ELSEVIER

Accident Analysis and Prevention 39 (2007) 197–205

ACCIDENT ANALYSIS & PREVENTION

www.elsevier.com/locate/aap

The effects of mobile phone use on pedestrian crossing behaviour at signalised and unsignalised intersections

Julie Hatfield*, Susanne Murphy

NSW Injury Risk Management Research Centre, The University of NSW, Sydney 2052, Australia

Received 2 May 2006; received in revised form 26 June 2006; accepted 4 July 2006

Abstract

Research amongst drivers suggests that pedestrians using mobile telephones may behave riskily while crossing the road, and casual observation suggests concerning levels of pedestrian mobile-use. An observational field survey of 270 females and 276 males was conducted to compare the safety of crossing behaviours for pedestrians using, versus not using, a mobile phone. Amongst females, pedestrians who crossed while talking on a mobile phone crossed more slowly, and were less likely to look at traffic before starting to cross, to wait for traffic to stop, or to look at traffic while crossing, compared to matched controls. For males, pedestrians who crossed while talking on a mobile phone crossed more slowly at unsignalised crossings. These effects suggest that talking on a mobile phone is associated with cognitive distraction that may undermine pedestrian safety. Messages explicitly suggesting techniques for avoiding mobile-use while road crossing may benefit pedestrian safety.

Keywords: Distraction; Mobile telephones; Road safety; Pedestrians

1. Introduction

1.1. Pedestrian road trauma involvement

Pedestrians are the largest group of road-users and they represent a large proportion of road casualties. In 2004, traffic crashes killed 4641 pedestrians in the U.S. (NHTSA, 2006) and 223 pedestrians in Australia (Australian Transport Safety Bureau, 2005), comprising 11 and 14% of those countries' respective road fatalities. Pedestrian injury rates are also high, with 68 000 pedestrians injured in the U.S. in 2004 (NHTSA, 2006). When pedestrians are involved in a crash with a motor vehicle, their injuries are typically severe. Because of their relative lack of visibility and protection the probability of a fatality is high if the vehicle is travelling at more than 40 km/h (Ashton, 1981).

Crashes involving pedestrians are most likely to occur when the pedestrian is crossing the road. For example, in the U.S. 63% of crashes involving pedestrians between 1995 and 1998 occurred while the pedestrian was crossing (da Silva et al., 2003). Both pedestrian and driver behaviour may contribute to crashes involving pedestrians. For example, up to 15% of pedestrian fatalities are though to owe to inattentiveness on the part of the pedestrian (Bungum et al., 2005). The present study focuses on pedestrian behaviour, and specifically on the involvement of mobile use. Casual observation suggests that pedestrians who are using a mobile phone while crossing the road may amble across the road without checking for traffic. However, no research has specifically examined the effects of mobile phone use on pedestrian road crossing. The present study aimed to redress this lack.

1.2. Mobile usage rates

In developed countries, mobile phone usage rates are high, and increasing. The Australian Mobile Telecommunication Association (2005) predicted that market penetration in Australia would be 94% by the end of the 2004/2005 financial year. Despite a general awareness of the associated dangers, more than half of Australian drivers report using their mobile phone while driving (Hatfield, unpublished data). Between 70 and 90% of American mobile phone users report using their phone while driving (Lissy et al., 2000; Sundeen, 2001) and an observational study conducted in the U.S. in 2004 (Glassbrenner, 2005) suggests that during the typical daylight moment 5% of drivers are holding a mobile phone. A systematic investigation

* Corresponding author. Tel.: +61 2 9385 7949; fax: +61 2 9385 6040.
E-mail addresses: j.hatfield@unsw.edu.au (J. Hatfield), susanne.murphy@unsw.edu.au (S. Murphy).

0001-4575/$ – see front matter © 2006 Elsevier Ltd. All rights reserved.
doi:10.1016/j.aap.2006.07.001

of the extent to which pedestrians use their mobile phones while crossing the road is yet to be conducted. However, casual observation suggests that pedestrians also use mobile phones quite frequently.

1.3. Mobile use and road-user behaviour

There is a lack of published literature regarding the effects of mobile phone use on pedestrian road crossing behaviour.

