVING O/S

Q33D. In which State/Territory did the accident occur?

1. NSW
2. ACT
3. VIC
4. TAS
5. SA
6. WA
7. NT
8. QLD
9. HAPPENED O/S

Q33E. What type of vehicle were you driving at the time of the most recent accident?

1. A standard car
2. A motorcycle
3. Ute
4. Van
5. A four-wheel drive
6. A heavy vehicle (such as a truck or bus that you need a heavy vehicle licence to drive)
7. Other Specify_____

QUALIFIERS HERE

If respondent answered NO to questions 32 AND 33 GOTO DEMOGRAPHICS

If respondent answered more than 5 years ago to questions 32B AND 33B – then go to question 26.

Otherwise - interview is to confirm that either the close call or the accident was the MOST recent experience. For example – if the close call happened 18 months ago, but the accident occurred less than 6 months ago – the interviewer would confirm that the accident is the MOST RECENT experience.

If the MOST RECENT experience for the close call and the accident was the same, then all questions herein are to use the word accident as the incident description.

Q34. On the day of the most recent incident [INSERT "close call" or "accident" DEPENDING ON WHICH IS MOST RECENT], approximately what time did you wake up? – check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

Q35. What was the approximate start time of your journey? – check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

Q36. What was the approximate time of the close call or crash?– check am or pm?

RECORD RESPONSE HOUR MINUTE AM/PM

DEMOGRAPHIC QUESTIONS

Q37. What is the highest level of education that you have completed…is it

1. Primary School (e.g. grades 1-6)
2. Lower Secondary School (e.g. grades 7-10) – School Certificate
3. Upper Secondary School (e.g. grades 10-12) – High School Certificate
4. Trade Certificate (4 years duration)
5. Diploma or Certificate taking 12 months or more full time
6. Diploma or Certificate taking less than 12 months full time
7. University – Undergraduate / Bachelor Degree
8. University – Post Graduate
9. Other (specify)
10. Refused

Q38. Which of the following best describes your current work situation? [PROMPT] [S/R] [INTERVIEWER NOTE: IF RESPONDENT SAYS SELF EMPLOYED OR STUDENT PROBE FOR EMPLOYMENT STATUS]

1. Full time home duties GO TO q39
2. Employed full time GO TO q38A
3. Employed part time GO TO q38A
4. Employed casually GO TO q38A
5. Retired GO TO q39
6. Unemployed GO TO q39
7. Student – no other employment GO TO q39
8. Disability/unable to work GO TO q39
9. Other (specify) GO TO q38A
10. Refused GO TO q39

Q38a. Does your employment encompass permanent night shift work or is rotating night shift work ? [PROMPT] [S/R]

1. Yes encompasses permanent night shift work
2. Yes encompasses rotating night shift work
3. No

Q39. Which of the following best describes how much you drive for work (not including driving to and from work) [READ OUT SINGLE RESPONSE]

1. I do not drive at all for work
2. I drive in urban areas during the day only
3. I drive in urban areas mostly at night
4. I drive long distances
5. Other (please state) _____

Q40. Which of the following best describes how much you drive for non-work reasons (not including driving to and from work)

1 I drive in urban areas mostly during the day and occasionally at night

2 I drive in urban areas mostly at night

3 I often drive long distances mostly during the day
4 I often drive long distances mostly at night
5 Other (please state) _____

Q41. What type of vehicle do you drive most often?

1 A standard car
2 A motorcycle
3 Ute
4 Van
5 A four-wheel drive

6 A heavy vehicle (such as a truck or bus that you need a heavy vehicle licence to drive)
7 Other SPECIFY_____

Q43. WHAT IS YOUR Country of Birth?
1 Australia
2 Other – SPECIFY_____go to Question 44.

Q44. If not Australia – what year did you arrive in Australia? [RECORD RESPONSE]

Appendix B

New South Wales Roads and Traffic Authority Proxy Definition

- The vehicle's controller was described by police as being asleep, drowsy or fatigued,
- The vehicle was involved in a head-on crash while travelling on the wrong side of the road (but was not overtaking and there were no other relevant mitigating circumstances), or
- The vehicle ran off the road (a straight section or the outside of a curve) but the vehicle was not considered to be travelling at an excessive speed.

Queensland Transport Proxy Definition

- Where the reporting police officer identifies a contributing circumstance is a driver or rider who fell asleep or is otherwise attributed with fatigue, or
- A single vehicle crash within a speed zone of 100 km/h or greater, between 2pm to 4pm or 10pm to 6am (typical fatigue times), or
- A crash where a vehicle leaves the roadway with the driver not attempting to avoid the crash.

Australian Transport Safety Bureau Proxy Definition

- include single vehicle crashes that occurred during 'critical times' (midnight-6am and 2pm-4pm)
- include head-on collisions where neither vehicle was overtaking at the time
- exclude crashes that
  - occurred on roads with speed limits under 80 km/h
  - involved pedestrians
  - involved unlicensed drivers
  - involved drivers with BAC over 0.05%.