



Cell phone use while driving 2015



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1 Overview

Introduction

During the last 35 years, cell phones have become a major source of communication and an essential device for many people. A wide range of new mobile phone services, designs and new users has led to new possibilities for business communication and increased personal convenience. Since in-car telephones first appeared in the mid-1980s, the use of hand-held and, more recently, hands-free devices has rapidly increased.

At the same time, a significant body of behavioural and epidemiological research (which includes recent studies of naturalistic driving), which has been subject to periodic literature review and meta-analyses, indicates the harmful consequences of driver distraction associated with use of a car telephone while driving, whether hand-held or hands-free. New availability of visual display information on mobile phones, new services offering broadband internet access and the increasing opportunity to use the car as a mobile office are all developments which are likely to increase further the road safety management and research challenges summarised below.

Cell phone use by drivers

Few EU countries conduct systematic surveys of car telephone use by drivers. Roadside surveys in Europe and the US have shown that between 1% and 11% of drivers use telephones while driving, with many drivers reporting occasional use.

Effects on driving performance and crash risk

- *Driver distraction and adverse effects on driver behaviour*

Research shows that using a cell phone while driving distracts the driver and causes driving behaviour which adversely affects road safety. While hands-free phones and other devices, such as speed dialling and voice activation reduce physical distraction, the most important negative factor associated with using a mobile phone while driving, whether hands-free or hand-held, is diversion of attention from driving to the conversation itself. The extent of the negative effects of telephone use while driving depends on the complexity of both the conversation and the driving situation. Driver reaction times are 30% slower when telephoning while driving than driving with BAC levels of 80mg/100ml and 50% slower than under normal driving conditions.

- *Hands-free versus hand-held?*

Studies indicate that the use of hands-free phones causes as much important driver distraction as the use of hand-held phones. Some studies show that in-car telephone conversations while driving can impair drivers more than listening to the radio or talking to passengers. An epidemiological study of crash involvement found that mobile phone use was associated with a greater likelihood of crash than passenger carriage and increasing numbers of passengers.

- *Effects of texting*

Many young drivers admit to the largely illegal activity of texting while driving. Text messaging has a detrimental effect on safety-critical driving tasks such as lane-keeping, hazard detection, headways and the detection and appropriate response to traffic signs. Studies indicate that texting and driving is a greater distraction and safety threat than dialing a cell phone, driving while drunk, smoking cannabis or talking on a cell phone.

- *Age-related effects*

Cell phone use while driving

Research indicates that use of mobile phone while driving is widespread amongst young novice drivers and adds to the problems experienced by this group who already have a higher crash risk. Older drivers can find it more difficult than drivers in general to conduct the two tasks at the same time involved in telephoning while driving.

- *Risk of crash involvement*

Methodologically sound studies show that telephone use while driving increases the likelihood of being involved either in a crash leading to property damage or serious injury by a factor of three to four. Crash involvement escalates with increased telephone use. Those driving and using cell phones a lot are twice more likely to be involved in a crash than those making minimal use of mobile phones. While mobile phone users have a greater chance of crash involvement, the increased crash rate is not exclusively due to telephone use since users engage in drink-driving and excess speed more frequently.

- *Size of crash injury problem*

The collection of data about mobile phone involvement in road crashes in EU countries is neither widespread nor very systematic and few estimates have been made. A Swedish study estimated that around 10 to 20 people die annually in Sweden as a result of using a mobile telephone while driving. A Dutch study estimated that nearly 600 road deaths and hospital admissions would have been prevented annually (2004 data) in the Netherlands with zero mobile phone use while driving. A US study estimated that telephone use while driving in the US results in around 2.600 deaths and 330.000 serious injuries annually.

- *Public awareness of crash risks*

While little research has been conducted into public attitudes to car telephone use in Europe, the available surveys indicate an under-estimation amongst drivers of how this behaviour adversely affects driving performance and an erroneous belief that the use of hands-free phones is largely danger-free. General support exists for hand-held bans for all drivers.

Policies and Interventions

- *Policies on cell phone use by drivers*

The use of hand-held car telephones while driving is illegal in most countries in the EU, Australia, and in parts of Canada and the US. Different policies can be found in several countries about the introduction of bans on use of hands-free telephones and driving. While some governments warn about the dangers of their use, they usually cite potential difficulties in securing compliance as the main reason for not banning hands-free use or point to existing blanket rules banning dangerous, distracting or careless driving. Some jurisdictions, notably in the US, ban all in-car telephone use by school bus drivers and by novice drivers as part of graduated licensing policies. More and more large companies, however, report bans on both hands-free and hand-held devices while driving as part of their work-related road safety strategies.

- *Effectiveness of interventions*

Currently, there is little data about the effectiveness of measures to reduce telephone use while driving in EU countries. Results to date from Japan, the US, Finland and the UK indicate that while the short-term effects of these laws on the level of use can be significant, they may not be sustained in the longer term and levels of use may even return to pre-law usage levels. Monitoring shows, however, that the effects can be enhanced by periodic, combined publicity and police enforcement and stricter penalties.

Cell phone use while driving

- *Technological development*

New technological development such as in-car access to email, internet and mobile visual display while driving presents the potential for a range of new safety management problems. It may also provide future solutions through better in-vehicle system design and in-car enforcement of legislation and research and development is taking place towards identifying solutions. Expert opinion points to in-car devices as a potentially effective and efficient means of securing compliance and there are calls for further activity towards harmonised action and requirements at EU level.

- *Research-based recommendations for action*

A variety of recommendations for action has been made in the literature which could inform EU, national, local and company policies:

Urgent research and data collection

- The extent of telephone use in EU driving needs to be ascertained to allow estimation of exposure to risk.
- Mobile phone use needs to be recorded in crash reports in order to ascertain the extent of its role in crash injury.
- Specific criteria and methodologies need to be developed for assessing the safety implications of in-vehicle information systems, including mobile phones followed by evaluation of the effects of intervention.
- Larger scale simulator studies on driver distraction (larger and more representative samples), more rigorous experiment designs and more uniform reporting of the results are now needed
- The effect of mobile phone use in traffic by road users other than car drivers such as cyclists, pedestrians and truck drivers needs to be studied.

Public and private sector rules and EU role

- Interventions regarding mobile phone use should be evidence-based and address hand-held and hands-free phones. If the detection of hands-free telephoning while driving is difficult to enforce by conventional means (although police have opted to use visual aids in some jurisdictions), in-vehicle enforcement through technological means provides an alternative future option.
- Texting and driving is on the increase amongst young drivers and needs targeting.
- Continuing enforcement and publicity will be needed to increase the efficacy of legislation.
- The EU can play a major role in supporting activity towards harmonised requirements as well as in provision of guidance, data collection and support for research and development. Company policies which impose a complete ban on the use of mobile phones while driving could be encouraged and supported.

Better hands-free design

The human-machine interface of in-car information systems and telephones needs to be designed as ergonomically as possible to allow safe use such as automatic postponement of the connection of incoming calls and designing complex human-machine interfaces that would regulate driver use of in-vehicle systems.

Information, education and training

Drivers need to be made more aware of the dangers of mobile phone use and of other various distracting activities and educated about the possible effects of distraction, their ability to compensate for it, as well as receiving practical advice on how to deal with telephones in vehicles.

