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Mobile phone use while driving: public opinions on restrictions

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Abstract. This paper reviews two road-user surveys on the use of mobile phones on the road in Finland where the mobile phone ownership rate is highest in the world (70% in August 2000). From 1998 to 1999 the proportion of drivers that chose to use a mobile phone while driving rose from 56% to 68%, while the proportion of phone using drivers who experienced dangerous situations due to phone use rose from 44% to 50%. The proportion of drivers who used their phones in some way to benefit safety on the road remained at about 55%. The youngest, novice drivers had the highest level of phone usage of all age categories. Over 48% of the interviewees believed that the government should ban the use of hand-held mobile phones while driving, and another 27% believed that all types of mobile phone use should be banned while driving. Those drivers who used their phones the most each day were more likely to want some form of restrictions, than those who had lower usage. This is a strong message to the elected lawmakers and raises the problem of exactly how regulatory bodies would go about controlling the future growth of new driver support and non-driving related communication devices in road vehicles. It was concluded that legislating for hands-free use only would be a reasonable course of action. Mandating that the current generation of equipment should be optimized for hands-free use should result in future generations of in-vehicle equipment also being optimized for hands-free use as a minimum criterion.

Introduction

Over the last several years there has been a large increase in both public and scientific interest in the impact that new and developing information and communication technology will have on road traffic and safety. This interest has been spurred on by the growing ownership rates and increasing usage rates of hand-held mobile (cellular) telephones. These phones are a relatively new addition to the array of possible devices that can appear inside a vehicle. However, they probably represent the first wave of truly driver-interactive devices, which are not directly related to the driving task (as opposed to the radio/CD that is *more set and forget* orientated), that will be mass marketed in the coming years. In the last few years the discussion on the impact of mobile

phones has revolved around trying to decide whether there is any real evidence that these phones have increased the driver's risk of having a crash or indeed whether they have increased the number of recorded crashes. A primary outcome from the discussion has been what the appropriate response from government regulatory agencies should be.

There is a large body of empirical research conducted both in simulators (e.g. Alm 1994, 1995) and on the road (e.g. Brookhuis & De Waard 1994; Lamble et al. 1999), which have clearly demonstrated the possible and likely performance impairments associated with mobile phone use while driving. Epidemiological research (e.g. Redelmeier & Tibshirani 1997; Violanti & Marshall 1996), which although criticized on methodological points, has also reported an increased risk of crashes due to phone use while driving. Phone use while driving can certainly be seen as another factor that decreases the attention that the driver will focus on the roadway, and should therefore be likely to increase the number of crashes that involve *driver inattention* or *distraction*. However, in their recent review, Goodman et al. (1999) show that although there are recorded cases of phone use in several fatal crashes in the US, there has been little recorded effect of mobile phone use on road crashes in general. This could be due to several reasons, such as, failure to report phone use for fear of litigation, lack of official recording mechanisms, improper use of official recording mechanisms, or simply that those drivers using phones are actually able to avoid most potential crash situations.

The point may be that in a forgiving road environment, where some road users compensate for other drivers' attention lapses, distraction due to phone use may not be affecting the number of crashes in full strength. However, will this situation change as the road environment becomes less forgiving due to increases in the number of phones on the road, increases in the amount of time that phones are used on the road, and additions of other driver interfaces/information systems in the vehicle? If more and more drivers are attending to their phones, then they will have less time to notice and compensate for other drivers' errors. It may be that as phone ownership and usage increases on the road, the more *driver inattention* type crashes are likely to occur. So what should government regulatory agencies do to help prevent this situation from happening, assuming that it is likely to happen? As Goodman et al. (1999) report, several jurisdictions have already banned the use of hand-held phones in vehicles, allowing only hands-free models. This does not seem to be based on any scientific evidence of danger, since most studies have concluded that the element of conversation is the principal distraction to the driver, rather than holding the phone. This type of regulation could have several different effects. Firstly, by placing legislation to ban the use of some phones it sends a clear warning to drivers that phone use is unsafe, thus helping to reduce the number of phone users on the road. Secondly,

as Goodman et al. (1999) point out, by regulating for the use of hands-free phones only, drivers may assume that these types pose no impairment to driver performance at all and so will use them more frequently than they would have otherwise, thus eventually increasing the usage of phones on the road. Lastly, this type of legislation passes an economic burden onto the user so that the wealthier drivers are able to afford hands-free conversion kits, whereas less wealthy driver may not be able to afford them.

