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Continuing to drive while sleepy: The influence of sleepiness countermeasures, motivation for driving sleepy, and risk perception

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ABSTRACT

Driver sleepiness is a major contributor to road crashes. The current study sought to examine the association between perceptions of effectiveness of six sleepiness countermeasures and their relationship with self-reports of continuing to drive while sleepy among 309 drivers after controlling for the influence of age, sex, motivation for driving sleepy, and risk perception of sleepy driving. The results demonstrate that the variables of age, sex, motivation, and risk perception were significantly associated with self-reports of continuing to drive while sleepy and only one countermeasure was associated with self-reports of continuing to drive while sleepy. Further, it was found that age differences in self-reports of continuing to drive while sleepy was mediated by participants' motivation and risk perception. These findings highlight modifiable factors that could be focused on with interventions that seek to modify drivers' attitudes and behaviours of driving while sleepy.

1. Introduction

Driver sleepiness is a major contributor to road crashes. The level of contribution from sleepiness to fatal and severe crashes is estimated from case–control studies to be approximately 20% (Connor et al., 2002; Kecklund et al., 2012). Reducing the likelihood of having a sleep-related crash can be accomplished by utilising a sleepiness countermeasure (Cummings et al., 2001). A number of sleepiness countermeasures (e.g., rest and nap breaks, swapping the driving) are recommended by traffic authorities. However, some drivers prefer utilising countermeasures that enable them to continue their journey without stopping (e.g., opening the window/turning on the air conditioner, turning on the radio). The association between the perceptions of effectiveness of sleepiness countermeasures and self-reports of continuing to drive while sleepy is unknown.

1.1. Driver sleepiness countermeasures

There are a number of sleepiness countermeasures used by drivers with varying levels of effectiveness. Primarily, when a sleepy driver stops driving and exits the road environment they remove themselves from the danger of a possible crash. Stopping at the roadside for a short duration is known as a rest break. Rest breaks have a short duration of effectiveness for reducing physiological and subjective sleepiness and can improve simulated driving performance such as lateral positioning (Phipps-Nelson et al., 2011). However, the longer term effectiveness of rest breaks have not been demonstrated (Phipps-Nelson et al., 2011; Watling et al., 2014).

The effectiveness of a nap break, a short period of sleep of 15–20 min is suggested as one of the most effective countermeasures to reduce sleep drive. Several studies have found nap breaks reduce levels of physiological and subjective sleepiness and improve simulated driving performance levels, such as lateral positioning (Horne and Reyner, 1996; Leger et al., 2009). Swapping drivers are another commonly promoted countermeasure, where the driver and the passenger/s will alternate between driver and passenger/s. While swapping drivers are commonly promoted by traffic authorities (Department of Transport and Main Roads, 2008), the effectiveness of this countermeasure is unknown. Consuming caffeine is another important driver sleepiness countermeasure and has some measure of effectiveness by increasing arousal. Specifically, caffeine intake has been shown to reduce physiological and subjective sleepiness and reduce indices of lane drifting (De Valck and Cluydts, 2001; Horne and Reyner, 1996).

Drivers also employ a number of countermeasures without stopping the vehicle. These in-vehicle countermeasures include

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listening to music and opening the window/turning on the air conditioner. Listening to music has limited effectiveness for reducing sleepiness. Specifically, music has a small effect for reducing subjective sleepiness (Reyner and Horne, 1998; Schwarz et al., 2012); however, the reductions of physiological sleepiness and improvement of driving performance are less pronounced (Reyner and Horne, 1998). The effect from opening the window/turning on the air conditioner has a small, albeit, transient effect on subjective sleepiness; however, the effect on physiological and driving performance indices are negligible to non-existent (Reyner and Horne, 1998; Schwarz et al., 2012). Overall, in-vehicle countermeasures have limited effectiveness for reducing sleepiness.

1.2. Factors influencing driving while sleepy

An individual's motivation for continuing to drive while sleepy is potentially an important factor. Previous research suggests drivers cite factors associated with destination arrival (i.e., time pressures, close to destination) as reasons for continuing to drive while sleepy (Armstrong et al., 2010; Nordbakke and Sagberg, 2007). Motivation to reach the destination has been associated with truck drivers self-reported instances of falling asleep at the wheel (McCartt et al., 2000). While previous research suggests that the motivation of continuing to drive while sleepy is an important factor, the strength or degree of association with instances of continuing to drive while sleepy has not been previously examined.