This overview draws on several literature reviews and meta-analyses of scientific studies on car telephone use and road safety. It is restricted to person-to-person talking and texting and does not include more than brief reference to other key distraction issues such as searching for information on the internet and its use as navigation device while driving which are dealt with in the Erso Driver Distraction web text.

2 Introduction

During the last 35 years, mobile telephones have become a major source of communication and an essential device for many people.

It is estimated that mobile telephone subscribers in Europe comprise 79% of the population with around 6,89 billion connections annually (GSMA, 2014). A Eurobarometer survey (EU 28) in 2014 found that more than nine in ten households said they have access to a mobile telephone (92%). Access is highest amongst respondents in Latvia, Czech Republic and Finland (all 98%). This compares with relatively lower access rates in Portugal (86%), Romania (87%) and Bulgaria (89%). The highest rates of mobile phone access tend to be in Scandinavian and Baltic Member States, and few Member States have mobile access levels below 90%. Just over half of all respondents with mobile phone access said at least one person in their household had a mobile subscription that included Internet (52%). Smartphones are set to account for more than half of the connection base in Europe by the end of 2015.

An earlier Eurobarometer survey (EU25) showed, that approximately 95% of people in the EU25 aged under 39, 85% of people aged between 40 and 54, and 55% of people aged over 55 had a mobile phone (Eurobarometer, 2007).

Since their first appearance in motor vehicles in the mid-1980s, the use of mobile telephones in cars, both hand-held and, more recently hands-free, has also rapidly increased against the background of rapid escalation in general cell phone services and use. More and more new vehicles are now being equipped with Bluetooth technology, facilitating voice activation and hands-free phone use (McEvoy et al, 2005).

Hand-held telephones are devices which require the telephone receiver to be held to the ear during a conversation.

Hands-free telephones are devices which enable the user to talk on the telephone without the need to hold the receiver to the ear. This is achieved through a separate earpiece and a microphone worn by the driver as a personal hands-free telephone or microphone and speaker mounted in the vehicle as a hands-free speaker mobile telephone.

A wide range of new services, new designs as well as new users of mobile telephones have led to enhanced business communication, increased personal convenience including opportunities to alert rescue services in the event of a crash or breakdown.

At the same time, a significant body of experimental and epidemiological research conducted during this period and summarised in this overview indicates the adverse consequences associated with use of a car telephone while driving, whether hand-held or hands-free.

3 Cell phone use by drivers

Surveys of car telephone use in traffic are conducted in few EU countries and are derived from observational studies and self-reports about the use of mobile phones while driving. Crash involvement is ascertained from national police data, insurance data and epidemiological study.

Observational studies

Roadside surveys indicate that around 1% to 11% of driving involves the use of telephones while driving (DfT, 2015; ITF, 2014; WHO 2011; Narine et al, 2010; McCartt et al, 2009).

Cell phone use in selected EU countries

Austria: In a road-side survey in Austria in 2013, 2% of drivers were talking on the phone without a hands-free kit. Another 1,2% held the phone in their hand. Drivers of vans and trucks were significantly more often observed with handheld devices than car drivers.

Czech Republic: In 2011, it was estimated that 2,7% of drivers were using a mobile phone while driving.

England and Scotland: In 2014, 1,6% of all drivers in England and Scotland were observed using a hand-held mobile phone whilst driving (DfT 2015). Drivers were more likely to be observed with a mobile phone in their hand rather than holding it to their ear. In 2014, 1.1% of drivers in England and Scotland were observed holding a phone in their hand compared with 0,5% observed holding the phone to their ear. A significantly higher proportion of male drivers were observed using hand-held mobile phones than female drivers; 1,7% of male drivers in England and Scotland were observed using a hand-held mobile phone compared with 1,3% of female drivers. Goods vehicles and lorry drivers had lower overall rates of mobile phone use than car drivers with 1,2% observed using a hand-held mobile phone. Bus, coach and minibus drivers had the lowest rate of mobile phone use with 0,4% observed using a hand-held mobile phone. Van drivers had a higher overall rate of mobile phone use than car drivers with 2,7% observed using a hand-held mobile. A London survey indicated that in 2009, the overall level of use was 2,7% with a greater proportion of car, van and taxi drivers using hands-free rather than hand-held phones. The use amongst van drivers was nearly twice as high as for car drivers. The use of hands-free for taxi drivers was almost nine times as high as the use of hand-held phones (Narine et al, 2010).

France: In 2012, a roadside survey showed that at any given time, 2% of car drivers were using a hand-held phone while driving. A study undertaken in 2010 estimated that 10% of injury crashes could be attributed to phone use while driving.

Ireland: An observational survey of drivers' mobile phone use when driving was carried out in 2013 which found that 4% of drivers used a hand-held mobile phone while driving.

Italy: During 2009-2011, observed cases of car drivers using mobile phones while driving represented around 9%. The observation surveys were limited to selected cities

Spain: Observational studies indicate that around 3% of drivers use their mobile phone while driving.

Sources: ITF, 2014; DfT, 2015; Narine et al, 2010

A naturalistic driving study indicated that around 30% of car drivers make use of the phone while driving (Stutts et al, 2003). A Dutch survey found that 48% of car drivers use the phone while driving. About a third made use of hands free phones and a third of handheld. About 15-35% of car drivers text while driving, either sending or reading messages (Stutts et al, 2005).

Males and younger people (younger than 30 years) use mobile phones while driving more often than other groups (Dragutinovic & Twisk, 2005).

Self-reports

A substantial proportion of drivers report occasional use of mobile phones while driving in EU countries and elsewhere (Dragutinovic & Twisk, 2005; Narine et al, 2010). Surveys indicate that the main reasons given for their use are safety and security and ease of communication for business, family or social purposes (Dragutinovic & Twisk, 2005).

A UK survey in 2009 indicated that 36% of motorists reported using a hand-held mobile phone while driving their car, with a quarter saying that they had done so in the past week. The motorists surveyed also reported that they had observed 93% of other motorists using a mobile phone while driving during the previous seven days (What Car, 2009). Some 50% of drivers in the Netherlands reported using a mobile phone while driving in 2005 (Dragutinovic & Twisk, 2005). An Australian survey (2013) of 1.500 people found that nine in ten active Australian drivers (91%) reported having a mobile phone and 61% reported they used a mobile phone while driving, up from 59% in 2011 (Petroulias 2014).

4 Effects on driving performance and crash risk

A range of studies conclude that the use of a mobile phone while driving i) distracts the driver and ii) causes various changes in driving behaviour that negatively affect traffic safety.

4.1 Driver Distraction

The use of cell phones in cars is one of several sources of driver distraction which contribute to road crashes and injuries to those both inside and outside the vehicle. Research results suggest that mobile phone use may be the most important in-vehicle distraction source for drivers (Yannis, 2013). Mobile phone use while driving can distract drivers in several ways:

Physical distraction can occur when the driver has to use one or both hands to manipulate the telephone to dial a number, answer or end a call instead of concentrating on the physical tasks required by driving (e.g. steering, changing gear etc.). Mobile phone use can also involve associated tasks that may further distract the driver such as writing down telephone numbers whilst driving or writing down dates or notes in diaries (Young et al, 2003).

