Car telephone use and road safety

Final Report

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Summary

During the last 30 years, mobile telephones 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 has been subject to periodic literature review and meta-analyses, indicates the adverse consequences 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 challenges summarised below.

Extent of car telephone use? Few EU countries conduct systematic surveys of car telephone use by drivers. Observational studies in Europe, the US and Australia have, in general, shown that between 1% to 6% of drivers use telephones while driving, with many drivers reporting occasional use.

Effects on driving performance? Research shows that using a car telephone 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 and the detection and appropriate response to traffic signs.

Age-related effects? 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 epidemiological 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 four. Crash involvement escalates with increased telephone use while driving and heavy users are twice as 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, 330,000 serious injuries annually.

Public attitudes to car telephone use? 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 but general support for hand-held bans for all drivers.

Policies on car telephone use? 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. In EU countries, only Portugal restricts the use of hands-free telephones in addition to hand-held devices. There has been debate 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 novice drivers as part of graduated licensing policies and school bus drivers. 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.

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 design and in-car enforcement of legislation.

Research-based recommendations for action? A variety of recommendations for action have 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 crash injury.
- Specific criteria and methodologies need to be developed for assessing the safety implications of in-vehicle information systems, including mobile phones.
- Evaluation of the effects of a range of interventions needs to be carried out.
- 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

- 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.
- Specific criteria and methodologies need to be developed at EU level for assessing the safety implications of in-vehicle information systems (IVIS), including mobile phones.

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 has drawn, in particular, on several literature reviews and meta-analyses of scientific studies on car telephone use and road safety (e.g. Dragutinovic and Twisk, 2005 and SWOV factsheet, 2008), Caird et al (2008), and the Royal Society for the Prevention of Accidents (RoSPA, 2002).

Introduction

During the last 30 years, mobile telephones have become a major source of communication and an essential device for many people. 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.

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 has led to enhanced business communication, increased personal convenience including opportunities to alert rescue services in the event of a crash or breakdown.

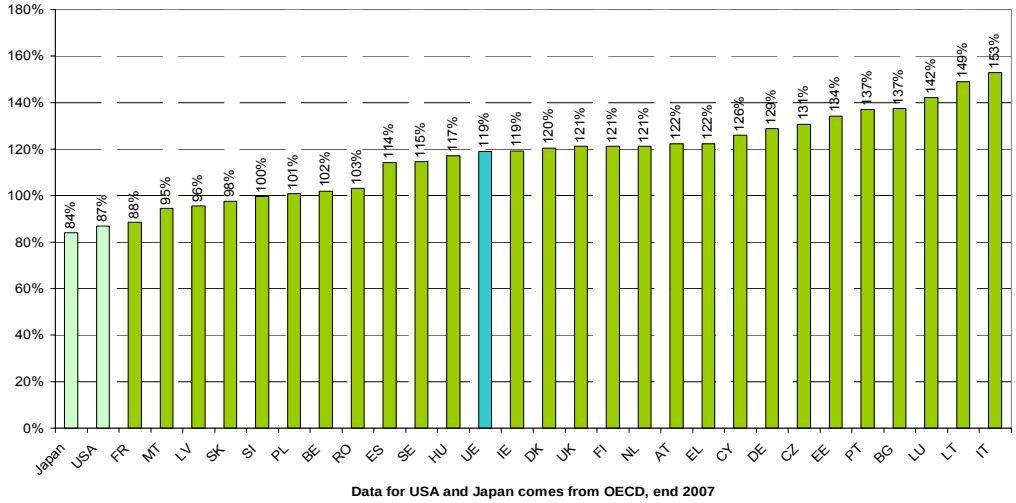
At the same time, a significant body of experimental and epidemiological research conducted during this period and summarised in this overview indicates the adverse consequences associated with use of a car telephone while driving, whether hand-held or hands-free.

Extent of mobile phone and car telephone use?

