Accident Analysis and Prevention 112 (2018) 77–83

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Driver education: Enhancing knowledge of sleep, fatigue and risky behaviour to improve decision making in young drivers☆

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A R T I C L E I N F O

Keywords:
Young drivers
Sleepiness
Sleep
Circadian rhythm
Fatigue
Driving education

A B S T R A C T

This study assessed the impact of an education program on knowledge of sleepiness and driving behaviour in young adult drivers and their performance and behaviour during simulated night driving.

Thirty-four participants (18–26 years old) were randomized to receive either a four-week education program about sleep and driving or a control condition. A series of questionnaires were administered to assess knowledge of factors affecting sleep and driving before and after the four-week education program. Participants also completed a two hour driving simulator task at 1am after 17 h of extended wakefulness to assess the impact on driving behaviour.

There was an increase in circadian rhythm knowledge in the intervention group following the education program. Self-reported risky behaviour increased in the control group with no changes in other aspects of sleep knowledge. There were no significant differences in proportion of intervention and control participants who had microsleeps ($p \le .096$), stopped driving due to sleepiness ($p = .107$), recorded objective episodes of drowsiness ($p = .455$), and crashed ($p = .761$), although there was a trend towards more control participants having microsleeps and stopping driving. Those in the intervention group reported higher subjective sleepiness at the end of the drive [M = 6.25, SD = 3.83, $t(31) = 2.15$, $p = .05$] and were more likely to indicate that they would stop driving [M = 3.08, SD = 1.16, $t(31) = 2.24$, $p = .04$].

The education program improved some aspects of driver knowledge about sleep and safety. The results also suggested that the education program lead to an increased awareness of sleepiness. Education about sleep and driving could reduce the risk of drowsy driving and associated road trauma in young drivers, but requires evaluation in a broader sample with assessment of real world driving outcomes.

1. Introduction

In 2010, the global road fatality toll reached approximately 1.24 million, the injury toll reached 30–50 million, and the estimated total cost of fatal and serious injury was US$1855 billion (World Health Organisation, 2013). In Australia, the estimated cost of road trauma is in excess of AU$27 billion and the fatality toll reached 1205 in 2015 (Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2016). Approximately 20%–30% of motor vehicle accidents (MVAs) are caused by sleepiness related fatigue as a result of inadequate sleep, extended duration of wakefulness, driving during circadian nadir and/or sleep disorders (Clarke et al., 2010, Horne and Reyner, 1995; Connor et al., 2002; Martiniuk et al., 2013; Pizza et al., 2010). The sleepiness impairs alertness, concentration and reaction time, and increases the risk of microsleeps. Sleepiness related MVAs are also more likely to result in death or severe injuries (Boyle et al., 2008; Bunn et al., 2005).

Young people (25 years ≤) are at particularly high risk for MVAs, including sleepiness related crashes (Pack et al., 1995). Lack of experience and risk taking behaviours such as recklessness, speeding, and drug and alcohol use contribute to MVA risk in this population (Clarke et al., 2010; Hung and Winston, 2011). In addition, increased social pressures, academic and work demands, and maturational changes experienced during adolescence and early adulthood can lead to sleep deprivation, and in turn, increase the risk of sleepiness-related MVAs

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https://doi.org/10.1016/j.aap.2017.12.017
Received 18 September 2017; Received in revised form 13 November 2017; Accepted 25 December 2017
0001-4575/

(Millman, 2005; Carskadon and Acebo, 2002). Indeed, drivers aged 18–24 are 5–10 times more likely to be involved in a MVA at night (Akestedt and Kecklund, 2001), and male drivers aged 25 or younger are three times more likely to die from a MVA (BITRE, 2012; Toroyan & Peden, 2007) than female drivers. Furthermore, 31% of all young driver fatalities in Australia occur between midnight and 6 a.m. (BITRE, 2009).

While subjective sleepiness is correlated with objective sleepiness (Horne, & Baulk, 2004; Connor et al., 2002), individuals often fail to accurately predict, identify or act on sleepiness while driving (Kaplan et al., 2007). Educating individuals about more specific signs and risk factors for drowsiness and fatigue may help improve driver recognition of sleepiness and decision making (Howard et al., 2014). Education in conjunction with modifying attitudes has been shown to modify speeding behaviour and hazard perception (Fisher et al., 2006; Parker et al., 1996).

This study assessed the impact of an intensive education program on knowledge of sleep and sleepiness in relation to driving in young adults, along with whether the program altered their driving performance and decisions to continue driving while impacted by sleepiness, following a period of extended wakefulness.

2. Methods

2.1. Participants

Thirty-four young adults (18–26) were recruited from Victoria University, Australia. Young drivers were selected because research shows that this group is the most traffic accident prone group due to sleepiness (Pack et al., 1995). Exclusion criteria included; epilepsy, insulin dependent diabetes, chronic psychiatric illness, visual impairment not corrected by wearing eye-glasses, inability to read or write English, five or more caffeinated drinks per day, ten or more cigarettes per day, and significant daytime sleepiness (Epworth Sleepiness Scale score > 15). Inclusion criteria included; aged 18–26, Australian Driver's License, access to a motor vehicle and computer. Ethical approval was granted by the Austin Health Human Research Ethics Committee.

