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Thought Leadership:

Chronic sleep deprivation and its connection with distraction

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While the number of road deaths in Australia has dropped over the past four-and-a-half decades, from a peak of 3,798 in 1970 to 1154 in 2014, this decreasing trend has since reversed with total road deaths in 2015 (1209) and 2016 (1293) being higher than that in 2014. The increasing death rate has been slightly ameliorated in 2017, with 1225 road deaths recorded - however this remains a 6% increase from the nadir of 2014.

The major causes of fatalities have historically been referred to as the fatal four – specifically, being intoxicated (drug and/or alcohol), speeding, not wearing seatbelts and being fatigued. However, this has recently been increased to the “fatal five”, with driving while distracted being added to the list of the major causes of road accidents.

Driver distraction has received considerable attention over the past decade arguably due to the proliferation of nomadic technologies that can be used in vehicles. We often think of driver distraction as involving technologies like mobile phones, complex sound systems, on-board DVD players and satellite navigation. However, the causes of distraction are more varied and some of the causes may surprise you.

Driver distraction and inattention were a primary area of analysis in a 2013 Monash University Accident Research Centre (MUARC) study. The researchers analysed a decade of Australian crashes and found that an estimated 15.9% per cent of 340 serious casualty crashes were caused by distraction.

The MUARC study found the most common type of distraction involved in serious crashes was voluntary, non-driving related distractions (accounting for 8.8% of serious crashes) originating within the vehicle, such as passenger interactions (3.2% serious crashes). Another major source of distraction (4.1% serious crashes) was, in fact, internal to the driver – such as disturbing thoughts or feeling stressed. Surprisingly, use of within-vehicle nomadic technology (mobile phone, sound system etc) accounted for only 3.6% of serious crashes.

What this and other studies tell us is that the sources of distraction are endless — from nomadic technologies, to a driver’s internal emotional state, to what events are happening on the side of the road. However, while the sources of distraction are manifold, to date there has been a fairly singular response to mitigating driver distraction with the primary focus being on nomadic technology and regulating drivers’ behaviour via education or legislation.



V. Beanland et al, Driver inattention and driver distraction in serious casualty crashes: Data from the Australian National Crash In-depth Study Accident Analysis and Prevention 54 (2013) 99–107

A. Thomas et al Driver crash risk factors and prevalence evaluation using naturalistic driving data (PNAS 2016 March, 113 (10) 2636-2641)

KJ Parnell et al. Exploring the mechanisms of distraction from in-vehicle technology: The development of the PARRC model Safety Science 87 (2016) 25–37

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While these mitigating strategies play a fundamental role in promoting driver safety, we need to understand a little more fully the mechanisms that make us susceptible to the distraction in the first place. After all, when we are sitting for an important exam, or delivering a presentation to a room full of people we are unlikely to be distracted by our mobile phone. Because of our ability to “select” distraction, theories of distraction have switched over time from considering it as a passive phenomenon that the driver is subjected to, towards a more active process that the driver has control over.

Arguably understanding the factors of this control is therefore key to managing and overcoming the problem of driver distraction.

Distraction may be defined as diversion of attention away from activities critical for safe driving towards a competing activity. In other words, distraction can be thought of simply as our mind moving away from the task at hand to another activity. When we consider it in this way the propensity for mind wandering becomes an important factor in our vulnerability for distraction.

In a French study of 954 drivers injured in a road crash during 2013 – 2015, researchers found 39% of respondents were classified with a mind wandering trait and 13% reported a disturbing thought just before the crash. The study found that both current mind wandering before the crash and the general propensity to mind wander in the everyday life were independently and strongly associated with crash responsibility.



Previous research has shown that mind wandering impacts the neurocognitive processing of external events, dampening response to external stimuli and may also lead to a relative disengagement in the driving task and a propensity in switching from one task to another

The correlation between mind wandering, distraction and crash responsibility is strengthened by research that found that drivers with symptoms of Attention Deficit Hyperactivity Disorder (ADHD) when faced with an external distraction were more than five times more likely to be crash responsible.

Approximately 2-3% of the adult population have ADHD and it is characterised by poor sustained attention, distractibility, impaired impulse control and increased risk-taking behaviour.

However, all of us may well display exactly the same characteristics when in the sleep deprived state.

