ELSEVIER

Accident Analysis and Prevention 37 (2005) 47–51

ACCIDENT ANALYSIS & PREVENTION

www.elsevier.com/locate/aap

Factors influencing the use of cellular (mobile) phone during driving and hazards while using it

Leena Pöysti [a], Sirpa Rajalin [a], Heikki Summala [b,*]

[a] *Liikenneturva (Central Organization for Traffic Safety in Finland), P.O. Box 29, 00421 Helsinki, Finland*
[b] *Department of Psychology, University of Helsinki, Traffic Research Unit, P.O. Box 9, 00014 Helsinki, Finland*

Abstract

This study addressed the strategic decisions on not using a mobile phone at all while driving, and phone-related driving hazards among those drivers who do use one, reflecting tactical and operational level processes. A representative sample of 834 licensed drivers who own a mobile phone were interviewed on their phone use and hazards, background factors, and self-image as a driver. Logistic regression models indicated that older age, female gender, smaller amount of driving, and occupation promoted not using a phone at all while driving. Additionally, low skill level and high safety motivation contributed to this decision. Among those who used a phone while driving, exposure to risk in terms of higher mileage and more extensive phone use increased phone-related hazards, as also did young age, leading occupational position, and low safety motivation. Neither gender nor driving skill level had any effect on such self-reported hazards. This study clearly indicates that potential risks of mobile phones are being controlled at many levels, by strategic as well as tactical decisions and, consequently, phone-related accidents have not increased in line with the use of the mobile phones.

Keywords: Cellular phones; Mobile phones; Motor-vehicle driver; Risk control; Decision making; Self-image

1. Introduction

Mobile phones are now widely used in the car and, with operators producing more and more services that are very useful for drivers, the total time and exposure to risks of using mobile technology while driving is bound to increase. For example, two thirds of Finnish drivers (Lamble et al., 2002) and 85% of American drivers (Goodman et al., 1999) use their phone while driving. Over the last several years, the impact of mobile communication technology on traffic safety has been a target of interest. The epidemiological studies give two to six fold risk crash estimates for phone use while driving (Violanti and Marshall, 1996; Redelmeier and Tibshirani, 1997; Sagberg, 2001) but these studies considered the time when phones were principally used for speaking only. Hands-free equipment, although now obligatory in many countries, seems not to offer essential safety advantage over hand-held units (e.g. Redelmeier and Tibshirani, 1997; Lamble et al., 1999; Sagberg, 2001; Nunes and Recarte, 2002). It may even induce drivers to be more on the phone and if older or less skilled drivers think that it makes phone use safe they may decide to start using it while driving.

It is of essential importance to note that drivers control their crash risk at several levels. Following the hierarchical structure proposed by Michon (1979, 1985) in his influential paper, drivers' *strategic decisions* refer to the use of a car, trip decisions, avoidance of bad weather and road conditions, and the decision of using or not using a phone while driving. These decisions have a major effect on exposure to risk, and they strongly depend on person-centered variables. Lamble et al. (2002) reported that older people (55+ years) do not use a mobile phone in the car to the degree that younger people do (18–24 years). They also do not own mobile phones as often as younger people (Kuusela and Vikki, 2002). Phone use while driving may be too loading for older drivers (Brouwer et al., 1991; McKnight and McKnight, 1993; Woo and Lin, 2001), which often results in adaptive behavior at a higher decision level—not using phone at all when driving (Summala, 1997). At the *tactical level*, while driving in traffic, drivers can also influence their exposure to risky situations as well as crash risk given respective exposure. They can adjust speed level, decide to follow a slower car instead of overtaking it in heavy traffic, use their phone on quiet road sections only and even stop to use their phone rather than continuing to drive. In this way drivers can

* Corresponding author. Tel.: +358-9-19129420; fax: +358-9-19129422.
E-mail address: heikki.summala@helsinki.fi (H. Summala).

0001-4575/$ – see front matter © 2004 Elsevier Ltd. All rights reserved.
doi:10.1016/j.aap.2004.06.003

adjust the workload due to mobile phone use that may be critical at the *operational level*, in moment-to-moment control of traffic situations.

