

# ROAD SAFETY IMPLICATIONS OF USING HANDS-FREE MOBILE TELEPHONES WHILE DRIVING

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Original version

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## 1. A BRIEF STATEMENT OF THE ISSUE

The heightened crash risk associated with mobile phone use has led many jurisdictions in Australia and around the world to ban the use of hand-held mobile phones while driving. Typically however, the legislation stops short of banning the use of hands-free mobiles, implying that it is acceptable to use them while driving.

## 2. AN ASSESSMENT OF THE ROAD SAFETY ISSUE

The extent to which mobile phones are used while driving, varies across both time and countries:

- The 2001 Swedish Traffic Safety Survey showed that 73% of all drivers had a mobile phone – three-quarters of which were hand-held – representing a 400% increase over a seven-year period (Thulin and Gustafsson, 2004). As part of the survey, drivers reported that they averaged just over one mobile phone call while driving each day, with many having reported associated risky driving behaviour.
- In the US, it has been estimated that in 2005, 6% of drivers at any given daylight moment used a hand-held mobile phone while driving, with a further 0.7% using hands-free devices. The figures for 2004 were 5% and 0.4%, respectively (NHTSA, 2005).
- In the UK, hand-held mobile phone use while driving a car was found to have decreased over the period 2002-2003, falling from 2.0% to 1.6% - whereas use of hands-free mobiles remained constant at 1.7% (Broughton and Hill, 2005). This decline was attributed to publicity preceding legislation banning the use of hand-held mobiles while driving, which took effect in December 2003.

Using a mobile phone while driving can cause distraction at a number of levels (Direct Line Motor Insurance, 2002). There is physical distraction, with the driver usually being required to drive one-handed, either for the total duration of the call if using a hand-held mobile phone or for some part of the call if using a hands-free device. Using either form of mobile phone also involves visual distraction, particularly when starting and completing calls. Mental distraction seems to be the key factor, with the mobile phone serving to divert a driver's attention from the driving task and the road environment. Auditory distraction is arguably the least dangerous form of distraction, perhaps because auditory cues have a minimal association with safe driving. These forms of distraction can result in various decrements in driving performance and a marked increase in crash involvement, with the weight of evidence

suggesting approximately a four-fold increase in crash risk while driving using a hand-held mobile phone (RoSPA, 2002).

While it appears logical that hand-held mobiles cause more distraction and pose the greater crash risk, it does not follow that hands-free devices are thus safe to use while driving. The exclusion of the latter from most legislation however, implies the contrary.

### **3. CURRENT POLICIES AND PRACTICES IN AUSTRALIAN JURISDICTIONS**

Rule 300 of the Australian Road Rules states that a driver of a vehicle (except an emergency vehicle or police vehicle) must not use a hand-held mobile phone while the vehicle is moving or is stationary (unless parked). Transgressing this rule can result in the loss of demerit points (e.g. three in Victoria and New South Wales, two in Tasmania and three in Western Australia) and a fine (e.g. a \$153 on-the-spot fine in Victoria, \$243 in NSW, \$110 in Tasmania and \$250 in WA). National and local legislation, however, permits the use of hands-free mobile phones.

Currently in New Zealand there is no legal requirement banning the use of mobile phones while driving, although this is being reviewed. Land Transport New Zealand recommends that drivers not make or receive phone calls while driving.

