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The use and risk of portable electronic devices while cycling among different age groups

C. Goldenbeld [a,*], M. Houtenbos [a], E. Ehlers [b], D. De Waard [c]

[a] SWOV, Netherlands
[b] University of California, Berkeley
[c] University of Groningen, Netherlands

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ABSTRACT

Introduction: In the Netherlands, a survey was set up to monitor the extent of the use of portable, electronic devices while cycling amongst different age groups of cyclists and to estimate the possible consequences for safety. *Method:* The main research questions concerned age differences in the self-reported use of electronic devices while cycling, self-reported crash involvement and risk, and self-reported compensatory behaviour. Teen cyclists (12–17 years) and young adult cyclists (18–34 years) were more frequent users, and also more indiscriminate users of portable devices while cycling than middle-aged and older adult cyclists (35–49 years; 50+ years). *Results:* After statistical correction for influences on crash risk of urbanization level, weekly time spent cycling, and cycling in more demanding traffic situations, the odds of being involved in a bicycle crash were estimated to be higher for teen cyclists and young adult cyclists who used electronic devices on every trip compared to same age groups cyclists who never used these devices. For middle-aged and older adult cyclists, the use of portable electronic devices was not a significant predictor of bicycle crashes, but frequency of cycling in demanding traffic situations was. Possible implications for education or legal measures are discussed. *Impact on Industry:* Results may inform researchers, policy makers, and cyclists themselves. Educational campaigns may use risk information to warn young cyclists about risk of device use while cycling.

1. Introduction

The use of technologies such as mobile phones, mp3-players, laptops, and non-integrated navigation systems has seen a sharp increase worldwide (WHO, 2011). The consequential use of these portable devices in traffic is a growing concern for road safety. The use of portable electronic devices while participating in traffic can distract road users in a physical, visual, cognitive, or auditory manner (WHO). In addition, music can also have an emotional influence on driving performance (mood effects; Dibben & Williamson, 2007; Meesmann, Boets, & Tant, 2009).

There are several studies that show that the use of mobile phones or other media devices impair driving performance and increase the crash risk of car drivers (e.g., Caird, Willness, Steel, & Scialfa, 2008; Crisler et al., 2008; Horrey & Wickens, 2006). Performance impairment is manifested by slower reaction times, slower reactions to traffic signals and more frequently missed signals, slower braking reactions with more intensive braking and longer stopping distances, reduced general awareness of other traffic, and more risks in decision-making (Jeanne Breen Consulting., 2009). Naturalistic driving studies showed that drivers were 23.2 times more likely to be involved in a safety-critical event while text messaging (Olson, Hanowski, Hickman, & Bocanegra, 2009). In the same research it was found that for commercial vehicle drivers, using a dispatching device increased risk of crash or near crash significantly by 9.9 times, while writing, using a calculator, looking at a map, dialing a cell phone, and reading significantly increased risk by 9.0, 8.2, 7.0, 5.9, and 4.0, respectively.

Recent studies have extended research on the possible safety effects of electronic devices on other road users, such as pedestrians and cyclists. A number of studies indicate that pedestrian behavior becomes more hazardous when pedestrians use devices, especially mobile phones, while crossing the street (Hatfield & Murphy, 2007; Nasar, Hecht, & Wener, 2008; Neider, McCarley, Crowell, Kaczmarski, & Kramer, 2010; Stavrinos, Byington, & Schwebel, 2009, 2011). Hatfield and Murphy (2007) detected a difference between men and women: women using a mobile phone while crossing the street pay less attention to traffic than men using a phone. A study by Nasar et al. (2008) showed that pedestrians that used mobile phones while walking behaved more dangerously on street crossings than non-users, but also more so than users of audio-devices. Using a virtual traffic environment, Neider et al. (2010) again showed that

* Corresponding author at: SWOV, C. Goldenbeld, Duindoorn 32, 2262 AR Leidschendam, Netherlands. Tel.: +31 70 3173374; fax: +31 70 3201261.
E-mail address: charles.goldenbeld@swov.nl (C. Goldenbeld).

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phone use had a higher impact on successfully and safely crossing a street than listening to music. In another simulator research, it was shown that college students behaved more dangerously when crossing a street while using a mobile phone compared to non-users. This applied to all students irrespective of experience in phone use, attentiveness, or content of conversation (Stavrinos et al., 2011).

The current study focused on the use and the associated risk of portable, electronic devices while cycling by different age groups. In the Netherlands, over 80% of the citizens own at least one bicycle, and nearly 30% of all trips are made by bicycle (Wegman et al., in press). Trend analysis of Dutch bicycle crash victims indicates that the number of bicycle fatalities has not decreased since 2004. Moreover, the number of seriously injured cyclists is actually showing an increasing trend over the period 1993–2008 (Weijermars, Goldenbeld, & Bos, 2010).

One of the contributory factors to cycling crashes may be distraction by use of electronic devices. Increasingly, Dutch citizens own portable media players and/or mobile phones, which are also used while cycling (CBS, 2009). Lee (2007) argues that young drivers are the group that is most motivated to use new technology, but also the user group that is most vulnerable to distractions caused by these "infotainment" systems. To find out whether this type of age difference also applies to cyclists, this study investigates the use of electronic devices and related crash involvement of cyclists in different age groups.