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Lee, J.D., et al (2008) Defining driver distraction. *Driver Distraction: Theory, Effects and Mitigation*, pp. 31–40.

Gil-Jardine C, et al. (2017) The distracted mind on the wheel: Overall propensity to mind wandering is associated with road crash responsibility. *PLoS ONE* 12(8): e0181327. <https://doi.org/10.1371/journal.pone.0181327>

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Gil-Jardine C, et al. (2017) The distracted mind on the wheel: Overall propensity to mind wandering is associated with road crash responsibility. *PLoS ONE* 12(8): e0181327. <https://doi.org/10.1371/journal.pone.0181327>

El Farouki K. et al. (2014) The Increased Risk of Road Crashes in Attention Deficit Hyperactivity Disorder (ADHD) Adult Drivers: Driven by Distraction? Results from a Responsibility Case-Control Study. *PLoS ONE* 9(12): e115002. doi:10.1371/journal.pone.0115002

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The effects of drowsy driving are well-known and publicised — in the US it is estimated that in 2014, 7 percent of all crashes and 16.5 percent of fatal crashes involved drowsy driving. In Australia the MUARC study found that in the decade 2000 — 2011, drivers falling asleep resulted in 11.8 per cent of serious crashes.

The drowsy driver is readily pictured — the one with heavy eyelids, who yawns repeatedly and has trouble keeping their head up. Usually these characteristics are a consequence of acute sleep deprivation — either the fact of too little sleep in the 24 hours beforehand or the result of maintaining wakefulness for more than 17 hours. In such cases the driver would be experiencing all the well-defined neurocognitive deficits of sleep deprivation including poor sustained attention, distractibility, impaired impulse control and increased risk-taking behaviour – the exact same symptoms associated with ADHD.

However, it is a mistake to restrict the effects of sleep deprivation just to its acute effect, as research has shown that chronic sleep deprivation can also have devastating cognitive effects and mostly without us realising it.

<https://www.nhtsa.gov/risky-driving/drowsy-driving>
Van Dongen et al; The Cumulative Cost of Additional Wakefulness SLEEP, Vol. 26, No. 2, 2003

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Drivers who are sleep deprived experience the same neurocognitive deficits as an individual with Attention Deficit Hyperactivity Disorder (ADHD).

These deficits include poor attention, distractibility, impaired impulse control and increased risk-taking behaviour.

Over the past 50 years our average sleep time has decreased by about 20%, and in our current 24/7 world it is unlikely that this decrease will reverse. While population data indicates that most adults require somewhere between 7-9 hours of sleep per night, it is now common for the working adult to get only 6 hours sleep during the week. It is important therefore to understand whether human sleep can be chronically reduced without consequences.

In a study that did just this, researchers took a group of people and totally deprived them of sleep for 3 nights (0 hours in bed). They took measures of neurocognitive performance and feelings of sleepiness at the beginning of the study period and after the 3 nights of total sleep deprivation and compared these results to those of a group that had been allowed only up to 6 hours of sleep per night for 14 nights. In other words, researchers were looking for the difference between the effects of acute sleep deprivation and those of chronic sleep deprivation.

Unsurprisingly they found that after the regime of total sleep deprivation, subjects reported

intense feelings of sleepiness and displayed significant deficits in their neurocognitive ability — total lack of sleep had caused extreme sleepiness and had eroded their psychomotor vigilance performance, working memory performance and cognitive process performance.

However, chronic lack of sleep is hidden. These drivers are largely not at risk of falling asleep behind the wheel as they do not feel sleepy. They do not form part of the statistic of drowsy driving or driving while fatigued. However, due to their significant cognitive deficits, they are at a significant increased risk of being distracted from the driving task (by maybe using the mobile phone or by setting the GPS or by any other myriad of distractions), and thus join the statistics of another accident caused by distraction.

Chronic lack of sleep has significant consequences personally but also publicly and it is time to educate drivers on the true consequences of their lifestyle choices.

Take home message

Keeping track of how much sleep you are having is important for driver safety. Even if you don't feel tired be aware that, if you have only been managing about 6 hours of nightly sleep over the last week or so, the risk of being distracted is significantly increased. To minimise this, take active steps to restrict the opportunities for distraction — turn off the phone, set and forget the radio, keep eyes on the road etc.