### **4. A REVIEW OF THE RESEARCH - DO HANDS-FREE MOBILE PHONES HAVE A SAFETY ADVANTAGE?**

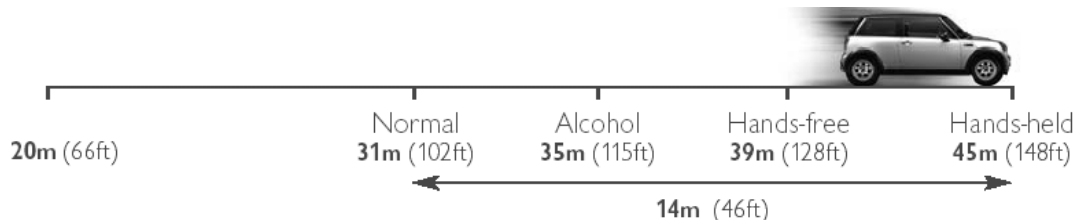
#### **4.1 Impact on driving performance**

There is ample evidence to show that mobile phone use while driving results in riskier driver behaviour (for reviews, see: Kircher, et al., 2004; Treffner and Barrett, 2004). While many of the studies were based on the use of hand-held mobile phones, others which have been restricted to hands-free mobile phones have produced equivalent results (for example: Strayer, Drews and Johnston, 2003; Beede and Kass, 2006). With many countries and jurisdictions having now passed legislation banning the use of hand-held mobiles when driving while still allowing the use of hand-held devices, the more critical question is whether the latter devices have any safety advantages.

A key study in this context was conducted in the UK by Direct Line Motor Insurance (2002). Twenty experienced drivers were tested on a simulator on two separate occasions, with the independent variables being normal driving, alcohol-impaired driving and driving while talking on a hands-free or hand-held mobile phone. Results included:

- best driving performances (based on a number of constituent measures) were obtained from those driving under normal conditions i.e. alcohol-free and not using a mobile phone
- driving under the influence of alcohol (at around a 0.08 bac level) was significantly worse than normal driving but significantly better than driving when using either form of phone
- driving while using a hands-free mobile was generally safer than using a hand-held device but conversation remained a major cause of distraction.

As an example of the results, the distances travelled before making a braking response are shown below:



Drivers unaffected by alcohol and not using mobile phones responded to a presented stimulus after 31 metres. Drivers using hands-free mobile phones responded after a further 8 metres, while drivers using hand-held mobile phones responded 14 metres after the control group.

In New Zealand, Matthews, Legg and Charlton (2003) looked at usage of three types of mobile phone: hand-held, hands-free with an external loudspeaker and microphone and hands-free with a personal single earphone. The subjective driving workload of 13 experienced drivers was measured across a range of scales (including mental demand, physical demand, temporal demand, effort and frustration) while driving on a rural highway under each of the three phone conditions and also without telephone use.

The results showed that all three forms of telephone use were associated with increased subjective workload when compared to the control condition (no use of telephone). There were also significant differences across the telephone types, such that the hands-free mobile phone with personal earphone had the lowest extra workload, followed by the hand-held mobile phone, with the hands-free mobile phone with external loudspeaker/microphone having surprisingly the highest workload. The research team suggested that the latter finding was probably due to the distance of the microphone and speaker from the user. This distance within a reasonably noisy environment was more likely to lead to frustration and difficulties in hearing, and subsequently to increased workload overall.

Patten et al. (2004) found that when drivers were required to complete a simple driving circuit characterized by a low level of road complexity in the form of vehicle handling and information processing requirements, their times in reacting to peripheral stimuli were slowed when conducting telephone conversations. However they also found that there was little difference in reaction times across the two telephone modalities: that is, whether hands-free or hand-held devices were used. A more important associate was the complexity of the conversation: while even simple conversations served as a distraction, the more complex the conversation, the greater the delay in response.

Tornos and Bolling (2005) reached a similar conclusion. Conducting conversations and dialling using hand-held and hands-free mobile phones resulted in equivalent delays across the two telephone modes in reaction times to stimuli and in equivalent numbers of missed signals— with the extent of decrement in both measures being greater for dialling. Similarly, shifts in lateral position while conversing or dialling occurred for both telephone modes and there was no discernible difference for the two modes, the extent of deviation being greater for dialling in both contexts. The only major performance difference between the two modes occurred in regard to travel speed while dialling: for both modalities, drivers slowed, but to a greater extent when using a hands-free mobile phone.