It is estimated that there are 3.7 billion mobile connections worldwide with over 50% of the global population owning or having regular access to a mobile phone in 2008. [1]

In the EU, 119% of population subscribed to mobile phone services in 2008 (compared with the US (87%) and Japan (84%) with a 7% increase in use compared with the previous year. [2]

Mobile penetration – country overview, October 2008 [2]



Data for USA and Japan comes from OECD, end 2007

A Eurobarometer survey showed, approximately 95% of people in the EU25 aged under 39, 85% of people aged between 40 to 54, and 55% of people aged over 55 had a mobile phone in 2006.[3] Car telephone use has increased against the background of rapid escalation in general mobile phone services and use. More and more new vehicles are now being equipped with *Bluetooth* technology, facilitating voice activation and hands-free phone use. [4]

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 [5]. Crash involvement is ascertained from national police data, insurance data and epidemiological study.

- *Observational studies*
  A review in 2005 of observational studies from the US, Australia and the UK indicated actual road exposure rates of between 1% to 4% of drivers using telephones while driving during the daytime. Males and younger people (younger than 30 years) use mobile phones while driving more often than other groups. [5] In the US, around 6% of drivers on the road at any time were observed using a handheld phone during 2007.[6]

Recent systematic surveys in the UK

National surveys Systematic observational surveys of the use of mobile telephone cars have been carried out in the UK since 2000. In 2007, the national rate of use of car telephones was 1.4% on representative roads with 1% of car drivers using hand-held phones and 0.4% using hands-free devices.[7]

Surveys in London In 2008, the use of mobile phone while driving in cars in London was observed to be 5% with a greater proportion of drivers using hands-free phones while driving, compared to a higher proportion using hand-held mobile phones in the previous surveys. [8]

- *Self-reports*

A substantial proportion of drivers report occasional use of mobile phones while driving in EU countries and elsewhere [5]. Surveys indicate that the main reasons given for their use are safety and security and ease of communication for business, family or social purposes. [5]

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. [9]

Some 50% of drivers In the Netherlands reported using a mobile phone while driving in 2005[5.]

User-reported hand-held and hands-free use of mobile phones while driving in the Netherlands 2005

Frequency	*Hand-held (%)*	*Hands-free (%)*
Often	2	14
Sometimes	24	27
Never	75	59

In a Gallup Home Poll in Finland in 2005, 81% of drivers reported occasional use of their phones while driving compared with 56% in 1998.[5]

Effect on driving performance?

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.

i) Driver distraction

The use of mobile telephones 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. Mobile phone use while driving can distract drivers in several ways:

- *Physical distraction* 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.[10]

- *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. [5]

- *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 judgment. 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. [11] The extent of the negative effects of mobile phone use while driving depends on the complexity of both mobile phone conversations and of 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. [12]

Hands-free versus hand-held use?
The majority of studies indicates that the use of hands-free phones cause as much important driver distraction as the use of hand-held phones. [5,13,14.] Hands-free phones and other aids such as speed dialling and voice activation can reduce physical distraction. However, the most important negative factor of mobile phone use 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. [15,16, 17,5.]

Hand-held and hands-free use versus other distractions?
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. [15, 17,18,19.] Mobile phone conversations have also been observed as being longer than conversations with car passengers with passengers. Normal in-car conversation with passengers is observed as being suppressed on the most demanding urban roads. [20] Two meta-analyses combining the results of experimental studies (not including two later references cited above [18,19] found similar deficiencies in reaction time for conversation tasks with passengers as for use of hand-held or hands-free phones. [21,14] 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. [5] 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. [22]

ii) 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 [23,5,13,14.] Research indicates 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.

- *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. [24]

- *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.

- *Slower braking reactions with more intensive braking and shorter stopping distances* Studies show that braking reaction time is reduced during an in-car telephone conversation by between 0.3 to approximately 0.7 seconds; drivers brake harder with shorter stopping distances.

- *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.

- *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.

- *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. The pattern of results to date in a recent 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. [14] The new behaviour, however, may not address the actual safety requirements of the driving task in any given situation. [5]

- *Lower seat belt use* Studies also indicate that seat belt use is significantly lower for hand-held mobile phone users than for non-users [25]. Mobile phone users while driving also engage in other risky behaviour like drinking and driving more often and exceeding the speed limit more frequently.

