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**TITLE:** Age and gender comparisons of driving while sleepy: Behaviours and risk perceptions.

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## **ABSTRACT**

To assist road safety professionals in developing effective strategies to combat the risk associated with driving while fatigued, a survey was administered to 1000 Australian drivers. Participants reported their past behaviours in regards to driving while sleepy and their perceptions of risk associated with driving fatigued as compared to speeding and driving under the influence of alcohol. Although participants appeared to be aware of the substantial risk associated with driving while sleepy, many drivers reported that they frequently drive when sleepy. Age and gender comparisons, revealed that risk taking behaviour in regards to driving while sleepy is occurring across all age groups and in both male and female drivers. Overall young to middle age drivers and male drivers reported the highest frequency of driving while sleepy and reported the lowest perceived personal risk in regards to driving while sleepy.

## **Introduction**

In Australia, fatigue has been recognised as the primary contributing factor in approximately six percent of all crashes and 15 percent of all fatal crashes (Legislative Assembly of Queensland, 2005). Despite the risks associated with driving while fatigued, many drivers continue driving after recognising the signs of sleepiness. Survey research conducted in Australia identified that participants frequently reported driving at times when they felt sleepy (Smith, Carrington, & Trinder, 2005). This finding is consistent with research conducted in other countries. For example, researchers in Norway found that 73 percent of drivers reported having continued to drive even when they felt too tired drive (Nordbakke & Sagberg, 2007). Similarly, in America 32 percent of survey respondents reported driving drowsy at least once per month, with 36 percent reporting having fallen asleep while driving (National Sleep Foundation, 2008).

Consistent with previous research, the current study will identify how frequently road users engage in driving while sleepy. The current study will then expand upon previous research by investigating risk perceptions pertaining to fatigue as compared to other road safety risk factors including speeding and drink driving. Australian traffic authorities recognise speeding, drink driving and fatigue to be major contributing factors in fatal traffic incidents (Knowles & Tay, 2002). Furthermore it has been acknowledged that fatigue can have similar impairments on driving ability to alcohol. More specifically, Williamson, Feyer, Friswell and Finlay-Brown (2000) report that similar levels of driving impairment result from remaining awake for 17 hours as having a blood alcohol concentration (BAC) of 0.05. Also a matched sample study conducted in America has identified that sleep impairments of as little as two hours at night produced a similar level of performance impairment to that observed from the participants driving with a mean BAC of 0.089 (Powell, Schechtman, Riley, Li, Troell, & Guilleminault, 2001). Given that research suggests that the potential risks of driving while fatigued are similar to the risks of driving under the influence of alcohol, the current study will investigate whether fatigue is perceived to be of a similar level of risk to alcohol and another established risk factor, speed.

The current study will also investigate the perceived risk associated with driving during peak times for fatigue related incidents. Researchers from around the world including the United Kingdom (Horne & Reyner, 1995), United States (Pack, Pack, Rodgman, Cucchiara, Dinges & Schwab, 1995), France (Philip, et al. 1996), and Israel (Zomer & Lavie, 1990), have identified a time-of-day pattern in sleep related motor vehicle incidents. Consistent with the natural dips in alertness associated with the human circadian rhythm, sleep related motor vehicle incidents peak between 2:00am-6:00am and 2:00pm-4:00pm.

Although all drivers are vulnerable to increased feelings of drowsiness between midnight and 7.00am, younger drivers appear to be at an increased risk of fatigue-related incidents during the night-time hours (Pack et al., 1995; Wang, Knipling, & Goodman, 1996). In comparison, road users aged over 50 years are more often involved in afternoon fatigue related incidents (Australian Transport Council, 2008). Concerns have recently been raised regarding the vulnerability of adolescents to risks associated with driving while fatigued due to their hazard perception and lifestyle. More specifically it has been noted that younger drivers tend to perceive hazardous situations, such as late night driving while sleepy, as less risky than older drivers (Ferguson, 2003). Due to social and lifestyle factors, youth may also engage in more driving in the early morning hours than older adults (Horne et al., 1995). Smith et al. (2005) has noted that almost two-thirds of all sleepiness related crashes involve young adults.

