

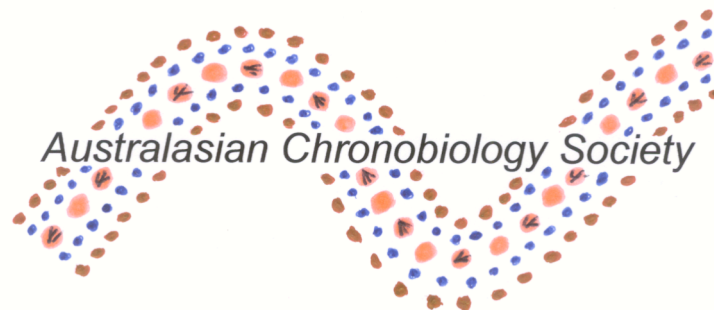
# Living in a 24/7 World:

## The impact of circadian disruption on sleep, work and health

Australasian Chronobiology Society  
7<sup>th</sup> Annual Meeting

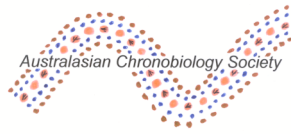
4 – 5 September 2010

University of South Australia, Adelaide, Australia



### Citation

Cortes-Simonet EN, Kennedy GA, Howard M, Gill H, McMahon M (2010). Young drivers' knowledge of road safety, sleepiness and fatigue: Examining the internal consistency of the Institute for Breathing and Sleep Driver Awareness Questionnaire (IBAS-DAQ). In: Sargent C, Darwent D, Roach GD (Eds). *Living in a 24/7 world: The impact of circadian disruption on sleep, work and health*. Australasian Chronobiology Society, Adelaide, Australia, pp. 35-39.



## Chapter 7

# Young drivers' knowledge of road safety, sleepiness and fatigue: Examining the internal consistency of the Institute for Breathing and Sleep Driver Awareness Questionnaire (IBAS-DAQ)

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**Aims:** To evaluate the psychometric qualities of the Institute of Breathing and Sleep Driver Awareness Questionnaire (IBAS-DAQ) and to determine whether gender differences existed in the scores within selected demographic variables and each subscale of the questionnaire.

**Methods:** 176 participants (118 women, 67% and 58 men, 33%) aged between 18 and 26 ( $M = 21.2$ ,  $SD \pm 2.4$ ) were recruited via convenience sampling from a university population and those of whom expressed an interest in participating completed the Institute for Breathing and Sleep Driver Awareness Questionnaire (IBAS-DAQ).

**Results:** Reliability analysis and exploratory principal components factor analysis with a direct oblim rotation revealed that the overall structure of the modified IBAS-DAQ had strong internal consistency ( $\alpha = 0.92$ ). Each of the seven subscales within the IBAS-DAQ had a significant value of sampling adequacy, a linear relationship was observed among the variables and examination of the data indicated that each item was normally distributed. Gender differences within each subscale analysed via parametric two-tailed independent samples *t*-tests indicated that women had significantly higher scores in knowledge relating to fatigue symptoms and had significantly higher risky attitude scores than men. Men consumed more alcohol and had greater driving exposure.

**Discussion:** The IBAS-DAQ was found to have strong internal consistency with the items within each subscale reflecting the different dimensions of the questionnaire including risky attitudes/behaviours and sleep/fatigue knowledge. Evaluating the relationship between these factors and crash risk attempting to modify these factors in young drivers has the potential to impact road crash risk in this population.

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### Introduction

The global burden of motor vehicle accidents has been a major concern of public health and safety authorities for several decades. Reports by the World Health Organization (WHO) have indicated that motor vehicle accidents are the leading global cause of death among 15 to 19 year olds and the second leading cause for those aged 20 to 24 years.<sup>9</sup> In 2007, The Australia Bureau of Statistics

reported that 26.2% of driver deaths involved young drivers (aged 18 to 25), with a large proportion of these involving men and occurring in times of the early morning (between midnight and 6 am).<sup>2</sup> In attempting to understand the aetiology of motor vehicle accidents in younger drivers, various explanations have been proposed and discussed within the scientific and governmental literature.