Are there age-related differences?

Use of a mobile phone while driving is widespread amongst young novice drivers who already have a higher crash risk [5] .

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. [14,]

Extent and effects of texting?

Studies indicate that text messaging while driving is more distracting than speaking into a mobile phone. Text messaging has a detrimental effect on safety critical driving measures such as ability to maintain a safe road position, lateral position, detect hazards and detect and respond appropriately to traffic signs. [26, 27]

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 significantly impaired ability to maintain a safe road position signs [27.] When text messaging, drivers spend 400% more time with their eyes off the road than in normal driving.[26]

Many drivers admit to texting while driving. A RAC Foundation survey in the UK in 2008 found that 45% of drivers reported texting while driving [27]. In an Australian study, 12.4% of drivers admitted to texting while driving.[4] 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. [28] A Swedish study found that young, inexperienced drivers were more likely than older drivers to text while driving. [29]

Risks of road crash and crash injury?

Methodologically sound epidemiological research shows that using car phones while driving increases the likelihood of being involved in a crash resulting in property damage [30] or injury resulting in hospital attendance [4] by a factor of four. 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.[4,31] Gender or age group does not affect the increased likelihood of a crash while using a mobile phone and driving. [4].

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. [32]

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'. [5] 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.

Size of crash problem in Europe and elsewhere?

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 underreporting of use is also identified as a key problem in efforts to ascertain the extent of the problem. [5]

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 deaths and hospital admissions [5.]

A Swedish study estimated that around 10-20 people die annually in Sweden as a result of using a mobile telephone while driving [29].

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. [33]

Public attitudes to car telephone use?

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. [5]

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. [34] 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. [35] 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. [36]

Government policies on car telephone use?

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 HMI and in-vehicle information systems.

National level:

Legislation

Most EU countries have introduced legislation aimed at restricting the use of car telephones. The most common legislative measure is the ban on hand-held telephones while driving in motor

vehicles. Insurance coverage may also be forfeited if the driver is involved in a crash while using a mobile phone.

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.

Some countries address telephone use while driving in legislation through the broader issue of driver distraction, careless or dangerous driving.

- **Banning the use of hand-held telephones**

The use of hand-held car telephone phones while driving is illegal in over 40 countries as shown in the box below; most EU countries, Australia, one Canadian province and the United States.

Overview of existing mobile phone legislation in various countries (source: www.cellular-news.com/car_bans/; as at December/2008).		
Country	*Hand-held banned*	*Notes*
Australia	Yes	Banned in all states - fines vary.
Austria	Yes	Fines vary - up to US$22 per incident
Belgium	Yes	Phones can be used without a hands-free unit when the car is stationary - but not while in traffic (such as at traffic lights)
Brazil	Yes	Ban imposed Jan. 2001
Bulgaria	Yes	Ban imposed May 2002 - fines of US$15 per infraction
Canada	One province	Banned in Newfoundland (Dec2002) fines up to US$180
Chile	Yes	
Czech Republic	Yes	
Denmark	Yes	Ban imposed July 1998 - US$60 fine for infringements
Egypt	Yes	Fines of about US$100 per offence.
Finland	Yes	Ban imposed January 2003 - US$55 fine for infringements
France	Yes	Ban imposed June 2003 - US$42 fine per infraction
Germany	Yes	Ban imposed Feb. 2001 - usage allowed without a hands-free unit only when the engine is switched off.
Greece	Yes	
Hong Kong	Yes	
Hungary	Yes	Fines up to US$20 per infraction
India - New Delhi	Yes	Ban extended to all use of mobile phones when driving, including use with a hands-free unit - July 2001
Ireland	Yes	Banned, with a US$380 fine and/or up to 3 months imprisonment on a third offence. Hands-free kits allowed, although that is subject to review.
Isle of Man	Yes	Banned since July 2000
Israel	Yes	
Italy	Yes	Fines of up to US$124 per infraction
Japan	Yes	Ban imposed Nov. 1999
Jersey	Yes	Ban imposed Feb. 1998
Jordan	Yes	Ban imposed Oct. 2001
Kenya	Yes	Ban imposed late 2001
Malaysia	Yes	
Netherlands	Yes	
Norway	Yes	Fines of over US$600 per infraction
Pakistan	Partial	Banned in Islamabad
Philippines	Yes	
Poland	Yes	Fines can be as high as US$1,000
Portugal	Yes	
Romania	Yes	