As previous researchers have identified young road users as a vulnerable group, the current study will compare driving behaviours and risk perceptions based on age across a sample of Australian drivers. The current study will also compare behaviours and perceptions between male

and female drivers. In regards to gender, several sources have identified male road users as more frequently involved in fatigue related incidents than females (Dobbie, 2002; Horne et al., 1995). For example a review of Australian fatigue related single vehicle crashes revealed that approximately 75 percent of the drivers and riders were male (Dobbie, 2002). Differences in behaviours and risk perceptions between age groups and between males and females will then be considered in regards to implications for road safety professionals.

## **Method**

To recruit Queensland drivers to participate in this study, 1000 Royal Automobile Club of Queensland (RACQ) members were randomly selected from the Australian RACQ membership database. The researchers arranged for the RACQ to mail out 1000 surveys. From these three hundred and five members returned surveys representing a 31 percent response rate. There were 114 males (37 percent) and 191 females (63 percent). Ages ranged from 17-78 years with a mean of 44.67 years ( $SD = 17.64$ ). Forty-six percent had a tertiary education qualification, 5 percent a trade qualification, 30 percent a senior high school certificate, 15 percent a junior high school certificate, and 4 percent had completed primary school only. In regards to participant's occupation, 57 percent were daytime workers, 17 percent shift workers, and 26 percent were not working (retired, unemployed, primary carers, or students).

The survey was developed by the researchers to explore participants' past behaviours in regards to driving while fatigued and their perceptions of risk associated with driving fatigued as compared to other driving risk factors. To explore past behaviours the researchers developed three items. Participants were asked to indicate whether they had ever felt sleepy while driving and whether they had ever had a 'close call' on the road because they were sleepy. A forced choice response format of yes or no was used for these two items. The third item asked participants to indicate how often they continue to drive after noticing symptoms of being sleepy. Participants selected their responses from a Likert scale ranging from one representing never, to 10 representing often.

To explore participant's risk perceptions the researchers developed six items. Using a Likert scale ranging from one representing no risk at all, to 10 representing extremely high risk, participants were asked to rate their risk of having a road crash in relation to six situations. These situations specified one of the following driving risks: fatigue; alcohol; speed. Two items were developed to assess each of the risk factors in isolation. For example the item 'what is the risk of driving at 4 o'clock in the morning' was developed to assess perceptions of risk associated with possible fatigue associated with the low point of the circadian daily cycle.

Upon completing the survey, participants were asked to return the survey directly to researchers in the supplied reply paid envelope. A complimentary tea bag was included with the survey as an incentive to participate in the research.

## **Results**

Analyses of self-reported past behaviours identified that driving while fatigued was common in this sample of Australian drivers. Seventy-seven percent of participants reported that they had driven while feeling sleepy. A significant difference in reported driving while sleepy was observed between age groups of drivers  $F(5, 294) = 3.53, p < .005$ . Post hoc comparisons with Bonferroni adjustments revealed that drivers aged between 35-44 years were significantly more likely to report driving while sleepy than drivers aged 65 years and over  $F(5, 294) = 3.53, p < .01$ . No significant difference was observed between genders for reported driving while sleepy.

When asked to indicate how often they continue to drive after noticing symptoms of being sleepy, on a scale ranging from one representing never to 10 representing often, the mean participant score was 3.7. Only twelve percent of participants indicated that they never drive after noticing symptoms of being sleepy. Twenty percent of participants selected five or above, indicating that they drive while sleepy relatively frequently. A significant difference in reported frequency of driving after noticing symptoms of being sleepy was observed between age groups of drivers  $F(5, 287) = 4.43, p < .005$ . Post hoc comparisons with Bonferroni adjustments revealed that drivers aged between 25-34 years were significantly more likely to report driving after noticing symptoms of being sleepy than drivers aged between 55-64 years  $F(5, 287) = 3.53, p < .05$  and drivers aged 65 years and over  $F(5, 287) = 3.53, p < .01$ . More specifically, only nine percent of participants aged between 25-34 years indicated that they never drive after noticing symptoms of being sleepy. In comparison, 20 percent of participants aged between 55-64 years and 23 percent of participants aged 65 years and over indicated that they never drive after noticing symptoms of being sleepy. Furthermore, 45 percent of participants aged between 25-34 years indicated that they drive while sleepy relatively frequently by selecting five or above. In comparison, 22 percent of participants aged between 55-64 years and 18 percent of participants aged 65 years and over selected five or above. A significant difference in reported frequency of driving after noticing symptoms of being sleepy was also observed between males and females  $\chi^2(9, 293) = 20.81, p < .05$ . Six percent of males, as compared to 17 percent of females, indicated that they never drive after noticing symptoms of being sleepy. Furthermore, 36 percent of males, as compared to 30 percent of females selected five or above.

