

THE RISKS ASSOCIATED WITH USING A MOBILE PHONE BY YOUNG DRIVERS

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Abstract. A substantial body of research has shown that mobile phone usage could lead to the impairment of driving performance and increase the likelihood of driving accidents. The use of mobile phone while driving is a major problem for inexperienced drivers. The reason for this lies in the fact that they have not developed abilities to process different types of information simultaneously. Mobile phone use may result in reduced attention allocation to the various tasks during driving. The research of young drivers' habits related to mobile phone usage while driving is presented in this paper. A series of questions were administered, including along with demographic measures, self-reported number of traffic accidents and several kinds of driving behaviour such as alcohol consumption. The results have shown that 68% of young drivers used mobile phone while driving. Additionally, a relationship was found between frequency of mobile phones usage and the number of traffic accidents, consequences of traffic accidents, as well as, driving under the influence of alcohol. The general conclusion could be drawn that young drivers choose their preferred driving style, safe or unsafe. If they are unsafe drivers, they combine various types of unsafe behaviour, the same stands for a safe driving style as well.

Keywords: mobile phones usage, young drivers, traffic accidents, alcohol consumption and driving, preferred driving style, risk.

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Introduction

More than 230 million people use mobile phones in the U.S.; moreover, between 50% and 73% of them use it while driving (NHTSA 1997). Epidemiological studies have shown that driver distractions are the main cause of 25% of all traffic accidents. Social and economic costs related to traffic accidents are estimated at around \$40 billion a year. Numerous studies indicated that the use of mobile phone while driving produces nearly the same reaction as alcohol consumption (Drews *et al.* 2004). On the other hand, the use of hands-free devices does not eliminate all risks, reducing driver distraction only to certain extent. According to the results of extensive research, mobile phone usage interferes with driving activity in many ways. Cell phone use by drivers may increase accident rates due to the distracting effect of telephone conversations, leading to an inability to deal with more than one task at the same time, i.e. drive a vehicle and

talk on a cell phone. It reduces attention spans and adversely affects reaction times causing the failure to drive in an appropriate traffic lane constantly. Besides, keeping appropriate and predictable speed and adequate distance from the vehicle in front could be disrupted. Accurate assessments of various driving manoeuvres safety could also be impaired. Furthermore, it increases driver's braking response time to hazards and reduces awareness of a surrounding traffic flow.

Various types of distractions occur while using mobile phone during driving. First of all, there is a physical distraction due to the necessity of using one or both hands for reaching, dialling, or holding a phone, compromising adequate wheel control. Distraction could be visual as well – drivers have to look away from the road when focusing at the mobile phone display. During the conversation, even when looking at the scene in front of the car, speaking diverts attention away from the activi-

ties critical for safe driving. Accordingly, selectivity in the processing of relevant information could take place. Finally, it comes to auditory distraction because of increased attentional load while simultaneously thinking and speaking. Just listening to a voice coming from a mobile phone reduces brain activity while driving by 37% (Center for Cognitive Brain Imaging at Carnegie Mellon University, <http://www.ccbi.cmu.edu>).

The organization of the paper is as follows: in the next section, a review of the literature about the impact of mobile phone use while driving is introduced. In the following section, the general results of the study are shown. The main parameters were the frequency of traffic accidents involvement, the patterns of mobile phone usage while driving, driving under the influence of alcohol and type of traffic accident consequences. Afterwards a discussion of the obtained results is presented. Finally, in conclusion the main findings of this study are summarized, some recommendations for the authorities and directions for possible further research are proposed.

1. A Literature Review

There are a number of studies analysing the influence of cell phones usage while driving. Korpinen and Pääkönen (2012) provide a comprehensive current review. Brown *et al.* (1969), in one of the earliest studies dealing with this issue, concluded that mobile phone use significantly impairs driving performance such as maintaining a constant predictable speed and the ability to react rationally in traffic situations. Haigney, Westerman (2001) in their study warned that the use of mobile phones while driving cause a reduction of attention necessary for the identification of risk events in traffic. This increases the probability of accidents occurrence. Constraints that arise in the cognitive capacity are documented in large number of studies (Wickens 1984; McKnight, A. J., McKnight, A. S. 1993; Pashler 1994). Redelmeier and Tibshirani (1997) also indicated that the use of mobile phones during driving results in reduced level of traffic safety. Few authors investigated the costs of accidents caused by using a mobile phone (Redelmeier, Weinstein 1999; Hahn *et al.* 2000; Cohen, Graham 2003). Some studies have been done attempting to determine the statistical relationship between the use of cell phones and self-reported traffic accidents (Violanti, Marshall 1996; Redelmeier, Tibshirani 1997; Violanti 1998; Dreyer *et al.* 1999). Various methods were used to determine this association: there were experimental conditions designed using simulators, the analyses on the roads under strictly controlled conditions have been done and analysis of police accident reports as well. The cross-case study as a method (Maclure 1991; Marshall, Jackson 1993) was used in the medical literature to determine the main causes of accidents. A study conducted in Toronto considered a sample of drivers who have had accidents in their driver experience. It was concluded that drivers who had used a mobile phone were 4.3 times more likely to experience a traffic accident com-

pared to those who had not, with a reliability level of 95%. Some studies have examined the influence of driver's personal characteristics on using mobile phones and generally, tendency to risky behaviour (NHTSA 1997). The data showed that male and younger drivers more frequently use their phones while driving (Lamble *et al.* 1999; Brusque, Alauzet 2008).