The alternative type of legislation would be to ban all phones in vehicles completely. However, as Hancock and Scallen (1999) point out, mobile phones seem to be widely accepted by the driving public, so both business and private users might resist attempts to remove the freedom of phone use that they have currently. Indeed the use of phones in vehicle may already have a substantial economic impact, as they seem to be a common business tool. Even if such legislation were introduced, how would it be enforced? You can't see a person using a hands-free phone inside a vehicle, whereas you can see a person not wearing a seatbelt. Goodman et al. (1999) note that Finland and Japan had both identified this problem when considering legislative options, and it was one of the reasons that both countries currently have no regulations on mobile phone use. Redelmeier and Weinstein (1999) also comment on the cost effectiveness of such legislation. Their financial analysis for the situation in North America concludes that such regulations are less cost effective than other safety measures that could be adopted to save lives on the road. They do however note that "regulations may be justifiable because the benefits and harms do not always involve the individual who has the cellular telephone" (p. 1).

This paper describes the recent mobile phone situation on Finnish roads and the opinions of road users about how the government should deal with this issue. Finland, a Nordic country and member of the European Union (EU), has 5.1 million people, 2.3 million motor vehicles, 78,000 km of public roads and 45 million annual vehicle km. The first mobile telephone network in the world was activated in Finland during 1988 and Finland has led the world in mobile phone ownership rates per capita since then. Mobile phone use is now heavily integrated into the Finnish lifestyle, and is highly evident in the streets, restaurants, bars, public transport, and private road vehicles. If any problems arise with mobile phone use in vehicles due to the density of ownership or the volume of use, then Finland is likely to be the first place that it is noticed. The only caveat to this is that Finland has a moderate traffic density (0.45 registered vehicles per capita) due to its low population density (17 persons/km^2), which may create more forgiving road conditions.

The ownership rate of mobile (cellular) phones per capita in Finland has already reached 70% (Ministry of Transport and Communication 2000). From 1998 to 1999 the number of mobile phone connections in Finland increased

by 14%, the average monthly usage increased 10% (to 120 minutes), and the average monthly use of text messages (SMS) increased +71% (to 21 messages) (Sonera 2000; Radiolinja 2000). Mobile phone ownership has been especially attractive to the younger age groups, who have been eager to utilize new communication technology. New age cohorts that learn to drive in the future will likely have had several years experience using a mobile phone in day-to-day life, and so it may seem quite natural to continue to use a phone inside their car.

Detailed crash investigations revealed that mobile phone use was determined as a risk factor in 26 of the 2,200 fatal or serious injury crashes in Finland from 1991 to 1998 (Holopainen 2000). This 0.9% of fatal crashes compares with 3% of fatal crashes in which conversation with a passenger was identified as a risk factor. The majority of the drivers (14) were talking on the phone at the time of the crash, and in 23 of the crashes the phone was a hand-held model. While it is evident that some road crashes in Finland have been at least partially caused by mobile phone use while driving, the incidence of such cases is very low. This would indicate that any legislation focusing on mobile phone use while driving might be a low priority for government authorities. However, what do the road-users and the voting populations of Finland think about the need for such legislation?

This paper describes self-reported usage and opinion data concerned with mobile phones and driving in Finland. The goal of the data collection was to monitor the changing situation on Finnish roads, with specific emphasis on age groups, and to find out what the public thought was the appropriate response from their government in regulating mobile phone usage while driving. The emphasis on age groupings was due to the concerns over the new cohorts of novice drivers who have just started to drive, but have a very high ownership rate of mobile phones.

Method

Data were collected by Gallup home poll during two separate periods, autumn 1998 and autumn 1999. The two phone polls contained sets of different questions with some overlapping sets that collected demographic and geographic information, as well as patterns of phone use while driving and the road situations experienced by phone users. There were 1,528 interviews in the 1998 sample (48.2% males, mean age 41.0 years, SD 16.9, range 15–82 years) and 1521 interviews in the 1999 sample (49.8% males, mean age 41.3 years, SD 17.3, range 15–79 years). There were no significant differences between the age of the two samples ($t_{3047} = 0.591$, $p = 0.555$, 2 tailed), the proportions of age groupings, employment type, and household income (Mann-

Whitney U tests; $p = 0.614$, $p = 0.652$ and $p = 0.519$ respectively, all 2-tailed). However, more of the 1999 sample lived in city areas, 73.1%, than the 1998 sample, 65.2%, and there were fewer regular drivers in the 1999 sample, 61.1%, than in the 1998 sample, 66.9% (Mann-Whitney U test; $p < 0.01$ and $p < 0.001$ respectively, both 2 tailed).