2.2. Design

A randomised, controlled, parallel group trial was used to assess the impact of a sleep and driving education program on sleep and driving knowledge and decision making during simulated driving. Participation began with an hour briefing session where the participants were consented, completed baseline questionnaires to assess knowledge related to sleep, driving and risk taking behaviour (IBAS-DAQ, ESS, and MAPS, refer to Section 2.3 for details), and had a ten-minute practice session on the simulator. The participants were also randomised into and completed the intervention/control conditions (see details in Section 2.4). During the following two weeks, participants reviewed the educational and control material at least three times, and completed an online questionnaire of fifteen multiple choice questions to assess their knowledge and assist with learning.

One month later participants undertook repeat assessment of sleep and driving knowledge and a simulated driving session. During this session, participants were required to restrict their sleep to 5 h. To ensure adherence they called an answering machine at 2 a.m. before going to bed and again upon waking at 7 a.m. (Vakulin et al., 2007). Participants then attended the Sleep Laboratory from 9 p.m that evening until 3 a.m., where they completed the repeat assessment of sleep and driving knowledge (IBAS-DAQ), undertook a ten-minute practice drive and were fitted with an Optalert device (Wilkinson et al., 2013). They were allowed to engage in passive activities, but remained awake at all times. At approximately 1 a.m. (18 h awake), the EEG leads were attached and the participant was briefed about the drive conditions. Following this, they completed the two-hour simulated drive (see Section 2.5 for a description). Fig. 1 illustrates the procedure of this study in diagrammatic form.

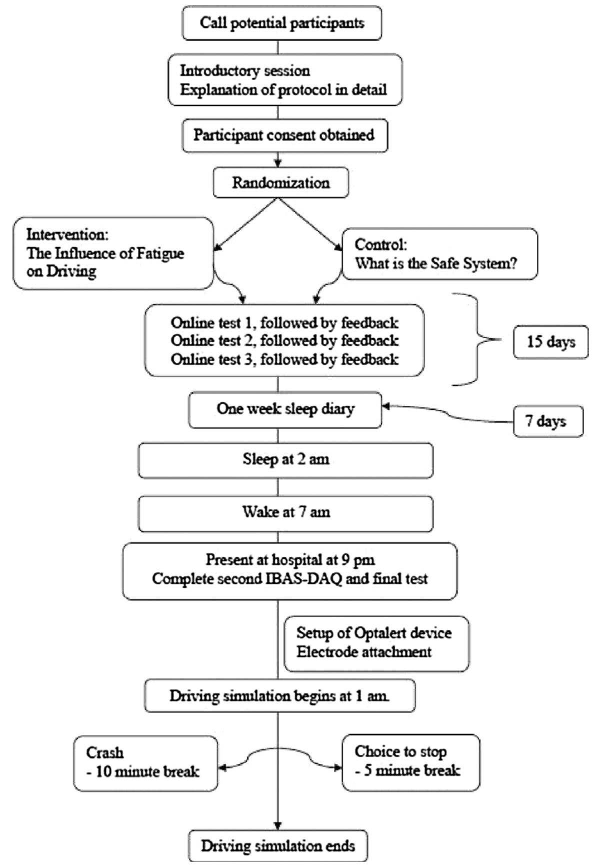

Fig. 1. Procedure of Study.

There were incentives to complete the two-hour drive, but also to undertake the drive in a safe fashion. Participants were advised to stop driving to take a 5 min break at any time if they felt too sleepy to drive safely. They also had to take a compulsory 10 min break if they had a crash. They could not nap, consume any stimulants or perform any strenuous activity during breaks; Participants were told that the breaks did not count towards the 2 h of driving time. Hence, there was an incentive to minimise breaks and crashes to finish the drive as quickly as possible. Although participants were not advised in advance, the drive was terminated at 4 a.m. regardless of total driving time or breaks. Objective sleepiness questionnaires were completed at drive completion defined by; 2 h drive completion, decision to stop driving completely, or termination at 4 a.m. Participants were reimbursed $200.00 for completing the study, $100.00 if they elected to stop driving prior to the end of the drive. The participant with the lowest number of crashes, lane and speed deviations throughout the drive received a $200 gift-voucher.

2.3. Measures

2.3.1. Demographic measures

Demographic and vehicle use information were obtained from part one (items 1–15) of the Institute for Breathing and Sleep Driver Awareness Questionnaire (IBAS-DAQ) (Cortes-Simonet et al., 2010; Kennedy et al., 2008). This included participant's age, gender, occupation, smoking status, alcohol consumption, preferred sleep pattern, hours driven per week, kilometres driven since obtaining provisional licence and learners permit, percentage of reason for driving (work, social) and percentage of driver/passenger scenarios.