Several studies indeed indicate impairments due to the phone use at operational and tactical levels. Strayer and Johnston (2001) reported significant slowing in the response to simulated traffic signals. Alm and Nilsson (1995) found that phone use during simulated driving extended reaction times, and that this effect was more marked for older drivers. Brookhuis et al. (1991) and Lamble et al. (1999) also showed that phone use delayed driver reactions to the decelerating of the car ahead in on-road conditions, and the recent results of Hancock et al. (2003) indicated that phone use seriously impairs crucial stopping decisions. de Waard et al. (2001) found that looking up telephone numbers while holding the phone in one hand showed a serious deterioration in driving performance in terms of lane control. This effect was clearly present despite the fact that drivers increased their safety margins by slowing down. Harbluk et al. (2002) and Nunes and Recarte (2002) showed that drivers made fewer saccadic eye movements and spent less time checking instruments and mirrors when using a phone, which also indicates adaptive behavior.

Age is a decisive factor when considering phone-related risks in traffic. In the years to come, car phone use will probably increase among older people as well as among new aging cohorts who will be increasingly more practiced both in car driving and the use of mobile phones. Occupation is expected to influence exposure to risk, in terms of mileage and phone use, as phones and other mobile devices become increasingly more important in providing a mobile office platform. Driving skills also probably have a major effect on drivers' phone use and risks. A driver's perception of their own skills probably influence whether they use a phone while driving and in what kind of situations they choose to use phone. Highly skilled drivers would be expected to be more willing to incur demanding multitasking, which would often be the case when using a phone in heavy traffic. However, driving skills do not alone determine safety. Safety is dependent on how drivers use their skills, as influenced by their goals, motives and safety orientation in driving (Näätänen and Summala, 1974, 1976). Safety orientation reflects general safety attitudes and safe driving practices in general. The two facets of driver self-image, the skill level and safety orientation, have a close connection to safety relevant personality characteristics. Skill level is positively associated with driving related aggression, sensation seeking, and the sense of coherence. Safety orientation in turn is negatively related to sensation seeking and aggressive behavior (Lajunen and Summala, 1995, 1997).

The aim of this study was to assess the factors that influence phone-related decisions at two levels. First, what factors determine whether a driver chooses to use or not use a phone while driving? This is a strategic decision taken by each driver who owns a mobile phone, either specifically restricted to car driving or possibly reflecting overall less active phone use. The second question concerns tactical decisions among those who have decided to use their mobile phone in car: what factors predict safe and "appropriate" use, as measured by phone-related hazards in traffic?

Table 1
Drivers' self-image, 10-item version (Lajunen and Summala, 1995; Lamble et al., 2000)

Skill factor ($\alpha = 0.80$)	Safety-motive factor ($\alpha = 0.74$)
Performance in a critical situation[a]	Self-control while driving
Fluent lane changing in heavy traffic	Tolerating other drivers' errors calmly
Controlling the vehicle	Keeping a sufficient following distance
Overtaking	Conforming to the speed limits
Fast reactions	Avoiding unnecessary risks

[a] On each item, the respondents evaluate their strong and weak components of driving on a scale 0 = definitely weak, 1 = weak, 2 = neither weak nor strong, 3 = strong and 4 = definitely strong.

2. Method

The Finnish Gallup home poll interviewed 834 over 18-year-old mobile phone owners who drive regularly or at least occasionally. Of the respondents 57.7% (481) were males. The mean age was 40.4 years, the standard deviation 15.3 years and the range 18–76 years. The self-reported dependent variables were phone usage in the car and hazardous situations experienced while using a phone in the car, during the last six months. The independent variables were: age, sex, yearly mileage (annual kilometers), amount of phone use, occupation, and the driver's self-image of him/herself as skilled and safe driver.

Drivers' self-image was measured with a 10-item version of the driver skill index (Lajunen and Summala, 1995; Lamble et al., 2000) that showed high internal reliability in these data ($\alpha = 0.74$ and 0.80 for each factor). Sum scores were used for skill and safety factors (Table 1). Two separate logistic regression analyses were made, the first for the use of phone and the second for hazards experienced while using the phone. The respondents were divided into four classes of similar size on both scales.

3. Results

Eighty-one percent of the drivers used their phone in the car at least sometimes, with 9% using it over 15 min a day. The logistic regression (Table 2) showed that age and annual kilometers, sex, and occupation predicted whether the driver used mobile phone in the vehicle or not. Young drivers and males use their phones more often than the older drivers or females, and people who drive a lot use them more often than the ones who only drive a little. The more skilled the drivers thought themselves to be, the more likely they had a