Results

From the responses of the regular drivers in both samples a comparison was made of phone use and driving situations experienced. A significantly larger proportion of the 1999 sample used a phone in their vehicle, 67.7%, than the 1998 sample, 55.8%, (Mann-Whitney U test, $p < 0.001$, 2 tailed). Figure 1 displays the amount of time the interviewees spent on the phone while driving. Over the two sample periods it shows the decrease in the proportion of drivers that do not own or use a phone (–11.7%), and a corresponding increase in the proportion of drivers who use their phone occasionally/less than daily (+7.6%), and between 6 and 15 minutes daily (+3.4%). Time spent on

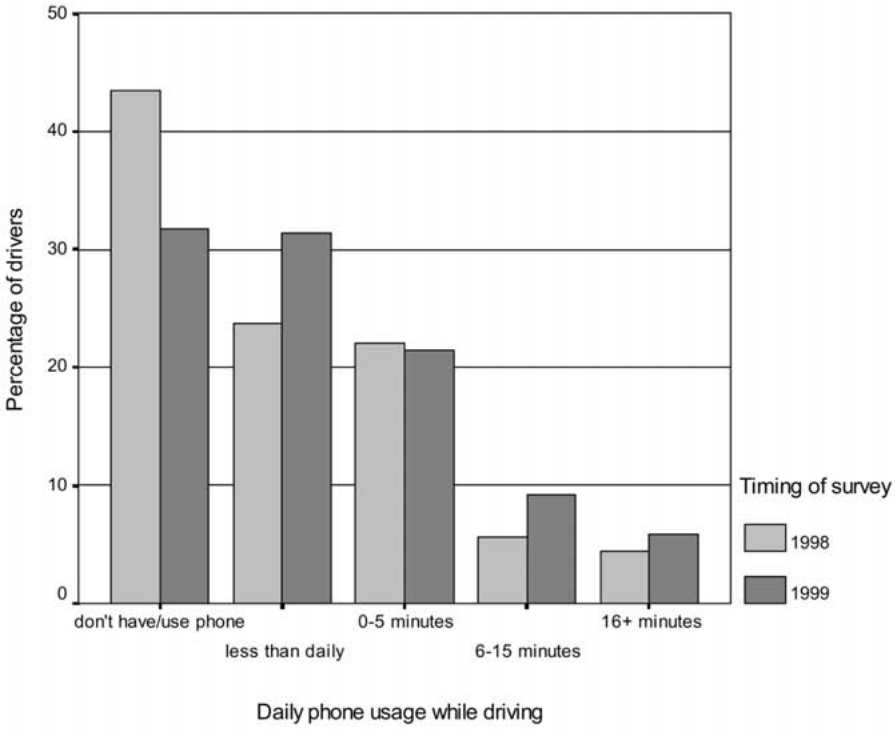

Figure 1. Daily phone usage while driving for the 1998 and 1999 samples.