In regards to consequences of driving while fatigued, 30 percent of participants reported having experienced a close call on the road due to being sleepy. No significant difference was observed between age groups in reported close calls experienced due to being sleepy. Males however were significantly more likely to report having a close call due to being sleepy than females  $\chi^2(1, 302) = 6.65, p < .01$ . More specifically 39 percent of males, as compared to 25 percent of females, reported experiencing a close call due to being sleepy.

Participants' perceptions regarding road safety risk factors including fatigue, speeding and drink driving were investigated. On a scale ranging from one representing no risk at all to 10 representing extremely high risk, only driving with a BAC of less than .05 was perceived to be low risk ( $M = 3.73, SD = 1.78$ ). Driving at 4am ( $M = 5.79, SD = 2.61$ ) was perceived to pose a similar level of moderate risk as driving at 10 kilometres over the speed limit ( $M = 5.85, SD = 2.28$ ). Driving situations that were perceived to involve more risk comprised driving with a BAC of greater than .05 ( $M = 7.72, SD = 1.91$ ), driving when sleepy ( $M = 8.27, SD = 1.66$ ) and driving 30 kilometres over the speed limit ( $M = 8.60, SD = 1.46$ ). Driving when sleepy was the only situation where a significant difference was identified between age groups.  $F(5, 292) = 4.25, p < .001$ . Post hoc comparisons with Bonferroni adjustments revealed that drivers aged between 17-24 years perceived driving when sleepy to be significantly less risky ( $M = 7.61, SD = 1.42$ ) than drivers aged between 45-54 years ( $M = 8.57, SD = 1.51$ )  $F(5, 287) = 3.53, p < .05$  and drivers aged between 55-64 years ( $M = 8.67, SD = 1.41$ )  $F(5, 287) = 3.53, p < .001$ . Females perceived three of the six situations to be significantly more risky than males. These comprised driving at 10 kilometres over the speed limit (Female  $M = 6.13, SD = 2.13$ ; Male  $M = 5.31, SD = 2.41$ ;  $\chi^2(8, 293) = 15.71, p < .05$ ), driving 30 kilometres over the speed limit (Female  $M = 8.80, SD = 1.40$ ; Male  $M = 8.23, SD = 1.49$ ;  $\chi^2(6, 299) = 14.76, p < .05$ ) and driving at 4am (Female  $M = 6.02, SD = 2.61$ ; Male  $M = 5.27, SD = 2.50$ ;  $\chi^2(9, 289) = 12.87, p < .05$ ).

## Discussion

The current study identified that almost 80 percent of the sample reported having driven while sleepy. Furthermore 20 percent of the sample reported having driven while sleepy relatively frequently. Consistent with previous research (Smith, et al., 2005; Nordbakke et al., 2007), these findings suggest that driving while fatigued is a common experience for many drivers. The current study also identified that driving while fatigued has consequences. In this study, thirty percent of drivers reported having experienced a close call on the road due to being sleepy. This finding is consistent with American research that found 36 percent of survey respondents reported having fallen asleep while driving (National Sleep Foundation, 2008).

Participants appeared to be aware of the substantial risk associated with driving while sleepy. They rated their perceived personal risk of having a road crash as a result of driving while sleepy to be high. This level of perceived personal risk was consistent with their perceptions of personal risk associated with driving with a BAC of greater than .05 and driving 30 kilometres over the speed limit. Interestingly, although research suggests that driving performance is substantially impaired in the early morning hours due to the biological circadian rhythm, participants perceived that driving at 4:00am would only pose a moderate risk. Given that operating a vehicle between the hours of 2:00am-6:00am and 2:00pm-4:00pm is associated with a high crash risk (Horne & Reyner, 2001), the authors suggest that drivers need to be educated about the circadian rhythm and the associated impairments to driving ability.