As a broad overview of the published literature:

- studies consistently show that hands-free mobile phone use while driving leads to significant performance impairment (Cooper et al., 2003; Hancock, Lesch & Simmons, 2003; Tokunaga, Hagiwara, Kagaya & Onodera, 2000; Treffner, Petersen & Barrett, 2003)
- some studies while confirming this association, are unable to show any differences between hand-held and hands-free mobile phones (e.g. Abdel-Aty, 2003; Consiglio, Driscoll, White & Berg, 2003; Lamble, Kauranen, Laakso & Summala, 1999; Strayer & Johnston, 2001)
- some studies show that hands-free mobile phones have advantages over hand-held mobile phones but are still associated with driver impairment (Direct Line Motor Insurance, 2002; Haigney, Taylor & Westerman, 2000; Ishida & Matsuura, 2001)
- at least one study shows that hand-held mobile phones have advantages over hands-free mobile phones with external speakers and microphones (Matthews et al. 2003).

The following statement summarises the current state of play:

... the use of cellular phones disrupts performance by diverting attention (from) the external environment immediately associated with driving.  
...legislative initiatives that restrict handheld devices but permit hands-free devices are not likely to eliminate the problems associated with using cell phones while driving because these problems are attributed in large part to the distracting effects of the phone conversations themselves .... (Strayer, Drews, Albert & Johnston, 2002).

## 4.2 The crash association

Although driving decrement can be associated with hand-held and/or hands-free mobile phone use while driving, it does not necessarily follow that there will be a commensurate increase in crash risk. The number of research studies that have tied mobile phone use to crash involvement is small and only three studies that have compared the crash implications of hand-held versus hands-free devices have been identified.

In the first study, Redelmeier and Tibshirani (1997) identified 699 drivers involved in non-casualty crashes in Toronto who owned mobile phones. Each driver's mobile phone use during the day of the collision and during the previous week were analysed through detailed billing records. The researchers used a case-crossover analysis, whereby each driver's extent of mobile phone use around the time of collision was compared with mobile phone use during an appropriate 'before' time interval. This method allowed each driver to serve as his or her own control, thereby eliminating some of the major confounding factors.

For calls made or received within ten minutes before the collision, the relative risk of being in a crash was 4.3x (95% CI 3.0-6.5). This heightened risk was robust across a range of variables, including driver age, experience, social background and gender.

The researchers found that both hand-held and hands-free mobile phones were associated with this extra crash risk and "found no safety advantages to hands-free as compared with hand-held mobile phones ... One [possible explanation] is that motor vehicle collisions result from a driver's limitations with regard to attention rather than dexterity ... our data do not support the policy followed in some countries of restricting hand-held mobile phones but not those that leave the hands free" (p456).

In the second study, about 9000 Norwegian drivers recently involved in crashes responded to a postal questionnaire about mobile phone use around the time of their accidents (Sagberg, 2001). After the drivers were allocated to either an 'innocent' (judged by their insurance company as not responsible for the crash) or 'guilty' (judged as responsible) group, their respective use of mobile phones at the time of the crash was examined.

Fifty per cent of all drivers reported that they used a mobile phone while driving, with 29% of all drivers using a hand-held device. Of the at-fault drivers, 0.66% reported that they were using a mobile phone at the time of the crash, compared to 0.3% of innocent drivers - meaning a statistically significant overall relative risk of 2.2. Despite the very small numbers of drivers involved in crashes, the 3.6x increase in relative risk for hand-held mobile phone users was significant. The relative risk for hands-free mobile phones was lower at 1.8 and was just short of statistical significance. The difference between the two relative risks was also not statistically significant.