Visual distraction is caused by the amount of time that the drivers' eyes are on the mobile phone and off the road or, while talking over the telephone, looking at the road but failing to see. The use of mobile phones that display visual information (e.g. reading SMS) while driving will further distract drivers' visual attention away from the road (Dragutinovic & Twisk, 2005).

Auditory distraction can occur when the driver is startled by the initial ringing of the telephone or by the conversation itself.

Cognitive distraction involves lapses in attention and judgement. It occurs when two mental tasks are performed at the same time. Conversation competes with the demands of driving. Listening, alone, can reduce activity in the part of the brain associated with driving by more than a third (Just et al, 2008). The extent of the negative effects of mobile phone use while driving depends

on the complexity of both mobile phone conversations and of the driving situation. The more difficult and complex the conversation, the stronger its effects on driving performance. The more difficult the driving situation, the more impact the telephone conversation can be expected to make (SWOV, 2008). An experimental study conducted in the US indicated that talking on a hand-held or hands-free cell phone are associated with moderate/significant increases in cognitive distraction. In-vehicle activities, such as using a speech-to-text system to send and receive text or e-mail messages, produced a relatively high level of cognitive distraction. This finding led the authors to conclude that a rush to voice-based interactions in the vehicle may have unintended consequences that adversely affect traffic safety (Strayer et al, 2013).

Although the sources of driver distraction may be different, the scientific literature indicates that the effects are a decrease in performance of driving task, resulting in slower speed, closer following distance, more problems with keeping course, more errors and narrower visual focus. As more devices are being installed inside the vehicles and as mobile telephone use continues to increase, the potential for driver distraction – and therefore the risk of severe injury from a distraction-related crash – is rising, especially for teenage drivers and their passengers.

See Erso web text Driver Distraction for detailed discussion.

4.2 Changes in driving behaviour

Reviews of the scientific literature have summarised the negative effects on driver performance which have been demonstrated in a range of studies using a variety of research techniques (Caird et al, 2005; Caird et al, 2008; Dragutinovic & Twisk, 2005; Elvik, 2011; RoSPA, 2002; Stelling & Hagenzieker, 2012). These reviews also indicate that the use of hands-free and hand-held phones produce similar impairment in performance compared to normal driving without using a phone. The driver's response to critical events is impaired more than the ability to maintain vehicular control. Other findings highlighted in research reviews (e.g. Dragutinovic & Twisk, 2005).

Slower braking reactions with more intensive braking and shorter stopping distances. Studies show that braking reaction time is increased during an in-car telephone conversation; drivers brake harder with shorter stopping distances (Strayer et al, 2003).

Slower reactions to traffic signals and more frequently missed signals. In-car telephoning while driving results in a significant reduction in driver reaction time to traffic signals or other relevant traffic events. The probability of missing important traffic signals is also increased (Strayer & Johnston, 2001).

Reduced general awareness of other traffic. Studies have shown a significant drop in situation awareness in perception, comprehension and projection of other traffic due to the level of concentration demanded by in-car telephone phone conversations (See Dragutinovic & Twisk, 2005).

More risks in decision-making. When using an in-car telephone, studies show that drivers accept shorter gaps, make fewer speed adjustments and adjust less to potentially dangerous road conditions such as slippery roads (See Dragutinovic & Twisk, 2005).

Slower reaction times than from excess alcohol. Research shows that driver reaction times are 30% slower when telephoning while driving than driving with BAC levels of 80mg/100ml and 50% slower than under normal driving conditions (Burns et al, 2002).

Compensatory behaviour. Some studies have observed that drivers engage in risk- compensatory behaviour during mobile phone use such as reducing speed or increasing headways to offset any perceived potential danger (Elvik, 2011; Stelling & Hagenzieker, 2012).

The pattern of results to date in one meta-analysis suggests that drivers may adjust their headways and reduce speeds when using a hand-held phone but not with a hands-free device (Caird et al, 2008). The new behaviour, however, may not address the actual safety requirements of the driving task in any given situation (Dragutinovic & Twisk, 2005).

Lower seat belt use. Studies also indicate that seat belt use is significantly lower for hand-held mobile phone users than for non-users (Eby, 2003). Mobile phone users while driving also engage in other risky behaviour like drinking and driving more often and exceeding the speed limit more frequently.

Inattention to traffic. Studies have found a relationship between the amount of time that a driver spends glancing away from traffic and glancing at equipment or an object and increased crash risk and that the threshold is around 1,6 seconds (Horrey and Wickens, 2006; Klauer et al, 2006; Theeuwes, 2008). Research has demonstrated that the average time of the longest glances at a mobile phone while texting is longer than 2 seconds (Hosking et al, 2006).

4.3 Age-related effects

Use of a mobile phone while driving is widespread amongst young novice drivers who already have a higher crash risk (Dragutinovic & Twisk, 2005; Lee, 2007; McEvoy et al, 2006). A study comparing young (18-25 years.), adult (26-54 years.) and older (55+years.) drivers found that young drivers (18-25 years.) more frequently use mobile phone, text, listen to music, and eat and drink than older drivers (26-54 years.; 55+) (Young & Lenne, 2010). Studies show that older drivers, in general, are slower reacting to events and find it more difficult to conduct two tasks at the same time (Caird et al, 2008). See ERSO web text on Older Drivers.

Other road users

Research on the effects of talking and listening among other road users is scarce. Two field studies among cyclists demonstrate that a conversation by phone leads to a reduction of speed, longer reaction time and the number of objects that are missed, and to a narrower visual focus (de Waard et al, 2010, 2011). Pedestrians that use mobile phones walk more slowly than pedestrians that do not use a phone or who listen to music (Hyman et al, 2010; Neider et al, 2010). Also, pedestrians who use the mobile phone notice fewer objects in their walking environment (Nasar, 2008).

A Dutch study (Goldenbeld et al, 2012) shows that the use of devices while cycling is also age-specific. Device use for various purposes (music, phone, information, texting) was about twice as high among younger cyclists (12-34 yrs.) than among older cyclists (35 years+). Older cyclists

(50+) report selectively not using devices in these situations – which is in fact a form of compensatory behaviour – two to three times more frequently than younger cyclists (12-17 and 18-34 years old).

4.4 Hands-free versus hand-held use

The majority of studies indicate that the use of hands-free phones cause as much important driver distraction as the use of hand-held phones (Caird et al, 2005, 2008; Dragutinovic & Twisk, 2005). Hands-free phones and other aids such as speed dialling and voice activation can reduce physical distraction. However, one US naturalistic driving study of hand-held, fixed and integrated phone systems indicated that fixed and integrated hands-free systems reduced – but did not eliminate – the need to manually operate a mobile phone. Many integrated or fixed systems still allow, and sometimes require, visual-manual phone tasks (Fitch et al 2013).

Typically, the most important negative factor of mobile phone use reported in experimental studies is cognitive distraction – the diversion of attention from driving to the conversation itself. The negative impact of conversation on driving performance is the same for both hand-held and hands-free phones (Consiglio et al, 2003; Dragutinovic & Twisk, 2005; Patten et al, 2004; Strayer & Johnston, 2001).