In regards to age, drivers aged between 25-34 years reported the highest frequency of continuing to drive after noticing symptoms of being sleepy. Forty-five percent of participants from this age group indicated that they regularly drive while sleepy. As this age group rated their perceived personal risk of having a road crash as a result of driving while sleepy to be high, they appear to be knowingly engaging in a high risk activity. Future research could explore what compels drivers, and in particular drivers aged between 25-34 years to accept the high level of risk associated with operating a vehicle while sleepy. To develop appropriate countermeasures, it would be worthwhile investigating the motivators for driving while fatigued. For example drivers from this age group may be regularly operating a vehicle when fatigued as a consequence of shift work, post-partum experiences or social and recreational experiences. The optimal method of motivating drivers to manage their fatigue related driving risk may vary in regards to each of these contributing lifestyle factors. It is also worth noting that consistent with previous research (Ferguson, 2003), the current study identified that younger drivers perceived driving while sleepy to be less risky than mature drivers. This finding would suggest that younger drivers may benefit from risk awareness raising initiatives.

In regards to gender, males reported more frequently continuing to drive after noticing symptoms of being sleepy than females. Males were also more likely to report having a close call due to being sleepy than females. These findings are in line with previous research that has identified male road users as more frequently being involved in fatigue-related incidents than females (Dobbie, 2002; Horne et al., 1995). Not only do males appear to engage in driving while fatigued more frequently than females, the current research identified that driving at 4:00am, a time associated with high fatigue, was perceived to be less risky by males as compared to females. Given that driving while fatigued is a common experience for many drivers, future research should be conducted to assist road safety professionals in developing effective countermeasures for all drivers and in particular, young male drivers.

## References

- Dobbie, K. (2002). Fatigue-related crashes: An analysis of fatigue-related crashes on Australian roads using an operational definition of fatigue. Road Safety Research Report OR23. Australian Transport Safety Bureau, Canberra.
- Ferguson, S. (2003). Other high-risk factors for young drivers – how graduated licensing does, doesn't, or could address them. *J Safety Res*, 34(1), 71-77.
- Horne, J. A., & Reyner, L. A. (1995). Sleep related vehicle accidents. *Br Med J*, 6979, 565-567.
- Horne, J., & Reyner, L. (2001). Sleep-related vehicle accidents: some guides for road safety policies. *Transport Research Part F*, 4, 63-74.
- Knowles, D., & Tay, R. (2002). *Driver Inattention: More Risky than the Fatal Four?* Proceedings of the 2002 Road Safety Research, Policing and Education Conference, Adelaide, SA, pp. 377–392.
- Legislative Assembly of Queensland: Parliamentary Travelsafe Committee. (2005). Driving on empty: Fatigue driving in Queensland. Report No. 43. Queensland Government, Brisbane.
- National Sleep Foundation (2008). Sleep in America poll: Summary of findings. URL: [www.sleepfoundation.org/polls/2000SleepPollExecSumm.pdf](http://www.sleepfoundation.org/polls/2000SleepPollExecSumm.pdf). Retrieved: December 15, 2008.
- Nordbakke, S., & Sagberg, F. (2007). Sleepy at the wheel: Knowledge, symptoms and behaviour among car drivers. *Transport Research Part F*, 10, 1-10.
- Pack, A., Pack, A., Rodgman, E., Cucchiara, A., Dinges, D., & Schwab, C. (1995). Characteristics of crashes attributed to the driver having fallen asleep. *Accid Anal Prev*, 27(6), 769–775.
- Philip P, Ghorayeb I, Stoohs R, Menny, J., Dabadie, P., Bioulac, B. & Guilleminault, C. (1996). Determinants of sleepiness in automobile drivers. *J Psychosom Res*, 41, 279–288.
- Powell, N., Schechtman, K., Riley, R., Li, K., Troell, R., & Guilleminault, C. (2001). The Road to Danger: The Comparative Risks of Driving While Sleepy. *Laryngoscope*, 111, 887-893.
- Smith, S., Carrington, M., & Trinder, J. (2005). Subjective and predicted sleepiness while driving in young adults. *Accid Anal Prev*, 37, 1066-1073.
- Wang, J., Knipling, R., & Goodman, M. (1996). The role of driver inattention in crashes: new statistics from the 1995 crashworthiness data system. Proceedings of the Fortieth Annual Proceedings of the Association for the Advancement of Automotive Medicine, pp. 377–392.
- Williamson, A., Feyer, A., Friswell, R., & Finlay-Brown, S. (2000). Development of measures of fatigue: Using an alcohol comparison to validate the effects of fatigue on performance. Australian Transport Safety Bureau, Canberra.
- Zomer J, & Lavie, P. (1990). Sleep-related automobile accidents—when and who? In: J. A. Horne (Ed.), *Sleep '90*, pp. 448-451, Pontenagel Press, Bochum.