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Original article

Can sleep habits predict driver behaviour?

Hygiène du sommeil et accidents de la route

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ABSTRACT

Introduction. – The role of sleep hygiene (those factors that promote or disrupt effective sleep) on human performance was examined.
Objective. – The study investigated the relationship between sleep hygiene and crash involvement.
Method. – Measures of sleep hygiene and crash involvement were considered for a sample of over 6000 drivers.
Results. – It was found that poorer sleep hygiene was associated with younger age and greater crash involvement. The association between sleep hygiene and crash involvement remained when age and risk taking had been taken into account.
Conclusion. – Poor sleep hygiene is associated with poorer performance as measured by crash involvement.

Mots clés :
Hygiène du sommeil
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RÉSUMÉ

Introduction. – Le rôle de l'hygiène du sommeil (les facteurs qui favorisent ou perturbent le sommeil efficace) sur la performance humaine a été étudié.
Objectif. – L'étude a examiné la relation entre l'hygiène du sommeil et le nombre d'accidents de la route.
Méthode. – Les mesures d'hygiène du sommeil et le nombre d'accidents de la route ont été considérés pour un échantillon de plus de 6000 automobilistes.
Résultats. – Il a été constaté qu'une faible hygiène du sommeil est associée à un plus jeune âge et à une plus grande implication dans les accidents de la route. La relation entre hygiène du sommeil et accidents est maintenue quand l'âge et la prise de risque sont contrôlés.
Conclusion. – Le manque d'hygiène de sommeil est associé à une moins bonne performance mesurée par le nombre d'accidents de la route.

1. Introduction

A fairly straightforward approach to understanding accident involvement is to examine the relationship between driver behaviour and crash involvement. If the way that a driver controls the vehicle dictates crash risk, then we might anticipate that we can modify the crash risk by training and licensing. Training ought to be a method by which safe driving may be improved and licensing ought to be a method by which safe driving standards can be implemented. We have major industries such as driver instruction and driver licensing that are predicated on these assumptions. However, the success of this approach is not obvious. If it was the case that vehicle control was a major ingredient in crash risk, then we might anticipate a strong relationship between crash risk and driver training and licensing. A range of reviews have failed to indicate the success of this approach (Brown, Groeger, & Biehl, 1987; Christie, 2001; Ker et al., 2005; Mayew, Simpson, Williams, & Ferguson, 1998; Mayew & Simpson, 2002; Vernick, Li, MacKenzie, Baker, & Gielen, 1999). There is little relationship between driver knowledge licensing tests and crash involvement (Conley & Smiley, 1976; Freeberg & Creech, 1971). Likewise, there is relatively little relationship between performance on a driving test and subsequent crash involvement (Baughan & Sexton, 2002; MacDonald, 1987). Indeed, those who perform most effectively on a driving test (young men) are those who are most, rather than least, likely to be involved in a crash. Even when new driving tests are introduced that are based on standard driving instruction, there is little evidence that they improve the crash rate (Gebers, Romanowicz, & Hagge, 1998;

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Potvin, Champagne, & Laberge-Nadeau, 1988). It is not at all clear that we have truly acknowledged the significance of the proposal that these multimillion dollar industries are simply not based on a solid foundation of evidence. Where driver licensing has a clear and demonstrable impact on crash risk, it often operates through driving exposure and experience. In one case, graduated licensing programs have been shown to be successful in reducing crash risk but the method has been through reducing drivers' exposure to high risk driving such as driving at night and with young passengers. In the other case, there has simply been a considerable increase in driving experience as in the Swedish experience with supervised driving (Gregersen et al., 2000).

There are perhaps some grounds for optimism in the finding that crash risk decreases with experience. If we could capture the key ingredients of experience and if these ingredients could be trained then optimism might be well founded.

The present state of knowledge prompts another line of enquiry. Here the proposal is that it is not so much that drivers know or do not know how to control the vehicle but rather that they fail to do so. Clearly, drivers may fail to do so for a number of reasons. One reason might be through distraction. The increase in crash risk when using a mobile phone might be an example (Redelmeier & Tibshirani, 1997). The point here is that it is not that drivers are unaware of how to control the vehicle but rather that they simply do not do so. Likewise, alcohol is known to inhibit the ability to control the vehicle safely (Zador, Krawchuk, & Voas, 2000).