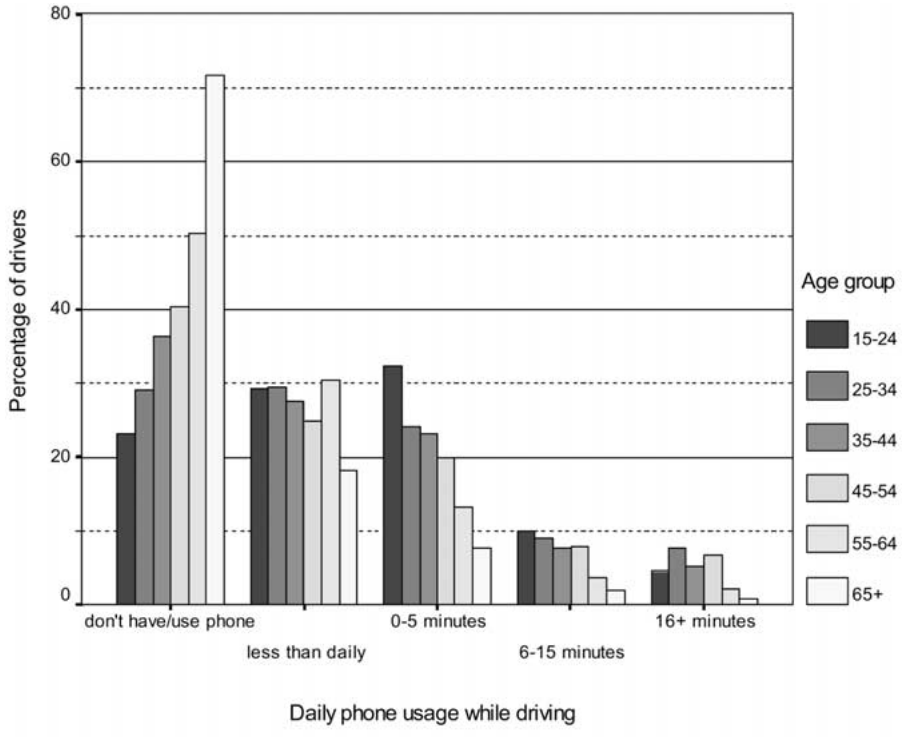

Figure 2. Daily phone usage while driving for each age group.

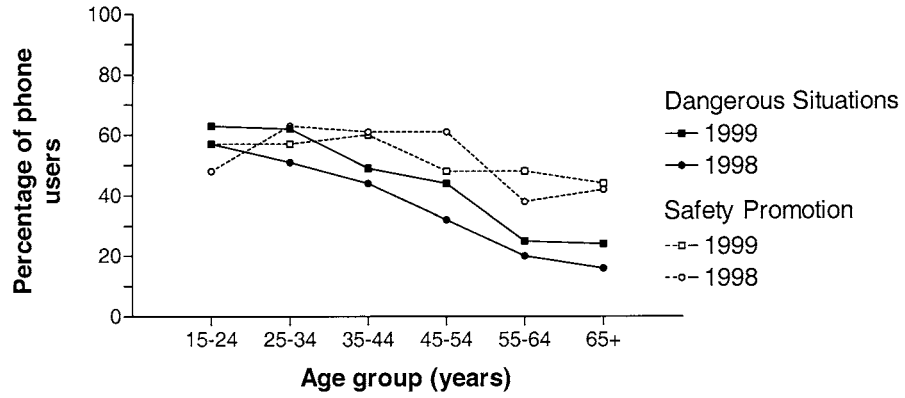

Figure 3. Percentage of phone-using drivers experiencing dangerous situations and using their phone for some safety benefit for each age group for 1998 and 1999.

the phone while driving was significantly higher in the 1999 sample than the 1998 sample (Mann-Whitney U test, $p < 0.001$, 2-tailed).

There was a significantly higher proportion of phone using drivers experiencing risky or dangerous situations in the 1999 sample, 50.2%, than in the 1998 sample, 43.5%, (Mann-Whitney U test, $p < 0.05$, 2 tailed). The main problems experienced by phone users were: momentary lapses in following other traffic (24%); drifting towards the lane boundaries (13%); not noticing a traffic sign (14%) and dropping speed to a point of disturbing other traffic (14%). Of interest was that a larger proportion of female phone users, 22%, reported having a problem with dropping their speed to the point of disturbing other traffic than males phone users, 10% (Mann-Whitney U test, $p < 0.001$, 2 tailed).

There was no significant difference between the proportion of phone using drivers reporting that they had used their phone to benefit safety in the 1999, 54.4%, and 1998, 56.3%, samples (Mann-Whitney U test, $p = 0.515$, 2 tailed). These activities included: calling to tell someone that the driver would be late, then driving safely rather than speeding; reporting dangerous situations or slippery roads; calling for help due to a breakdown or accident; and, keeping themselves awake by talking to someone when there was a risk of falling asleep at the wheel.

Age groups

Young people generally use mobile phones more than older generations in day-to-day life. The results showed that new license cohorts also use their mobile phones while driving. Figure 2 shows the distribution of daily phone usage for each age category. It is clear that a smaller proportion of the older drivers either had or used a mobile phone while driving than the younger drivers. The youngest drivers (15–24 and 25–34 years) also used their phones more each day than the older drivers (Kruskal-Wallis Tests $\chi^2 = 83.456$, df = 5, $p < 0.001$).