One of the most highly reported explanations provided in the literature has focused on the impact of undertaking risky driving behaviours whilst driving, which result in an increased risk of collision.<sup>10</sup> Cognitive and physiological maturation and social interactions in adolescence results in increased sensation seeking and heightened levels of perceived locus of control which result in formation of attitudes and engagement in behaviours deemed to be risky.<sup>4,9</sup> This is evident with young drivers, especially men, reporting higher consumption of alcohol than women,<sup>4</sup> having a greater tendency to violate road safety rules and higher engagement in driving habits that are deemed risky (i.e. speeding).<sup>9</sup>

Apart from the examination of risky attitudes/behaviours, there has been an emergence of literature supporting the contribution of other important, but less publicised factors of motor vehicle accidents including sleepiness, fatigue and circadian rhythms.<sup>3</sup> These manifest as physiological symptoms which result in tiredness, drowsiness and reduced concentration which impact upon the ability to undertake cognitively demanding tasks such as driving.<sup>8</sup> The impact and probability of sleepiness causing a motor vehicle collision has been deemed to have a strong association and results from studies utilizing driving simulator tasks have indicated that sleep deprivation impairs cognitive performance similarly to or even greater than the consumption of alcohol.<sup>6</sup> There is also evidence to suggest that younger drivers are more prone to the effects of sleepiness whilst driving compared to older drivers<sup>11</sup> as they lack sleep knowledge, under-estimate their likelihood of falling asleep at the wheel,<sup>8</sup> engage in social activities which limit their amount of sleep, are more prone to sleep pattern dysrhythmias, and in some cases continue to drive even while feeling sleepy.<sup>8</sup> Similarly to the effects of sleepiness, driver fatigue has been implicated in increasing the risk of a

collision in driving simulator tasks<sup>6</sup> as the monotonous nature of driving for a prolonged period of time results in feelings of sleepiness<sup>6</sup> and subsequently increases accident risk.

Circadian rhythms also have a strong influence on driver sleepiness and fatigue as they regulate sleep propensity within individuals' time of day.<sup>1</sup> This impact is more apparent in younger drivers as they frequently engage in driving behaviour in the early morning, which exacerbates the effects of sleepiness, fatigue and alcohol intake on driving performance.<sup>1</sup> In order to highlight this issue and possibly alleviate some of this burden, it has been suggested that educating young drivers in knowledge relating to sleepiness, fatigue and circadian rhythms may be an important means of reducing their involvement in motor vehicle accidents<sup>8,9</sup> by highlighting the importance of sleep hygiene practices in general, and whilst undertaking cognitive demanding tasks such as driving.<sup>8</sup> However, there is a lack of psychometrically scrutinized questionnaire tools available in the literature which evaluates young driver's knowledge about these factors. Based on this premise the IBAS-DAQ was constructed and evaluated so that a measure would be available and utilised in the future.

## Methods

176 volunteers consisting of 118 women and 58 men with a mean age of 21.2 (SD  $\pm$  2.4) years gave informed consent to participate in this study. The sampling procedure was primarily of convenience with questionnaires distributed to students within multiple campuses of Victoria University and to other individuals who met the inclusion criteria (aged between 18-26, current Australian provisional or unrestricted license and ownership/access to a motor vehicle). Those who indicated an expression of interest were also given a plain language statement explaining the various aspects of the research including rationale,

requirements and any associated risks involved.

The research protocol was approved by the Victoria University ethics committee which conforms to the guidelines established by the National Health and Medical Research Council of Australia. The Institute of Breathing and Sleep Driver Awareness Questionnaire (IBAS-DAQ), developed by Austin Health and Victoria University, was used to measure drivers' self-reported risky attitudes/behaviours as well as their knowledge about sleep, fatigue and circadian rhythms with regard to road safety. The 140 item questionnaire (utilising a five-point Likert rating scale) consisted of seven sub-sections including Risky Attitude, Road Rage, Risky Behaviour, Sleep Behaviour Knowledge, Circadian Rhythms Knowledge, Fatigue Symptoms Knowledge and Sleepiness Symptoms Knowledge. The Risky Attitude reflected similar attitudes held by younger drivers in driving practices e.g. 'I think that taking the occasional risk while driving is exciting'. The Road Rage scale reflected signs of road rage e.g. 'I use my horn to express my frustration with other drivers'. The Risky Behaviour scale reflected items regarding risky behaviour while driving e.g. 'drive when under the influence of illegal drugs (e.g. marijuana, speed etc)'. Sleep Behaviour Knowledge reflected sleep hygiene practices e.g. 'going to bed at the same time each night disrupts sleep' Circadian Rhythms Knowledge asked about the effects of driving at different time e.g. 'Driving at 3am involves the same level of risk as driving at 10am'. Fatigue Symptoms Knowledge evaluated signs of fatigue e.g. 'Difficulty concentrating while driving can indicate fatigue' and Sleepiness Symptoms Knowledge evaluated signs of sleepiness e.g.

'yawning can be a sign of sleepiness'. Items were scored out of a maximum mean score of 5. Respondents were also asked some demographic questions relating to their frequency of driving (hours/weeks and kilometers/week) and alcohol consumption.