The third study was conducted in Western Australia, involving drivers involved in crashes between April 2002 and July 2004 who were subsequently treated at one of three main hospitals (McEvoy, Stevenson, McCartt, Woodward, Haworth, Palamara & Cercarelli, 2005). For the 456 participants who met the various selection criteria, time of crash was checked against telecommunications records to determine whether the mobile phone had been used during the ten minutes before and up to the crash. The participants served as their own controls, in that their telephone activity was also determined during up to three control intervals (equivalent times during the preceding week when the participants were driving but did not crash).

Mobile phone use within the 10-minute period before the crash was associated with a fourfold increase in the likelihood of being in a crash that required hospital attendance. Sex, age group and type of mobile phone did not affect this overall association – with the risks for hand-held and hands-free mobiles being 4.9x and 3.8x, respectively (and in both cases, statistically significant).

McEvoy et al. (2005) have thus confirmed previous research demonstrating the association between mobile phone use while driving and crash risk (Redelmeier and Tibshirani, 1997; Sagberg, 2001). However, as noted by the authors, this association may be attributable to the possibility that drivers who use mobile phones while driving have a greater propensity to take risks of any sort. The research design used in the West Australian study has shown that the association can be more directly anchored to mobile phone use while driving, as using crash-involved drivers as their own controls has controlled for any differences in risk taking and other driver characteristics that might have a potential influence.

## **5. POLITICAL, SOCIAL AND OTHER FACTORS**

There are at least two criteria for judging whether a given issue represents a road safety concern:

- the extent to which the issue can be associated with an increased crash risk
- the proportion of road casualties which can be associated with the issue.

Using a mobile phone while driving is associated with a significantly heightened crash risk, with the risk being more or less common to both hand-held and hands-free devices. In different contexts (e.g. speeding and drink driving) the extent of extra risk has been judged unacceptable and has been targeted through legislation. This additional risk has also been used as the justification for the widespread ban on the use of hand-held mobiles while driving.

In at least some instances, the available studies almost certainly under-report the true incidence of mobile phone use while driving, with the incidence likely to increase dramatically as the numbers of mobile phone users grow.

Enforcing the ban on hand-held devices is in principle at least, straightforward, given offenders' relative visibility. The only major indicator when using a hands-free device, however, is lip movement, an action which could arise from any number of legitimate causes.

A further difficulty in extending the ban on mobiles to include hands-free devices, relates to impending technological developments. It is likely that in the immediate future, the equivalent of today's mobile phones will be integrated so thoroughly with in-vehicle communications and entertainment systems that they will be beyond the scope of current legislation programs governing mobile phone use.

These difficulties notwithstanding, it remains that the ban on hand-held devices is already in place. There is an apparent inconsistency in banning one device while allowing the use of another, when both are known to be associated with a more or less comparable increase in crash risk. Further, unless carefully managed, a failure to ban hands-free mobiles may be/has been interpreted as implying that their use is safe - a perception that could have further disbenefits if it results in increased mobile phone use while driving.

As a possible compromise to these conflicting issues, it seems that the only practical way forward is to continue the ban on using hand-held devices while driving - with the exclusion of hands-free devices from the ban being justified (if required) in terms of enforcement practicalities. It is also recommended that all mobile phone use while driving be strongly discouraged – e.g. through public education programs and through Occupational Health and Safety policies.

The extent to which the installation of in-vehicle hands-free mobile phone facilities should be encouraged, remains problematic. On the one hand, failure by employers, fleet managers and others to provide these facilities may result in increased illegal use of hand-held devices; on the other hand, provision of facilities will inevitably be perceived as permission to use hands-free mobiles while driving and may well counter other attempts to discourage mobile phone use.

## **7. CONCLUSIONS**

While the use of mobile phones while driving is a contributing factor in less than one percent of all fatal and serious injury crashes (Regan, 2007), it is still an important road safety issue because it increases an individual driver's risk of being involved in a crash four-fold.

Completely banning mobile phone use while driving is presently problematic. In the meantime, the most viable option is to continue to target hand-held units through enforcement, backed by appropriate public education campaigns to discourage all mobile phone use while driving.

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