Risk perceptions are suggested to be a causal factor for the performance of health behaviours (Janz and Becker, 1984) whereby the more risky a behaviour is perceived, the less likely an individual will perform that behaviour (Helweg-Larsen and Shepperd, 2001). That is, drivers who perceive sleepy driving as a risky behaviour are less likely to perform the behaviour. Yet sleepy driving is not always perceived by drivers as a critical issue for road safety and is typically rated lower than speeding, drink driving, and distracted driving as a crash risk factor (e.g., Pennay, 2008; Vanlaar et al., 2008). To date, no study has examined the influence of risk perception with continuing to drive while sleepy.

1.2.1. Dual process model of decision making

A rational decision making process should theoretically ensure that risky behaviours would rarely be performed. Recent research has shown the utility of dual process models of decision making in relation to performing risky driving behaviours (e.g., McNally and Titchener, 2012; Rhodes and Pivik, 2011). The dual process model suggests that decision making is the outcome of two different modes of information processing; the cognitive and affective processes. The cognitive process is rational, analytical, and measured with the outcome of decisions following a slow effortful and logical evaluation (Epstein, 1994; Slovic et al., 2004). Risk perception is considered as an analogy for the cognitive process.

In contrast, the affective process is experiential, intuitive, and represents decision making based on affect which is typically a fast process (Epstein, 1994; Slovic et al., 2004). In relation to sleepy driving, it could be argued that an antecedent of affective processes could be the motivation to reach the intended destination – as the affective processes are suggested to be formed from experiential processes (Alhakami and Slovic, 1994; Epstein, 1994). Additionally, several studies have demonstrated that experiential and affective based motivations can influence an individual's driving behaviours (McNally and Titchener, 2012; Reyna and Farley, 2006). Therefore, motivation to drive while sleepy could be a pertinent process for continuing to drive while sleepy.

Previous research demonstrates that the demographic factors of age (being younger) and sex (being male) are associated with greater instances of sleepy driving (Anund et al., 2008; Vanlaar et al., 2008; Watling, 2014). The risk perceptions of younger drivers and males drivers for several risky driving behaviours are typically lower when compared to older drivers and female drivers respectively (Harré et al., 2001; Hatfield and Fernandes, 2009). Consequently, research demonstrates younger drivers are more likely to drive during times of high levels of sleepiness, even when they perceive their sleepiness levels to be elevated (Smith et al., 2005). Limited research has examined how the dual process model could contribute to driving while sleepy for these two demographic factors. As such, examining the utility of the dual process model for continuing to drive while sleepy is needed.

1.3. The current study

The reviewed literature suggests that a number of factors could influence self-reports of continuing to drive while sleepy. The first aim sought to examine how demographic factors, motivation, risk perception, and perceptions of the effectiveness of six sleepiness countermeasures were associated with self-reports of continuing to drive while sleepy. The second aim sought to examine if age and sex differences in self-reports of continuing to drive while sleepy was mediated by participants' motivation and risk perception.

2. Method

2.1. Participants

Potential participants were sourced from the Royal Automobile Club of Queensland (RACQ) membership database. The RACQ is a motoring club, which provides roadside assistance, insurance, and other motoring related services to members. A total of 1000 randomly selected RACQ members were invited to participate in the study. In total, 309 completed questionnaires were returned to the researchers (30.90% response rate).

The average age of participants was 44.67 years (SD = 17.64). The majority of the participants were female (62.62%). Over three quarters of participants were employed (78.17%), which included daytime employment (57.39%), regular nightshift work (2.82%), and variable shift work (17.96%). The largest proportion of participants had a tertiary education (45.75%), the remaining participants reported having a secondary education (44.77%), a trade qualification (5.23%), or a primary education (4.25%). The majority of participants' personal driving occurred in urban areas predominantly during the day (88.36%), or during the night (2.05%). The remaining participants reported driving long distances, during the day and night (9.59%).

2.2. Measures

The questionnaire was developed by the researchers to examine several aspects of sleepy driving behaviours and perceptions. Demographic items include age, sex, employment, education, and personal driving routines. The outcome variable assessed how often the participants had continued to drive after noticing symptoms of sleepiness. The wording of this item was "please rate how often you have continued to drive after noticing symptoms of sleepiness". This item used a 10-point Likert scale scored 1 (never) to 10 (frequently).

The motivation to drive while sleepy was assessed with three items. These items focused on continuing to drive sleepy when "close to home", "to get to the destination", and "due to time factors", with participants responding on a dichotomous scale (yes or no). The three items were summated to produce the motivation scale with a range of 0–3; higher scores indicate greater motivation to drive while sleepy. Risk perception of sleepy driving was