Studies indicate that both hands-free and hand-held conversations can impair driver performance more than in-car conversations with passengers or listening to the radio (Caird et al, 2008; Charlton, 2008; Consiglio et al, 2003; Parkes et al, 2007; Strayer & Johnston, 2001). Mobile phone conversations have also been observed as being longer than conversations with car passengers. Normal in-car conversation with passengers is observed as being suppressed on the most demanding urban roads (Crundall et al, 2005). Two meta-analyses combining the results of experimental studies (not including two later references cited above (Carlton, 2008; Parks et al, 2007) found similar deficiencies in reaction time for conversation tasks with passengers as for use of hand-held or hands-free phones (Caird et al, 2008; Horrey & Wickens, 2006). Research shows that for young novice drivers, the presence of peers is particularly dangerous not just because of the conversation itself, but also because young people take more risks in the presence of their peers (Dragutinovic & Twisk, 2005). An epidemiological study of crash involvement found that mobile phone use in general was associated with a greater likelihood of crash than passenger carriage and increasing numbers of passengers (McEvoy et al, 2007).

4.5 Extent and effects of texting

In recent years an increasing number of studies has been carried out showing how texting while driving can have a detrimental impact on driving performance and road safety. Caird et al, (2014a) indicated that among the myriad of potential driver distractions, some researchers have concluded that texting and driving is a greater distraction and safety threat than dialling a cell phone (Ranney et al, 2011; GHSA, 2013; Reed and Robbins, 2008), driving while drunk (Elvik, 2012), smoking cannabis (Asbridge et al, 2012; Elvik, 2012), or talking on a cell phone (Caird et al, 2008; McEvoy et al, 2005; Redelmeier and Tibshirani, 1997).

Text messaging has a detrimental effect on safety critical driving measures. Typing and reading text messages affects drivers' capability to adequately direct attention to safety critical driving measures such as attention to the road, respond to important traffic events, control a vehicle within a lane, maintain speed and headway, detect hazards and detect and respond appropriately to traffic signs. (Hosking et al, 2006; Reed & Robbins, 2008; Caird et al, 2014a, 2014b).

The dangers of texting while driving result from a combination of: i) increased mental workload required to write a text message, ii) the control impairment caused by the physical act of holding the phone, and iii) the visual impairment caused by continually shifting visual orientation between the phone display and the road ahead. These factors lead to a significantly impaired ability to maintain a safe road position (Hosking et al, 2006). When text messaging, drivers spend 4 times more time with their eyes off the road than in normal driving (Eby, 2003).

Many drivers admit to texting while driving. A recent meta-analysis of studies found that in Europe, the self-reported frequency of texting "regularly or fairly often" or "at least once" in the past 30 days ranged from approximately 15% to 31% (Caird et al, 2014). A RAC Foundation survey in the UK in 2008 found that 45% of drivers reported texting while driving (Hosking et al, 2006). A Spanish study indicated that 19% of drivers admitted to texting while driving on the highways and 22,5% on rural roads at least once a month (Gras et al, 2007). A Swedish study found that young, inexperienced drivers were more likely to text while driving than older drivers (Thulin & Gustafsson, 2004). In an Australian study, 12,4% of drivers admitted to texting while driving (McEvoy et al, 2005). A New Zealand study of self-reported behaviour found that 66% of participants reported reading at least 1–5 text messages while driving, and 52% reported sending at least 1–5 text messages while driving, during a typical week (Hallett et al, 2007). A US study of high school drivers indicated that 45% reported cell phone use and driving in 2012.

4.6 Effects of social networking using a smartphone on driving performance

One experimental study using a driving behaviour simulator investigated the effect of social networking using a smartphone on driving performance and concluded that performance was impaired not only for the driving task but also for the smartphone task (Basacik et al, 2011). One of the reasons for the performance decrement was visual behaviour with drivers looking down at the smartphone between 40% and 60% of the time.

4.7 Risk of crash involvement

Two methodologically sound epidemiological studies (using a case-crossover design) show that using car phones while driving increases the likelihood of being involved in a crash resulting in property damage (Redelmeier & Tibshirani, 1997) or injury resulting in hospital attendance (McEvoy et al, 2005) by a factor of four. A meta-analysis including these and other types of studies based on reliable data concluded that the odds ratio of crash involvement risk was 2,86 i.e. increased risk by a factor of around three (Elvik, 2011). As shown in Table 1, naturalistic driving studies estimate the risk as being somewhat lower and three naturalistic driving studies show no increased risk of hands-free mobile phone use (Hickman et al, 2010; Klauer et al, 2006; Olson et al, 2009; Stelling & Hagenzieker, 2012). Scientific explanations for this difference are not yet available. Naturalistic driving studies allow the observation of road user behaviour in real

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traffic conditions over long periods of time. However, the disadvantages of this method are that driving behaviour may be influenced by the knowledge of being under observation (Regan et al, 2011). Different task definitions used in the different types of studies may also be a contributing factor. A meta-analysis of studies of varying quality noted the tendency for the odds-ratio of crash involvement to be reduced over time which deserves further exploration (Elvik, 2011).

Table 1 presents change in crash risk (odds ratio) for being distracted by talking or listening while driving, as has been estimated in both epidemiological crash research and naturalistic driving studies. An odds ratio higher than 1 signifies that a (distractive) activity is associated with larger risk than 'normal' driving, whereas an odds ratio lower than 1 indicates a lower risk. Naturalistic driving studies of mobile phone use by truck (and bus) drivers who are texting while driving indicates that they have a 23 times or even 160 times higher chance of a (near-) crash than when they are not texting.

Table 1. Estimates of relative risk (odds ratios) of talking/listening among drivers of personal cars and trucks/buses).

Distractive activity	Naturalistic Driving-studies		Crash studies
	Person car drivers	Truck-/ bus drivers	
Conversation by mobile phone			4,34 4,15 5,60 1,1 (males) 1,2 (females)
• Hands-free		0,44 0,65	5,94 3,85
• Hand-held	1,30	1,04 0,90	3,94 4,95
Conversation with a passenger	0,50	0,35	

Sources: Backer and Grondahl (2009), Hickman et al (2010), Klauer et al(2006), Laberge-Nadau (2003), McEvoy et al (2005), Olson et al (2009), Redelmeier and Tibshirani (1997), Violanti and Marshall, (1996)

Crash involvement increases with an increasing amount of in-car telephone use. Heavy users are twice as likely to be involved in a crash as those making minimal use of mobile phones. Hands-free phones offer no safety advantage over hand-held units (Laberge-Nadau et al, 2003; McEvoy et al, 2005). Gender or age group does not affect the increased likelihood of a crash while using a mobile phone and driving (McEvoy et al, 2005).

A Norwegian study based on insurance records concluded that compared to driving without using a phone, mobile telephone use during driving increases the likelihood of being involved in a crash by about 1,7 times, rising to 2,2 for "at fault" drivers. The study also found that rear-end collisions were over-represented among the crashes occurring during mobile telephoning (Sagberg, 2001).