Another method through which catastrophic failures of vehicle control may occur is through sleepiness. It has generally been noted that sleep-related crashes are typified by the absence of vehicle control such as braking and steering (Horne & Reyner, 1995). Overall estimates indicate that sleepiness may play a role in between 9 and 16% of all accidents and between 15 and 20% on motorways (Horne & Reyner, 1995; Maycock, 1996). It has been reported that that 29% of drivers indicated that they had come close to falling asleep at the wheel in the last year (Maycock, 1996) and that 16% had fallen asleep at the wheel in the last two years (McKenna, 2007). Transient states that curtail sleep such as having a prior night's sleep of less than six hours have been shown to increase crash risk (Hartley, 2004; Stutts, Wilkins, Osberg, & Vaughn, 2003). More permanent circumstances such having a sleep disorder like sleep apnea is associated with a six-fold increase in crash risk (Teran-Santos, Jimenez-Gomez, & Cordero-Guevaro, 1999). While an extreme circumstance, such as having a sleep disorder, might readily be understood to influence crash involvement, the present investigation considers the more commonplace circumstance of sleep habits. Here, the question is whether our everyday sleep hygiene habits have any impact on our crash likelihood. Sleep hygiene refers to behavioural factors associated improvements or decrements in both sleep quantity and sleep quality (Stepanski & Wyatt, 2003). This includes factors such as having a regular bedtime. The interest is in whether a factor that has nothing to do with driving can nevertheless influence crash risk. The idea here is to test the proposal that poor sleep hygiene could render a driver unfit to drive. Whether a measure that has so little to do with driving will have any demonstrable effect is the question at hand.

2. Method

2.1. Participants

A total of 7075 drivers attending speed awareness courses responded to the questions. Of those attending the course 4000 were men and 3075 were women. Age was determined in large part by participants responding in 5-year ranges e.g. 26–30. At the young end an exception was made such that up to age 20, drivers specified their actual age. The modal age of those attending the courses was 36–40 years of age.

Table 1
Logistic regression with accident involvement as dependent variable and sleep hygiene as independent variable.

	B	Exp (B)	95% Confidence interval for Exp (B)	
			Lower	Upper
Sleep hygiene	.544	1.72	1.52	1.95

2.2. Procedure

As part of the speed awareness course, the first session consisted of the computer-based assessment and tailored feedback. The system was designed to be used by people who had little or no experience of computers. All participants were informed that their responses were anonymous and that no questions would or could be used to identify an individual. This was reinforced by the fact that drivers could choose their own computer and no unique identification was requested. They were informed that they would receive feedback and that the accuracy of the feedback was dependent on the accuracy of their answers. The Perception and Performance Driver Risk Profile provided assessment on a range of risk factors including self-report speed, driving violations, using the vehicle as an emotional outlet and attention\ distractibility. In addition, they received a section on fatigue susceptibility within which there was a section on sleep hygiene. The measure consisted of 17 items constructed from known factors that facilitate sleep (e.g. maintaining a regular sleep schedule, avoiding late nights) and those that disrupt sleep (e.g. use of stimulants such as caffeine). Further details on the psychometric properties of the Driver Risk Profile and the sleep hygiene measure can be obtained from McKenna (2008).

At the end of the session drivers received a 5-page printout providing firstly, feedback on their attitudes and ability and secondly, safety messages tailored to their personal responses. The overall session took approximately 40 minutes with a maximum of 1 hour permitted.

3. Results

Providing a characterisation of the measure, sleep hygiene is not simple because it might reasonably be construed as a formative rather than reflective measure. Constructs are usually viewed as reflective in the sense that measures reflect or are caused by the underlying construct. Alternatively, formative measures are viewed as causes of constructs in the sense that the construct is formed from the measures rather than the other way round (Edwards & Bagozzi, 2000). Unlike items used in a reflective measure there is no necessary assumption that items share a common source of variation so statistics such as Cronbach's alpha are not appropriate. Theoretically, it is likely that a measure such as sleep hygiene is formed from diverse variables such as the timing of sleep and use of stimulants such as caffeine. To determine if the sleep hygiene measure could predict crash involvement a logistic regression was carried out. A binary attribute was created for crash involvement (having zero crashes versus having at least one crash). Table 1 indicates that sleep hygiene does predict crash involvement.

3.1. Demographics

Fig. 1 illustrates the age and gender differences in sleep hygiene. ANOVA confirmed that there was a significant effect of age $F(2,6900) = 264.2$, $p < .001$, $\eta_p{}^2 = .07$ indicating poorer sleep hygiene for younger people. The gender difference did not reach conven-