Figure 3 summarizes the percentage of drivers experiencing dangerous situations while using their phone and the percentage that used their phone for some safety promoting purpose. More younger drivers (15–24 and 25–34 years) experienced dangerous situations while using their phone than the older drivers (Kruskal-Wallis Tests, $\chi^2 = 44.380$, df = 5, $p < 0.001$), as would be expected due to their higher exposure. There was no statistically significant difference between the age categories for using the phone for safety purposes (Kruskal-Wallis Tests, $\chi^2 = 7.415$, df = 5, $p = 0.284$).

Opinions on mobile phone regulations

All 1,521 interviewees in the 1999 sample were asked for their opinion on regulations for mobile phone use while driving. They responded to three exclusive options; whether there should be no restrictions on phone use while driving (25.2%); or, whether hand-held phone should be banned while driving (48.3%); or, whether all types of phones should be banned while driving (26.5%). A binary logistic regression was performed using a dichotomous "restriction type" dependent variable with the values "no restrictions" and "some type of restrictions (either ban all phones or ban hand-held phone)", in order to determine whether some simple demographic information might be able to predict an individual's preference for restrictions. The covariates used for the regression were gender (significant to $p < 0.001$), age group (significant to $p < 0.01$), residential location [city/rural] (significant to $p < 0.01$), type of interviewee [non-driver/non-car phone user/car phone user] (significant to $p < 0.001$), profession (not significant, $p = 0.183$), and income category (not significant, $p = 0.335$).

Figure 4 shows the percentage of each age category wishing some restrictions for the interviewee's gender and location. The regression analysis revealed that females were almost twice as likely to want some kind of restrictions as males were, and those living in the city were 1.6 times more likely to want restrictions as those living in rural areas. The youngest age group (15–24 years) were the least in favor of restrictions, with the older age groups becoming more likely to want some restrictions as age increased.

Figure 5 shows the percentage of each age category wishing some restrictions as a function of the interviewee's vehicle and phone usage. Those already

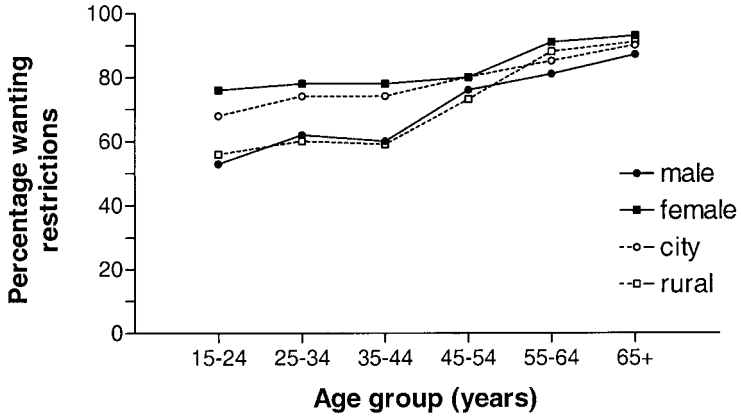

Figure 4. Percentage of males and females, city and rural dwellers in each age group wishing some restrictions for mobile phone use while driving.

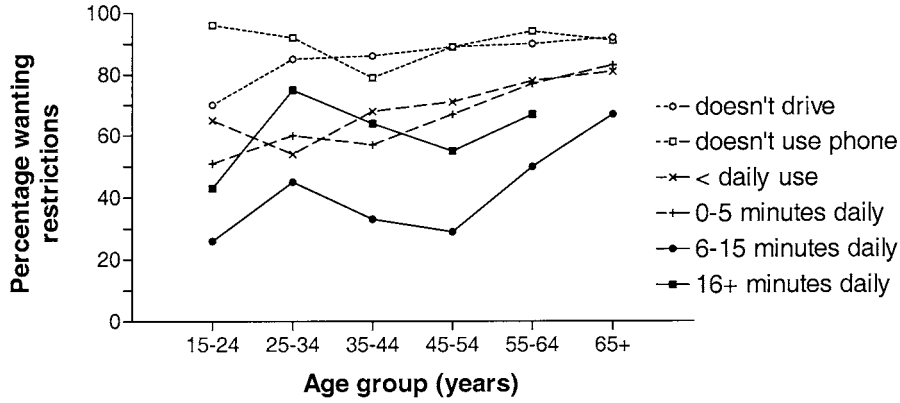

Figure 5. Percentage of interviewees by vehicle and phone usage in each age group wishing some restrictions for mobile phone use while driving.