While mobile phone users have a greater chance of being involved in a crash, the increased crash rate is not exclusively due to mobile phoning: mobile phone users also wear their seatbelt less frequently and show risky behaviour such as drink-driving and speeding more frequently. Scientists point out that while research to date has found a strong link between car phone use and crash risk, a causal connection between mobile phone use and road crashes has yet to be

scientifically established. Determining a causal connection requires 'exposure assessment' and the need to determine any 'confounding factors' (Dragutinovic & Twisk, 2005). For example, a higher crash injury risk for mobile phone users may be caused by their greater acceptance of high-risk behaviour (such as failure to wear a seat belt) or by their higher annual mileage compared with non-users.

4.8 Size of crash injury problem

Several reviews conclude that the collection of data about mobile phone involvement in road crashes is neither widespread nor very systematic which makes it difficult to estimate the danger of mobile phone use in vehicles on European roads. In most European countries, the presence or use of a mobile phone in a vehicle is generally not recorded in a crash unless the crash has severe consequences. The likelihood of under-reporting of use is also identified as a key problem in efforts to ascertain the extent of the problem (Dragutinovic & Twisk, 2005).

The Institute for Road Safety Research (SWOV) estimated that eliminating mobile phone use while driving in the Netherlands in 2004 would have prevented nearly 600 road deaths and hospital admissions, approximating to 8% of all registered road deaths and hospital admissions (Dragutinovic & Twisk, 2005).

A Swedish study estimated that around 10-20 people die annually in Sweden as a result of using a mobile telephone while driving (Gras, et al, 2007).

A study by the Harvard Center for Risk Analysis (HCRA) estimated that the use of telephones while driving may result in approximately 2.600 deaths, 330.000 moderate to critical injuries, 240.000 minor injuries, and 1,5 million instances of property damage in the US annually (Cohen, 2003).

An Australian study indicated that mobile devices in general may be a factor in 7% of crashes, accounting for 83 deaths and 2.300 hospitalised injuries in 2013 (BITRE, 2014).

4.9 Public perception of crash risks

While little research has been conducted into public attitudes to car telephone use in Europe, the available surveys indicate an underestimation amongst drivers of how this behaviour adversely affects driving performance, an erroneous belief that the use of hands-free phones is largely danger-free and general support for hand-held bans for all drivers (Dragutinovic & Twisk, 2005). Research to date suggests that drivers do not seem to be entirely aware of the adverse effects of mobile phone use on their driving performance (Horrey et al, 2008). Young drivers and women drivers, in particular, feel that they can cope with its distracting potential. At the same time drivers recognise impaired driving performance of others during mobile phone use (Lesch & Hancock, 2004). In a Canadian survey of adult drivers in Canada, respondents were asked how frequently they saw nine potentially unsafe driving behaviours. Talking on a mobile phone while driving topped the list, rated as more common than behaviours such as speeding, failing to signal, tailgating, and running a red light (Vanlaar et al, 2006).

4.10 Research directions

The extent of cell phone use in EU driving needs to be ascertained to allow estimation of exposure to risk; cell phone use needs to be recorded in crash reports in order to ascertain the extent of crash injury; the effect of mobile phone use in traffic by road users other than car drivers such as cyclists, pedestrians and truck drivers needs to be studied. Simulator studies on driver distraction provide useful insights into how driver, vehicle, and roadway characteristics influence distracted driving behaviour and safety. Larger scale simulator studies on driver distraction (larger and more representative samples), more rigorous experiment designs and more uniform reporting of the results are now needed (Papantoniou et al, in press). Not least, specific criteria and methodologies need to be developed for assessing the safety implications of in-vehicle information systems, including mobile phones followed by evaluation of the effects of intervention.

As Caird et al (2014b) have highlighted: “The effects of dialling and conversing on a mobile phone on driving performance and crash risk require careful analysis across and within naturalistic, epidemiological, and driving simulation studies. No single methodological approach will paint a complete picture, and each type of study has strengths and weaknesses. Naturalistic, epidemiological and simulation studies each add convergent information about the impact of distractions on driver performance and crashes. Meta-analyses and research syntheses of driver distraction and countermeasures will increase the strength of evidence across levels of analysis.”

5 Policies and Interventions

5.1 Policies on car telephone use

The World Health Organisation has called for Governments to be proactive now in reducing distraction from the use of mobile phones and put in place measures to address mobile phone use among drivers, while simultaneously monitoring and evaluating the effects of these interventions. This will require legislative measures, creative ways of enforcement, some degree of cooperation or regulation of industry, and a shift in societal perceptions about what behaviour is “acceptable” at the wheel (WHO, 2011).

EU level:

An EU framework for action to address general safety issues of mobile phone use amongst younger teenagers and children has been established at European level. The safety issues around the in-vehicle use of mobile phones are mainly being addressed within the context of research and development of Human Machine Interface (HMI) and in-vehicle information systems. A new study on Road User Distraction funded by the European Commission is underway (TNO, TRL 2015). The EU can play a major role in supporting activity towards harmonised requirements as well as in the provision of guidance, data collection and support for research and development. (Janitzek et al, 2009; ETSC, 2010).

National level:

Legislative frameworks

An EU project review indicates diversity in the approach to regulation and legislation in the 27 EU Member States, Switzerland and Iceland (Janitzek et al, SMART, 2009; Avenoso, 2012). Most

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EU countries except Sweden have introduced legislation aimed at restricting the use of car telephones and banning the use of hand-held phones (see Table 2). Australia and many US states also ban the use of hand-held phones. Some countries address telephone use while driving in legislation through the broader issue of driver distraction, careless or dangerous driving.

Cell phone bans in the United States

Hand-held Cell Phone Use: 14 states, District of Columbia (D.C.) prohibit all drivers from using hand-held cell phones while driving. All are primary enforcement laws – an officer may cite a driver for using a hand-held cell phone without any other traffic offense taking place.

All Cell Phone Use: No state bans all cell phone use for all drivers, but 38 states and D.C. ban all cell phone use by novice drivers, and 20 states and D.C. prohibit it for school bus drivers.

Text Messaging: Washington was the first state to pass a texting ban in 2007. Currently, 46 states, D.C., ban text messaging for all drivers. All but 5 have primary enforcement. Of the 4 states without an all driver texting ban: 2 prohibit text messaging by novice drivers and **1 restricts** school bus drivers from texting.

Most EU countries permit the use of hands-free equipment. Most commonly a headset or wireless equipment (e.g. Bluetooth) is sufficient. Some countries additionally require that the phone must be fixed in a mounting (Greece, Italy, Luxembourg, Malta and Slovenia). Luxembourg and Slovenia have rather highly intervening regulations in place that restrict using/mounting mobile phones in several ways (e.g. all functions that involve continuous handling are prohibited).

Other measures include prohibiting the use of car telephones – both hand-held and hands-free – for special categories of drivers (e.g. school bus drivers) or young novice drivers, usually within the framework of graduated licensing systems.

Enforcement is technically more difficult compared to traditional offences and is exclusively subject to non-automated enforcement by police officers. In about half of the European countries targeted checks are applied. In some jurisdictions offences outnumber traditional offences such as driving impaired or unbelted, notwithstanding low levels of specific enforcement (Avenoso, 2012). Insurance cover may also be forfeited if the driver is involved in a crash while using a mobile phone.

In some countries, e.g. the UK, there is an exemption for calls to the emergency services in genuine emergencies where it is unsafe or impractical, or when two-way radios are in use.