Russia	Yes	Ban imposed March 2001
Singapore	Yes	
Slovak Republic	Yes	
Slovenia	Yes	
South Africa	Yes	
South Korea	Yes	Ban imposed July 2001 - US$47 fine + 15 points on the license.
Spain	Yes	Ban imposed 2002 - only fully fitted car kits are permitted.
Sweden	No	
Switzerland	Yes	
Taiwan	Yes	If the driver has a reflective screen on the car, local privacy laws forbid stopping the car for violating the ban.
Thailand	Yes	
Turkey	Yes	
Turkmenistan	Yes	With effect from May 1st 2003,
UK	Yes	Banned from December 2003. In February 2007 the penalties for using a hand-held phone increased to three penalty points and the fine was doubled to £60.

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.

- **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. [5,37]

In EU countries, only Portugal restricts the use of hands-free telephones in addition to hand-held telephones. Some jurisdictions in the US support a legislative ban on all telephone use while driving for novice drivers and school bus drivers but not for all drivers.

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 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 [38].

- **Bans on text messaging while driving**

Generally in Europe, text messaging is included in the general bans use 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).[39]

- **Bans on mobile phone use while driving for young drivers**

Mobile telephones are more commonly used by young drivers (who are already 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.
Twenty States and the District of Columbia prohibit mobile phone use while driving for some young drivers. In most States, these cell phone restrictions cover teenagers holding a learner's permit or intermediate license, although in some States the restrictions cover all drivers under the age of 18 or 19. [40]

- **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

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. [41,42] Driver distraction which includes the use of mobile phones and driving has been identified as a key factor [42] 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 [5] 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 .[23] 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."

*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) [43].

What employers should do (RoSPA, 2004) [43]

Expect Safe Driving
Ensure all staff, including senior managers and line managers, understands 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.rospa.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.

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 [43]

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.

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 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 [44].

United States Legislation has been introduced in the US States of California, Connecticut, New Jersey, New York, Utah and Washington and the District of Columbia. 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%. [45] 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. [46]
- Washington DC The ban in Washington DC 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). [47, 48,49]
- 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. [49]

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. [50] An new offence was introduced of causing or permitting a driver to use a hand-held mobile phone while driving, or to use a hand-held 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.[51] 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 [52]. In 2007, tougher penalties were introduced making the use of a hand-held mobile phone while driving an endorsable 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 £1000 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.[7]

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. [53]

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. [12]

The number of fines issued in the Netherlands for using the hand-held phone during driving (source: Bureau Traffic Enforcement of the Public Prosecution Service BVOM; Central Fine Collection Agency CJIB).

Period	Number of fines in period	Number of fines per month
April-December 2002	25 000	2778
January-August 2003	55 000	6875
January-December 2004	100 000	8333
January-December 2005	116 792	9733
January-December 2006	117 343	9779
Source: SWOV 2008		

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. [23]

- **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 for 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.[54]

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[55] 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. [56]

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. [5,10].

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. [57] Negative impacts on driving performance of speech-based email have been identified [58]and the potential safety impact of other interface systems are, as yet unknown [10.] 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 [56].

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 miniaturisation [5].

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. [59].

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.
- Mobile 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.
- Evaluation of the effects of a range of interventions needs to be carried out.
- 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

- 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.
- Specific criteria and methodologies need to be developed at EU level for assessing the safety implications of in-vehicle information systems (IVIS), including mobile phones.

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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