using their phones while driving were the least in favor of restrictions. Non-drivers were 2.5 times more likely to want some restrictions as the phone-using group, and those who drove but did not use a phone in their vehicle were 4 times more likely to want some restrictions as the phone-using group. The "16+ minutes per day" group, and therefore the group with the highest exposure to possible risks, were significantly more in favor of restrictions than the "6–15 minutes per day" group (post-hoc binomial logistic regression analysis; significant to $p < 0.001$). The highest usage group (16+ minutes per day) principally chose to "ban hand-held phones (56%), rather than "ban all phones" (7%) or have "no restrictions" (36%). Therefore, it seems that the group most highly exposed to using mobile phones while driving, believed that hands-free models had some benefit over hand-held models in terms of safety, possibly due to their exposure to these models. In contrast, the "6–15 minute" group principally chose "no restrictions" (64%), rather than "ban hand-held phones" (33%) or "ban all phones" (4%). This group may have been less likely to have used a hand-free system, and so believed that the hand-held phones they had been using did not pose a safety problem.

An additional binomial logistic regression analysis was conducted on the phone-using group, so that "experience of dangerous situations" and "using the phone for some safety benefit" could be added as covariates in the model. Surprisingly, experience of dangerous situations was not a significant factor ($p = 0.344$), but those drivers who had no recent experience of using their phone for some safety benefit were twice as likely to want some restrictions as drivers who had used their phone for some safety benefit (significant to $p < 0.001$).

Discussion

The analysis of the phone survey data clearly showed the expected increasing trend for drivers to have and use a mobile phone in their vehicle, as well as an increase in the amount of time that they used it each day. This is the primary concern behind the question of safety of mobile phone use; how many drivers have mobile phones available in their vehicles and how often do they use them. The 1999 data showed that 68% of drivers choose to use a mobile phone while driving, at least occasionally, with about 15% using their phone more than 5 minutes everyday. It is of interest that there was a significantly larger proportion of drivers reported being in risky or dangerous situations while using a mobile phone in the 1999 survey (50%) than in the 1998 survey (44%). This reported increase reflects the concerns of many people in the transportation safety industry, that phone use in vehicles is likely lead to more crashes, which so far has not been born out in crash statistics. It may be that the expected increase in crash rates is more visible in confidential self-reported incidences of risky or dangerous situations, than in official police reports that can often fail to record the use a phone just prior to the crash. It also may be the case that many possible phone-related crashes are largely avoidable due to the generally forgiving nature of most road traffic environments. Whether or not the number of inattention/distraction type crashes is actually increasing due to mobile phone use while driving, it does seem that the amount of risky of dangerous situations experienced by phone using drivers is increasing.

It should be noted that the surveys found that a large proportion of drivers reported using their mobile phone to benefit or improve safety (55%), such as reporting dangerous road conditions or rescheduling appointments to avoid the need to exceed the speed limit. However, this level of usage remained the same across the two surveys. It may simply be that only a certain proportion of the driving population is likely to think of using their in-car phone to try to increase driving safety. Some drivers may only see their phone as a one-way (in-coming) communication channel for convenience purposes only, rather than a two-way channel that allows them to reschedule their movements to reduce time pressures while driving. This may be an area for traffic safety organizations to promote, so that more drivers take advantage of the possible safety benefits that can be gained from having a phone in their vehicle.

From the interview data it can be seen that the youngest age drivers (< 25 and 25–34 years) had the highest level of phone use while driving and correspondingly the highest level of experiencing dangerous or risky situations on the road while using their phone. This is to be expected, since these drivers also have the lowest amount of driving experience, and so are likely to be more at risk than more experienced drivers (Wikman et al. 1998). It may be

important to note that the younger drivers appear to be using their phones in their vehicles without recognizing that they may be posing a problem to traffic safety, as can be seen by their preference for no restrictions. As the younger age cohort grows older, their level of usage is unlikely to decrease to the level of the current older users. Rather their usage may increase, as they become more dependent on the benefits their phone can provide and more services such as those provided via Wireless Application Protocols (WAP) become available. New young age cohorts are also likely to start driving with a higher usage rate of their mobile phones. The current younger drivers are also likely to be less resistant to new interactive devices in their vehicles, such as the Personal Digital Assistant (PDA), because of their experience with the current second-generation mobile phone technology. This means that there should be some thought given to exactly how demanding we allow such new devices to be in vehicles.