Only one study has considered the effects of mobile phone use on pedestrian behaviour, however interpretation of the findings is limited by methodological issues. In their observational study of pedestrians crossing at a stoplight and zebra painted crossing, Bungum et al. (2005) found that "distraction was negatively but weakly associated with displaying cautious pedestrian behaviours" (p. 269). However, pedestrians were held to be distracted if they were wearing headphones, talking on a mobile phone, eating, driving, smoking or talking. The study was not designed to examine the effects of mobile phone use, and there are unlikely to be sufficient pedestrians observed crossing while using a mobile to make meaningful comparisons. In fact, Bungum et al. (2005) do not report the observed rate of mobile phone use. We know only that 15% of the sample (50 of 866) crossed wearing headphones *or* talking on a mobile phone. Whilst several behaviours were observed, the effect of distraction was only assessed for an index comprised of looking left and looking right and starting to cross on the "Walk" signal. Finally, the study was conducted on a particularly dangerous stretch of road, and near a university campus (where road users "frequently fail to observe traffic rules", Bungum et al., 2005, p. 272). Thus, poor pedestrian behaviours may be overdetermined in the study sample, and the generalisability of the findings may be limited.

An extensive literature indicates that using a mobile phone while driving increases crash risk, and impairs driving performance (for a recent review see Young et al., 2003; for meta-analyses see Caird et al., 2004; Horrey and Wickens, 2004). These effects have mostly been explained in terms of "driver distraction", a term which appears to have a somewhat broader than usual meaning in the road-safety literature. For the present purposes, driver distraction is taken to refer to any situation in which some of a driver's cognitive physical, visual, and auditory, resources are co-opted by a driving-irrelevant activity (see Lamble et al., 1999; Young et al., 2003). Consideration of how the cognitive, physical, auditory, or visual, demands of different aspects of phone use (e.g. talking, text messaging) detract from the availability of corresponding resources for safe pedestrian behaviour suggests that pedestrian use of mobile phones whilst crossing the road may pose a safety risk.

1.4. Cognitive distraction

Various studies suggest that the impact of mobile phone use on driving owes partly to cognitive distraction (for reviews, see Caird et al., 2004; Horrey and Wickens, 2004; Young et al., 2003).

Crossing the road safely involves several cognitive demands (Tabibi and Pfeffer, 2003; Whitebread and Nielson, 1999). For example, at non-signalised intersections pedestrians must remember to stop and check for traffic, and may be required to judge the distance from, and speed of, oncoming vehicles, in order to evaluate gap safety. At signalised intersections, pedestrians must remember to observe and obey the signals. Even during the crossing, cognition may play a role. While it has been traditionally assumed that walking is a fairly automatic task, involving minimal cognitive demand, recent research suggests that substantial attentional resources must be devoted to fluid and unaided postural control (Woollacott and Shumway-Cook, 2002). This may be particularly true for elderly pedestrians. Thus, cognitive distraction may result in slower walking and so greater exposure to risk. The longer a pedestrian takes to cross, the longer they are exposed to risk, and the less likely they are to complete their crossing in the time allowed at signalised intersections.

Slower walking may also result from compensatory processes. Numerous studies have found that mobile use results in reduced speed while driving (Brown et al., 1969; Burns et al., 2002; Haigney et al., 2000; Jenness et al., 2002a; Tornros and Boiling, 2005) and this is often interpreted as compensation for the secondary task (mobile phone use). Pedestrians may also compensate by slowing down, for example so that they do not trip.

1.5. Physical distraction

The view that it is dangerous for a driver to have one hand unavailable for driving (e.g., steering, changing gears, operating the indicator lever) underlies legislation not allowing hand-held phones but allowing hands-free phones (see Wheatley, 2000). However, findings that using a hands-free phone produces similar driving impairments to using a hand-held phone (for reviews see Caird et al., 2004; Horrey and Wickens, 2004; Young et al., 2003) suggest that physical distraction is of limited relevance. Nonetheless, few studies employ a manual vehicle (or equivalent) and most involve little manoeuvring. Eating and drinking appear to have a small negative impact on driving, and are primarily manual tasks, although they also involve visual distraction (see Jenness et al., 2002b; Stutts et al., 2001).

Holding a phone is unlikely to interfere with walking as directly as it may interfere with driving. However, if holding a phone results in a pedestrian's movement being awkward, for example because they are carrying other things, then it may decrease their walking their speed, and so increase their risk of conflict with a vehicle.

1.6. Visual distraction

Mobile phone use is assumed to impair safe driving partly because of drivers taking their eyes from driving-relevant stimuli (to find the phone, dial, or receive a call; see Salvucci and Macuga, 2002). Several studies have demonstrated negative impacts of dialling a mobile phone (Gartner et al. (2002) as cited in Young et al., 2003; Green et al., 1993; Jenness et al., 2002b), although these impacts could reflect cognitive, physical *or* visual distraction. Jenness et al. (2002a) found voice-activated