Table 2: Legislation on mobile phone use in EU countries

Cell phone use while driving

Country	Legislation requires		Hand-held phone is prohibited if		Requirement to use		Hands-free required when using		Forbidden to use			Requirements concerning	
	complete ban	use of hands-free equipment	engine is running	vehicle is moving	headset/Bluetooth	additionally fixed phone	phone function	other function	texting function	all functions that involve continuous handling	headphones	location of mounting	way of fixing
AT		X		X	X		X						
BE		X	X		X		X	X					
BG		X		X	X		X	X					
CY		X		X	X		X		X				
CZ		X		X	X		X	X					
DE		X	X		X		X	X	X				
DK		X	X		X		X	X					
EE		X		X	X		X						
EL		X		X		X	X	X	X				X
ES		X	X				X			X			
FI		X		X	X		X	X		X			
FR		X		X	X		X	X	X				
HU		X	X		X		X						
IE		X	X		X		X						
IT		X		X		X	X	X	X				
LT		X	X		X		X	X		X			
LU		X		X		X	X		X	X			X
LV		X		X	X		X		X				
MT		X		X		X	X						
NL		X		X	X		X	X					
PL		X		X	X		X	X					
PT		X		X	X		X	X	X	X			
RO		X		X	X		X						
SE													
SI		X		X		X	X	X	X	X			
SK		X		X	X		X	X					
UK		X	X		X		X	X					
CH		X		X	X		X	X	X				
IS		X	X		X		X						

Source: Table 2, SMART 2009

Cell phone use while driving

Banning the use of hands-free telephones

There has been wide debate about the introduction of legislation banning the use of hands-free telephones while driving in several countries. Safety organisations have called for a complete ban on mobile phone use while driving such as the National Safety Council in the US, the European Transport Safety Council at EU level, and the Royal Society for the Prevention of Accidents and PACTS in the UK, while some industry bodies advocate education over legislation as the appropriate intervention e.g. the Wireless Association in the US. While usually warning about their use while driving, governments have usually cited potential difficulties in securing compliance with hands-free options as the main reason against bans. The observation of hands-free use by roadside police enforcement or for novice drivers in isolation is identified as a practical problem (Dragutinovic & Twisk, 2005; OECD, 2006).

Some countries look to careless or dangerous driving legislation to address problems of hands-free use. For example, while only hand-held use is specifically prohibited in the UK, the use of hands-free phones may still be considered to be distracting by the courts. Individuals risk prosecution for failing to have proper control of a vehicle under Regulation 104 of the Road Vehicles (Construction and Use) Regulations 1986 if they use a hands-free phone when driving. In the event of an incident involving the use of hand-held or hands-free telephones, drivers may be prosecuted for careless or dangerous driving. The first conviction in the UK involving hands-free took place in 2009 when a company director was convicted of careless driving, banned from driving for 12 months and fined £2,000 following a crash that caused the death of a fellow motorist whilst using a hands-free mobile phone (Wallace, 2007).

Bans on text messaging while driving

Generally in Europe, text messaging is included in the general bans on the use of a hand held phone. In the US text messaging is specifically banned for all drivers in 10 states (Alaska, Arkansas, California, Connecticut, Louisiana, Minnesota, New Jersey, Utah, Virginia and Washington) and the District of Columbia. In addition, novice drivers are banned from texting in 9 states (Delaware, Maine, Maryland, Nebraska, North Carolina, Oregon, Texas, Virginia, and West Virginia) and school bus drivers are banned from text messaging in 3 states (North Carolina, Texas, and Virginia) (IIHS, 2009).

Bans on mobile phone use while driving for young drivers

Mobile telephones are more commonly used by young drivers (who are already at high risk) than adult drivers. In the US, bans on telephoning while driving – whether hands-held or hands-free – are being introduced increasingly as part of graduated driver licensing arrangements.

Bans on mobile use by school bus drivers

In seventeen US States and the District of Columbia, school bus drivers are prohibited from all cell phone use when passengers are present. States also legally restrict school bus drivers from texting while driving.

Information and publicity campaigns

Information and publicity has been used to draw attention to the consequences of using a telephone while driving and in support of the introduction of legislation. See for example <http://think.dft.gov.uk/think/mediacentre/237144/mobilephones>

Cell phone use while driving

Several wireless providers and automobile manufacturers have launched campaigns to increase the awareness of the risks of driver inattention.

Company policies on car telephone use

Research has shown that high mileage company car drivers have a crash and casualty rate that is around 50% higher than private motorists after adjusting for exposure (Broughton, 2003), (Downs et al, 1999). Driver distraction which includes the use of mobile phones and driving has been identified as a key factor (Downs et al, 1999) and a ban on the use of mobile telephones in companies is becoming increasingly common.

Reference in the literature is made to bans by the petro-chemical industry in the Netherlands (Dragutinovic & Twisk, 2005) and several large companies in the UK. A survey of company policies on car telephone use in the UK in 2000 indicated that large companies had, for the most part, policies to ban or restrict the use of mobile phones when driving for work purposes. Most companies restricted the use of hand-held mobile phones while driving. Many provided hands-free kits to enable their staff to use phones while driving under limited conditions. Some large companies prohibit the use of any mobile phone while driving for work purposes and require staff to use their phones only when safely parked (RoSPA, 2002). Many fleets in the UK have since banned hands-free phones while driving (see the example of First Group plc).

First Group plc ban on mobile phones including hands-free sets

A large transport company, First Group plc, banned its 135,000 employee workforce in the UK and US from using mobile phones, including hands free mobile sets, when driving on company business with effect from 1 January 2008. The decision was based on research from the Transport Research Laboratory which adds to a growing body of evidence that driving performance is significantly impaired when holding a telephone conversation.

Research suggests that driver performance while making a hands-free telephone conversation is at a lower level than when driving at the UK legal limit of alcohol intoxication. The ban was accompanied by an internal communications programme – including thought provoking posters and DVDs – in support the policy and detailed advice on the new policy was given to First's staff throughout the UK and North America. It will remind them that mobile phones and other devices capable of making or receiving calls are switched off when driving and to check that when receiving calls made by FirstGroup they are complying with the policy.

Announcing the decision in December 2007, Moir Lockhead, Chief Executive of First Group plc, said: "Our philosophy at First is simple: If you cannot do it safely, don't do it! When we reviewed the evidence produced by the Transport Research Laboratory we decided to implement this new policy and to put a company-wide communications campaign in place to inform our staff. "This decision is in line with our Injury Prevention Programme which is designed to create a safe working environment for our staff and to ensure we deliver safe services to our passengers."

Source: www.trl.co.uk/news/latest_news/firstgroup_bans_use_of_hands-free_mobile

A variety of guidance is available to employers concerning the use of mobile phones while driving. For example, the Royal Society for the Prevention of Accidents (RoSPA) has produced guidance on how employers and line managers can achieve the business and communication benefits of mobile phones without experiencing the financial and safety risks of their staff using mobile phones while driving on work journeys (see boxes below) (RoSPA, 2004).

What employers should do (RoSPA, 2004; Broughton, 2003)

Expect Safe Driving

Ensure all staff, including senior managers and line managers, understand that the organisation expects everyone who drives for work to drive safely for their own, and others' benefit.

Consult Staff

Ensure that staff and/or their safety representatives are fully consulted about the organisation's policy on Mobile Phones and Driving and that this is reviewed periodically in joint health and safety committee meetings.