It was quite remarkable that only 25% of the interviewees felt that there should be no regulation of phone use while driving. It was interesting to note that those drivers that used their mobile phones the most (16+ minutes daily) were more in favor of some form of restrictions, principally banning hand-held phones, than drivers who used their phones less (6–15 minutes daily). This effect was not explained by any increase in experiences of dangerous situations while using their phone. Rather it seems that those drivers who use their phone a great deal appear to be aware that it does pose some risk to traffic safety. The people who would like to see some regulations were generally more likely to be female, older (45+), living in city areas, and driving without owning or using a phone in their vehicle. Those wishing to have continued unrestricted use were more likely to be male, young (< 24 years), living in rural areas, and already using a phone while driving. Almost half (48%) of those interviewed felt that all phone use in vehicles should be banned. This is certainly a strong message to the elected lawmakers and raises the problem of exactly how regulatory bodies would go about controlling the future growth of new driver support devices in road vehicles.

The most sensible course, from a scientific perspective, is that proposed by Hancock and Scallen (1999), which is that all in-vehicle equipment of any type should not be allowed to be installed or used within a vehicle unless the manufacturers have demonstrated that its use is *safe*. Of course the problem is then to define *safe* for manufacturers and provide standardized metrics and methods for testing. This seems rather unlikely for any jurisdiction to adopt due to the fact that it is unlikely to be popular with the companies that produce the equipment, and that there is no agreed metric to measure *safe* driving performance on, except perhaps for alcohol use. A possible solution to the meaning of *safe* would be to assess driver performance while using new equipment in the vehicle and to compare that performance against

impairment caused by blood alcohol concentrations (BAC) of different levels, then use the impairment at 0.05% as the *most unsafe level allowable*. This comparative technique has been used in several studies already (e.g. Dawson & Reid 1997; Powell et al. 1999; Lamond & Dawson 1999; Williamson & Feyer 2000). Brookhuis and De Waard (1994) have already investigated the effects of several types of impairment on coherence during car following on real roads. They reported that hands-free phone use caused an average impairment over three time larger (0.600 s delay) than a "just legal" BAC of 0.046% decreasing to 0.034% (0.168 s delay).

To date all of the road, simulator and epidemiological research conducted on mobile phone use while driving has concluded that phone use does impair driving performance and is likely to increase a driver's risk of a crash. There is no research to show that hands-free phones have any benefits over hand-held phones. Despite this, there seems to be a large public opinion in Finland that hands-free phones are better than hand-held phones in terms of traffic safety. This paper raises the important point that a clear majority of the road-users, drivers and pedestrians, interviewed in Finland think that unrestricted phone use while driving is inappropriate. Given that mobile phones in vehicles have become an important tool for business and personal convenience it may be extremely difficult to ban all phone use while driving. The findings from this study would suggest that a reasonable course of action would be to legislate to restrict phone use while driving to hands-free operation only. This would be done to highlight the possible safety problems with phone use in general, and would have to include education campaigns to teach drivers when they should avoid phone use altogether, and how to use their phone to provide some safety benefits. This should produce reasonable driver acceptance of such measures and would not need specific enforcement measures, as the goal is mainly warning and education of drivers. Like seat-belt use it would be primarily self-regulated by drivers, with police only intervening in visible cases during the course of normal road patrols.

The "hands-free only" restriction has important consequences for the revolution in data and communication technology that is taking place. The next generation of mobile communication systems will use the Universal Mobile System (UMS) protocol, which is promised to provide much greater versatility in user applications. This means we can expect more services to be available and more types of interfaces that make use of these services. The mobile phone in the vehicle could well become a much more complex and versatile tool for the driver and with this complexity comes the possibility of more distraction from the road environment. It would seem better to adopt a sound and standardized approach to the regulation of the current generation of mobile communication in-car devices, before the use of the next generation of devices becomes as widespread as current mobile phones. Mandating that the current

generation of equipment should be optimized for hands-free use should result in future generations of in-vehicle equipment also being optimized for hands-free use as a minimum criterion.

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