A few studies have investigated the possible road safety implications of device use by cyclists. The results of a Japanese questionnaire study on the use of mobile phones among young cyclists indicated a possible risk-increasing effect of the use of mobile phones (Ichikawa & Nakahara, 2008). However, the results of this study need to be looked at with some caution, since the study did not correct for other potentially relevant factors, such as the extent to which the cyclist was exposed to hazardous traffic situations. In assessing the contribution of device usage to cycling crashes, the present study attempts to control for other risk factors such as time spent cycling, urbanization of environment, and exposure to risky traffic situations.

Further evidence concerning device use as a risk factor for cycling comes from three studies in the Netherlands by de Waard, Schepers, Ormel, and Brookhuis (2010). In their observation study of cyclist behavior, they found that, after weighting for age, 5% of cyclists were listening to an mp3 player, 1.2% were calling on the phone, and 0.3% of cyclists were texting. In their survey study, cyclists were asked about the circumstances surrounding the bicycle crash. Concerning potential secondary activities preceding the crash, 3.4% of the crash-involved cyclists mentioned listening to music, 0.3% mentioned talking on a hand-held mobile phone, and 0.2% mentioned texting. A distractive factor that was mentioned more often than device use was talking to another cyclist or passenger: 12.6% of the cyclists mentioned this factor. In their third study, they investigated the direct effects of the use of mobile phones on cycling behavior itself. Twenty-four cyclists circled a secluded bicycle track under six different conditions: with or without the use of devices and with or without simultaneously carrying out a simple or more complex arithmetic task while handling a mobile phone. The study indicated that, on average, cyclists using a mobile phone cycled at a lower speed, reported more mental effort, and experienced greater risks. While texting messages, cyclists kept more distance to the road edge. When using the phone or texting a message, cyclists more often overlooked things compared to not using the phone or texting. Text messaging had the largest effect on cycling behavior and was also perceived as the most hazardous, even though speed was reduced. In the study, no or only limited effects of listening to music on cycling behavior were found. However, cyclists themselves indicated that they experienced a higher risk while listening to music compared to not listening to music. In a later study with a similar setup (de Waard et al., 2011) it was found that listening to music while cycling deteriorates auditory perception - cyclists miss more auditory information. These negative effects were particularly large when earbuds were used and when the rider was listening to something of high volume or fast tempo. It was also found that hands-free use of a mobile phone while cycling had similar negative effects on cycling behavior as hand-held phone use, with the exception of effects on response time.

Extending earlier research by de Waard and colleagues, the present study aims to provide a more accurate estimate of device use of cyclists based on a national sample and an estimate of associated crash odds. In the current study we were especially interested in age differences. In the Netherlands, child cyclists in the 12–17 year-old age have a higher risk of being injured in a crash with a motor vehicle than cyclists between 25 and 49 years of age (Reurings, 2011). Around the age of 12, Dutch children make the transition from primary to secondary school and, as a result of that, they often start to cycle larger distances. Part of the explanation may also be that older children have a greater tendency to show risky cycling behavior (Bailey & Natora, 1999). In recent years, the tendency to engage in risky behavior while cycling may also include the use of electronic devices.

In the present study, age differences between cyclists are studied with regard to four topics: (a) the use of portable devices while cycling and motives; (b) cyclists' involvement in bicycle crashes; (c) the contribution of the use of portable electronic devices to bicycle crashes; and (d) possible compensatory behavior for the use of devices while cycling.

2. Method

An internet survey among Dutch cyclists was used to collect data about the use of portable, electronic devices while cycling, crash involvement, circumstances of crashes, and compensatory behavior. The term 'device' refers to all portable devices that can be used to make a telephone call, listen to music, find information, or read or send text messages. Regarding bicycle crashes, cyclists were asked to report all situations in which they fell from their bicycle, irrespective of whether they collided with another road user or obstacle and irrespective of whether the crash resulted in an injury. This decision was based on the argument that every fall of a cyclist constituted a possible risk of injury.

Since nearly all Dutch persons own or have access to a bicycle (Ministry of Transport, Public Works, & Water Management, 2009; SWOV, Institute for Road Safety Research, 2009) and since 89% of Dutch households in 2010 were connected to the internet (TNS Opinion & Social, 2010), an internet-sample was considered to be well-suited in obtaining a representative sample of Dutch cyclists.

2.1. Sample and response

A quota sample was drawn from on-line population panel in order to achieve a sample that would be similar to the national Dutch population in terms of gender and region distribution. Since there was a special interest in the youngest age group (12–17 years), it was decided to over-sample this category and to sample 250 extra respondents in this category in order to achieve about 600 observations of this youngest age group, comparable to the number of observations in the other age groups.

The survey took place between June 10–23, 2009. In total 5,505 persons were invited on-line to cooperate. The criterion for inclusion was that persons used a bicycle minimally one day per week. Of the 5,505 invited persons, 2,553 respondents completed the full questionnaire, of which 594 were between 12 and17 years old, 633 were 18–34 years old, 713 were 35–49 years old, and 613 were 50 years or older. After exclusion of non-cyclists and incomplete questionnaires, this constitutes a response of 69%. The sample did not differ from the population concerning regional distribution. In the sample, male cyclists were slightly underrepresented (44% vs. national 49%) and as a result of planned oversampling the youngest age category