Raise Awareness

As part of recruitment, training and staff appraisal, ensure that drivers and line managers are reminded about:

- the dangers of using a hand-held or hands-free mobile phone while driving
- the organisation's policy on mobile phone use
- the need to go to voicemail, or to switch the phone off while driving, and to stop in a safe place to check messages, or to allow a passenger to use the phone
- that good communication can easily be maintained without using a phone while driving
- the importance of line managers not expecting staff to make or receive calls when driving
- the legal, financial and bad PR consequences that could result from using a mobile phone while driving

Avoid Using a Mobile Phone

In particular, emphasise that staff should never make or receive calls on a mobile phone, or use any similar device, while driving.

Lead by Example

Senior Managers, from the head of the organisation down, should lead by personal example by not using a mobile phone while they are driving themselves.

Plan Safer Journeys

Ensure that journey plans include time and places to stop for rest and refreshment, and to check messages and return calls. For further advice see 'Driving for Work: Safer Journey Planning' at www.rosipa.com/roadsafety/info/worksafejourney.pdf

Review Work Practices

Review work practices to ensure they do not pressurise staff into making or receiving calls when driving.

Record and Investigate Crashes and Incidents

Require staff who are involved in any crash or damage-only incident when driving at work (in their own, a hire or company vehicle) to report this to their line manager. Check if the driver was using a mobile phone, and what (if any) action is necessary to prevent repeat occurrences. If the company provides the phone, a check could be made against the phone bill.

Provide Training

Interview staff who have been identified as using a phone while driving, or been involved in a crash, to establish the details and to identify what lessons can be learned. The approach should be positive and helpful, rather than punitive, although it should be made clear that further incidents may lead to disciplinary procedures. Consider if driving training would help.

What employers should do (RoSPA, 2004; Broughton, 2003) - continued from previous page

Liaise with the Police

Make it clear to staff that the organisation will co-operate with police enquiries resulting from a crash and will supply to the police all relevant information on the employee to whom the vehicle is allocated or if someone else was driving at the time, their details.

Monitor Compliance

Managers should discuss this issue with their drivers during periodic staff appraisals and team meetings. It should form part of an individual employee's performance appraisal, leading, where appropriate, to new personal performance targets. Staff should be encouraged to report any pressure from managers or customers to use a phone while driving.

Sample Company Mobile Phones and Driving Policy (Broughton, 2003)

As part of our overall health and safety policy is committed to reducing the risks which our staff face and create when driving or riding for work. We ask all our staff to play their part, whether they use a company vehicle, their own or a hire vehicle.

Staff driving for work must never make or receive calls on a mobile phone, whether hand-held or hands-free, while driving. Persistent failure to do so will be regarded as a serious matter.

Senior Managers must:

Lead by example, both in the way they drive themselves and by not tolerating poor driving practice among colleagues. They must never make or receive a call on a mobile phone while driving.

Line Managers must ensure:

- they also lead by personal example
- they do not expect staff to answer calls when they are driving
- staff understand their responsibilities not to use a hand-held or hands-free mobile phone while driving
- staff switch phones to voicemail, or switch them off, while driving, or ask a passenger to use the phone
- staff plan journeys to include rest stops which also provide opportunities to check messages and return calls
- work practices do not pressurise staff to use a mobile phone while driving
- compliance with the mobile phone policy is included in team meetings and staff appraisals and periodic checks are conducted to ensure that the policy is being followed
- they follow our monitoring, reporting and investigation procedures to help learn lessons which could help improve our future road safety performance
- they challenge unsafe attitudes and behaviours, encourage staff to drive safely, and lead by personal example by never themselves using a phone when driving.

Staff who drive for work must

- never use a hand-held or hands-free phone while driving
- plan journeys so they include rest stops when messages can be checked and calls returned
- ensure their phone is switched off and can take messages while they are driving, or allow a passenger to use the phone
- co-operate with monitoring, reporting and investigation procedures.

5.2 Effectiveness of interventions

Banning the use of car telephones while driving

There is little data about the effectiveness of interventions to reduce the use of car telephones while driving in EU countries. Japan, several US States, Finland and the UK have evaluated the effectiveness of banning the use of car telephones while driving and its enforcement in terms of use, though not crash involvement. Results to date indicate that the short-term effects of these laws on the level of use could be significant but may not be sustained in the longer term with levels of use even returning to pre-law usage levels. Compliance with legislation increases with some combination of publicity and education campaigns, enforcement and appropriate penalties in the event of non-compliance.

Banning hand-held phones

Evaluations in the US, Finland, and the UK indicate that the introduction of legislation prohibiting hand-held phone use while driving led to around a 50% reduction in use shortly after the laws became effective (McCartt et al, 2006).

- United States Studies of laws prohibiting use of hand-held phones have found that such use declined significantly in the first few months after the implementation of legislation prohibiting the use of hand-held telephones while driving. Longer term reductions were not found.
- New York New York was the first state in the US to ban hand-held mobile phone use while driving in 2001. The law was accompanied by considerable publicity and it included a one-month warning phase and a three-month period in which fines could be waived if a driver could provide proof of purchase of a headset or speakerphone. The percentage of drivers using hand-held mobile phones declined significantly from 2,3% before the law to 1,1% after one month of the law being implemented. After four months, use was still at the same level of 1,1%. Overall reduction in mobile phone use in the period prior to the law to after the fine-without-waiver phase was 52% (McCartt et al, 2003). Monitoring after the legislation had been in place for 12 months indicated that the use of hand-held mobile phones had risen to 2,1%. Publicity declined after the law's implementation. No targeted enforcement efforts were evident (McCartt & Geary, 2004).
- Washington D.C. The ban in Washington D.C. took effect in July 2004. Four months after the ban went into effect, the proportion of drivers using hand-held phones declined from 6% to 3,5% and produced longer term reductions in use. Mobile phone offence records represented 8% of all moving traffic offences (compared with 4% in New York). (IIHS, 2005; McCartt & Hellinga, 2007; McCartt et al, 2005).
- District of Columbia Following the introduction of hand-held mobile phone use, monitoring after 12 months showed that the 50% reduction of pre-law levels had been achieved which was largely attributed to tougher enforcement (McCartt et al, 2005).
- United Kingdom Against the background of a gradual increase in the number of drivers using mobile phones (from 1,5% in 2000 to 2,4% in April 2003, a ban on driving while using a hand-held mobile phone came into force in December 2003 (DfT UK, 2003). A new offence was introduced regarding using a hand-held mobile phone while driving, or using a hand-held

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mobile phone while supervising a novice driver. In the year to September 2004, use of hand-held mobile phones fell by 30% among car drivers and by 5% among other drivers (PACTS, 2005). In September 2004 observational studies found 1,1% of car drivers and 2,2% of other drivers using hand-held mobile phones and 1,4% of car drivers and 1,6% of other drivers using hands-free mobile phones. Use of mobile phones rose to 2,5% for car drivers and 3,5% for other drivers by April, 2006 (TRL, 2006). In 2007, tougher penalties were introduced making the use of a hand-held mobile phone while driving an offence subject to three penalty points and a £60 fine. Previously, this offence had carried a fixed penalty £30 fine without penalty points or a fine of £1.000 if there is attendance at court (£2.500 for drivers of goods vehicles or passenger carrying vehicles with 9 or more passenger seats). A survey in August 2007, indicated the reduced levels of use -1,4% for car drivers (1% hand-held and 0,4% hands-free) and 3% for other drivers.