## Results

The data were entered and analysed using the Statistical Package for the Social Sciences (SPSS Version 15.0). Statistical assumptions were tested to ensure that the data fell within acceptable ranges and were normally distributed whilst descriptive statistics were computed to generate percentages and summarise the data. In order to enhance the internal consistency of each of the subscales, Cronbach's  $\alpha$  was calculated prior to any further analysis and consequently the original 140-item IBAS-DAQ was reduced to 102 items.

Exploratory principal components factor analysis with a direct oblim rotation revealed that the overall structure of the modified IBAS-DAQ had strong internal consistency ( $\alpha = 0.92$ ). The items within each of the seven subscales of the IBAS-DAQ had significant KMO values (measure of sampling adequacy), a linear relationship was observed among the variables (with correlations higher than .3 and confirmed by examination of a scree plot), and examination of the data indicated that each item was normally distributed (refer to Table 1). Gender differences within each subscale analysed via parametric, two-tailed, independent samples *t-tests*, indicated that women had significantly higher scores in knowledge relating to fatigue symptoms and had significantly higher risky attitude scores than men. Men consumed significantly more alcohol and had greater driving exposure (refer to Table 2).

**Table 1.** Descriptive statistics of the final 7 IBAS-DAQ subscales (n = 176).

Subscale	Number of Items	Number of Factor Loadings*	Variance in Scale (%)	Cronbach's $\alpha$
Risky Attitude	5	1	65.6	0.87
Road Rage	9	2	58.3	0.82
Risky Behaviour	22	3	74.2	0.97
Sleep Behaviour Knowledge	12	4	58.3	0.69
Circadian Rhythms Knowledge	15	3	53.8	0.87
Fatigue Symptoms Knowledge	17	3	55.6	0.83
Sleepiness Symptoms Knowledge	7	1	51	0.84

Note: \* Factors with Eigenvalues exceeding 1.

**Table 2.** Gender differences in driving demographics, alcohol consumption and IBAS-DAQ scores.

	Women (n = 118)		Men (n = 58)		t-test	
	Mean	SD	Mean	SD	t	df
<b>Demographic Variables</b>						
Amount of Driving (km/wk)	218.5	154.4	285.4	209.3	-2.3*	43
Duration of Driving (hr/wk)	9.2	8.9	12.5	7.7	-2.4*	174
Alcohol Consumption (drinks/wk)	3.6	6.2	8.8	9.8	-3.7***	176
<b>IBAS-DAQ Subscales</b>						
Risky Attitude	2.90	0.72	2.49	0.84	3.33**	174
Road Rage	3.68	0.72	3.76	0.58	-0.76	138
Risky Behaviour	3.42	1.10	3.48	1.07	-0.36	174
Sleep Behaviour Knowledge	3.69	0.46	3.59	0.42	1.35	174
Circadian Rhythms Knowledge	3.43	0.59	3.26	0.66	1.67	174
Fatigue Symptoms Knowledge	4.10	0.45	3.87	0.47	3.20**	174
Sleepiness Symptoms Knowledge	4.40	0.47	4.27	0.50	1.67	174

Note: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ , df = degrees of freedom.

## Discussion

The IBAS-DAQ was found to have strong internal consistency within each subscale (Cronbach's  $\alpha$  range of .69 to .97) and that the variance explained by each subscale was over 50% in each of the seven subscales. The items within each of the risky attitude, road rage and risky behaviour subscales had moderate loadings on the factors, reflected the different dimensions of the constructs being measured and focused on the inclination of young drivers to speed, express frustration under heavy traffic conditions and disregard road safety rules.<sup>4,9,10</sup> In addition, sleep behaviour knowledge, circadian rhythms knowledge, fatigue symptoms knowledge and sleepiness symptoms knowledge items had moderate loadings and reflected sleep practices, the time of day effects on driving, the impact of alcohol consumption during specific times of

early morning and the symptoms associated with driving for prolonged periods of time.<sup>1,6,8</sup> The results also showed that men had significantly higher driving exposure and consumed more alcohol than women which conforms to previous findings.<sup>4,9</sup> Unexpectedly, women displayed higher levels of risky attitudes than men which, according to Krahe (2005), may represent a current socio-cultural trend in driving practice, which has indicated an emergence of women displaying higher signs of risky attitudes (e.g., aggressiveness). While mean scores on the Risky Attitudes, Road Rage and Risky Behaviours scales indicated that drivers did not represent a high affinity of these types of attitudes and behaviours, and whilst knowledge of sleep behaviour, circadian rhythms, fatigue symptoms and sleepiness symptoms was deemed acceptable, there is always room for improvement.

These findings and previous research suggest that highlighting the importance of education about these factors would be beneficial in young drivers to assess the associated risks and dangers involved in driving whilst sleepy and/or fatigued and may subsequently reduce their statistical contribution to motor vehicle accidents.

### Acknowledgements

We would like to thank Dr. Phillip Swann from Vicroads for his valuable support and advice.

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