- Finland Legislation came into force in the beginning of 2003 prohibiting the driver of an engine-powered vehicle from using a hand-held mobile phone during driving. Monitoring showed that the legislation led to a self-reported decrease in the use of hand held phones, a doubling of the use of hands-free phones and more reported conversations, and an overall decrease in the use of car phones in general. Immediately after the Act entered into force, the proportion of drivers who reported using hand-held phones during driving decreased from 56% to 15%. Although this rose to 20% by early 2004. However, the legislative change has not decreased dangerous traffic situations related to mobile phone use reported by drivers (Rajalin et al, 2004).
- The Netherlands A ban on the use of hand-held phones while driving was introduced in the Netherlands in April 2002. Monitoring indicates that the number of fines for using a hand-held mobile phone while driving has risen substantially between 2002 and 2006. However, it is not known whether the number of fines reflects the level of enforcement or actual mobile phone use while driving (SWOV, 2008).

Table 3: The number of fines issued in the Netherlands for using the hand-held phone during driving

Period	Number of fines in period	Number of fines per month
April-December 2002	25.000	2.778
January-August 2003	55.000	6.875
January-December 2004	100.000	8.333
January-December 2005	116.792	9.733
January-December 2006	117.343	9.779

Source: SWOV 2008, Bureau Traffic Enforcement of the Public Prosecution Service BVOM; Central Fine Collection Agency CJIB

- Japan Results from Japan show a substantial reduction in the number of crashes involving mobile phone use (52%), in the number of people injured in such crashes (53%) and in the number of people killed in mobile phone crashes (20%) following the introduction of a ban (RoSPA, 2002).

Banning all mobile phone use while driving for young drivers

There is little information concerning the effectiveness of laws banning mobile phone use for young drivers.

North Carolina Legislation banning the use of any mobile phone device by drivers younger than 18 was introduced by the state in December 2006, under its graduated licensing system. About 11% of teenage drivers were seen using mobile phones while driving before the law was introduced. That percentage rose slightly to 12% in the post law survey.

Telephone interviews with parents and teens found that support for the restriction was high among both parents (95%) and teens (74%), but awareness of the restriction was only moderate. There was also very little perceived (and actual) enforcement of the law. Hence, it appears that combined publicity and enforcement are important obtaining compliance with teenage driver mobile phone restrictions (Foss et al, 2008).

5.3 Technological development

Further technological development has the potential to create new problems associated with the use of mobile phone in cars as well as contributing new solutions.

In-vehicle internet and email access

On average, 30% of the workforce spends at least two to three days per week outside the office (EMPO, 2008) and the use of the car as office is becoming increasingly viable. Mobile phones in cars can be combined with a range of computerised devices such as personal organisers, address books, electronic mail or company computer systems. Thirty-eight percent of mobile phone users in Western Europe are forecast to become users of mobile Internet services by 2013 (Forrester, 2009).

The potential distractions associated with use of in-vehicle internet and email access systems while driving and the urgent need for evaluation is highlighted in the literature (Dragutinovic & Twisk, 2005; Young et al, 2003).

Several types of interface for these systems are now commercially available for use while driving. These include systems that use tactile marks on the phone key pad buttons to give each button a distinct feel, thus reducing the need for drivers to look away from the road to see what they are pressing; systems that employ steering mounted buttons to input information; and systems which rely on voice activation for input (Burns, 2000). Negative impacts on driving performance of speech-based email have been identified (Lee et al, 2001) and the potential safety impact of other interface systems are, as yet, unknown (Young et al, 2003). Experts recommend that while vehicle users can access the Internet using conventional interfaces while the vehicle is stationary, vehicle systems should lock out some in-transit functionality for the driver, while at the same time allowing passenger use (EMPO, 2008).

Visual displays on mobiles and miniaturisation of telephones

The use of mobile phones while driving which display a variety of visual information (e.g. SMS) will distract a driver's visual attention away from the road. Since driving is a visual task, this is more than likely to create new safety problems, as might new trends in mobile phone design such as miniaturization (Dragutinovic & Twisk, 2005).

Technological devices to block mobile use while driving

Attempts are being made to develop technology through GPS and other means to block mobile use while driving in the same way as interlocks have been used to reduce speeding and drinking and driving (NSC, 2009).

5.4 Research-based recommendations for action

A range of recommendations for action and future research follow:

Urgent research and data collection

- The extent of telephone use in EU driving needs to be ascertained to allow estimation of exposure to risk.
- Cell phone use needs to be recorded in crash reports in order to ascertain the extent of crash injury.
- Specific criteria and methodologies need to be developed for assessing the safety implications of in-vehicle information systems, including mobile phones followed by evaluation of the effects of intervention.
- The effect of mobile phone use in traffic by road users other than car drivers such as cyclists, pedestrians and truck drivers needs to be studied.
- There is a need for larger scale simulator studies on driver distraction (larger and more representative samples), more rigorous experiment designs and more uniform reporting of the results.

Public and private sector rules

- Interventions regarding mobile phone use should be evidence-based and address hand-held and hands-free phones. If the detection of hands-free telephoning while driving is difficult to enforce by conventional means, in-vehicle enforcement through technological means might provide an alternative future option.
- Continuing enforcement and publicity will be needed to increase the efficacy of legislation.
- Company policies which impose a complete ban on the use of mobile phones while driving could be encouraged and supported.

Better hands-free design

The human-machine interface of in-car information systems and telephones needs to be designed as ergonomically as possible to allow safe use such as automatic postponement of the connection of incoming calls and designing complex human-machine interfaces that would regulate driver use of in-vehicle systems.

Information, education and training

Drivers need to be made more aware of the dangers of mobile phone use and of other various distracting activities and educated about the possible effects of distraction, their ability to compensate for it, as well as receiving practical advice on how to deal with telephones in vehicles.

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Notes

1. Country abbreviations

	Belgium	BE		Italy	IT		Romania	RO
	Bulgaria	BG		Cyprus	CY		Slovenia	SI
	Czech Republic	CZ		Latvia	LV		Slovakia	SK
	Denmark	DK		Lithuania	LT		Finland	FI
	Germany	DE		Luxembourg	LU		Sweden	SE
	Estonia	EE		Hungary	HU		United Kingdom	UK
	Ireland	IE		Malta	MT			
	Greece	EL		Netherlands	NL		Iceland	IS
	Spain	ES		Austria	AT		Liechtenstein	LI
	France	FR		Poland	PL		Norway	NO
	Croatia	HR		Portugal	PT		Switzerland	CH

2. This 2015 edition of Traffic Safety Synthesis on Cell Phone Use While Driving updates the previous versions produced within the EU co-funded research projects [SafetyNet](#) (2008) and [DaCoTA](#) (2012). This Synthesis on Cell Phone Use While Driving was originally written in 2008 and then updated in 2012 and in 2015 by Jeanne Breen, [Jeanne Breen Consulting](#).

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5. Please refer to this Report as follows:

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