An interesting question to consider is the usage of hands-free devices. Is it a safe alternative for drivers against the hand-held mobile phones? There are studies that have shown that distraction for drivers occurs in both cases. Hancock *et al.* (2003) tested the ability of 42 drivers to make decisions vital to avoid accidents on the closed section of road while using phone with hands-free devices. All drivers reported the awareness of reduced attention to relevant information from the visual field. The same conclusion was published earlier by Warren and Wertheim (1990) and Schiff and Arnone (1995). The study of Violanti and Marshall (1996) showed that drivers in New York talking over 50 minutes of driving time are at least 5 times or more likely to be the participants in road accidents. Simulation results showed that driving with the use of cell phones decrease the driver's ability to notice the vehicle in front, while the response time extends to 0.5 seconds (Lamble *et al.* 1999).

Probably the most dramatic results are those that in the case of sudden stopping at 70 km/h, mobile phone use increases the reaction time and stopping distance of 8 m in the case of hand-held mobile telephones, and 14m using hands-free devices. Alm and Nilsson (1994) used advanced forms of simulation to examine the effects of using mobile phone on driver performance. The results showed that in simple traffic situations such as driving on a straight road, mobile phone conversation extends the reaction time and affects the maintenance of speed. When it comes to more complex traffic situations such as driving on the road with many curves, there were obtained completely different results. These unexpected results could be explained by attributing different priorities of attention. The authors assumed that the complex driving conditions mobilize more cognitive resources, while monotonous stimulation does not activate the attention in that way. Patten *et al.* (2004) have pointed out that drivers using hand-held phones maintain a constant speed longer compared to those who use hands-free devices. Increased risk of experiencing accidents can be caused by careless or unsafe driver's actions, rather than cell phone use (Lissy *et al.* 2000). The risk of its use may be overestimated because it is difficult to distinguish the effects of unsafe manoeuvres and potential detrimental effects of using mobile phones while driving (Marchione 2007). An intensive or complex business communication or some other conversations requiring a great mental effort could produce pronounced decrease in driver performance. The effect is even higher for texting while driving which includes composing, sending, reading text messages, emails and similar actions (Transport Canada: Road... 2003, 2005). Furthermore, the decrease in performance is independent of the phone model. The primary cause of decline in performance is connected to the cognitive demands of

conversation, rather than to the manual manipulation with mobile phones (Utter 2001).

The results of various studies on the effects of distractors while driving, conducted by the American Foundation for Traffic Safety, showed that mobile phones are not listed as a frequent source of disturbance for drivers, compared with other distractors (Stutts *et al.* 2001). The results are shown in Table 1.

Table 1. The participation of various distractors in traffic accidents

Distractors	The percentage of participation in road accidents
Object, event, out of the vehicle	29.4
Radio, cassette, CD player	11.4
Other persons in the vehicle	10.9
Moving objects in the vehicle	4.3
Other devices/items	2.9
Setting the climate in the vehicle	2.8
Food, drink	1.7
Use of mobile phones	1.5
Smoking	0.9
Other distractors	25.6
Unidentified distractors	8.6

A study of Violanti (1998) is based on data about 223137 traffic accidents; 1548 of which were fatal. The relationship between accidents' characteristics and the use of mobile phones was analysed. The results showed that mobile phones had been used in 4% of vehicles involved in the traffic accidents with fatal consequences, while nearly 8% of drivers had used mobile phone at a time when the accident happened.

Drivers who use mobile phones are nine times more likely to experience traffic accident, compared to drivers who do not use mobile phones. The presence of a mobile phone in the car itself results in a double risk of traffic accident. A study of the National Traffic Safety Administration (NHTSA 1997) provides consistent evidence that manual dialling makes the driver's control of the vehicle poorer. It particularly affects staying in traffic lane, appropriate speed, driver's situational awareness, reaction time and frequency of mirror use. Based on these results also occurred that the use of hands-free device exerts less influence on the driver's control of the vehicle, but impairs the driver's situational awareness and increases braking time.

The main aim of the study presented in this paper was to determine a mobile phone usage rate among young drivers and its connection with experienced traffic accidents.

2. Results and Discussion

The participants from a convenience sample were students from University of Belgrade – Faculty of Transport and Traffic Engineering. 94 drivers aged between 19 and 26 years voluntarily agreed to complete a survey

created by the authors. Gender structure, driving experience regarding time and mileage, and the percentage of involvement in traffic accidents are shown in Table 2. Considering crash rates, 67.74% of drivers were involved in traffic accident just once, 29.03% took part in two accidents, while three or more accidents were experienced by 3.23% of participants (Fig. 1).

Table 2. General structure of the participants

Parameter	[%]
<i>Gender</i>	
Female	27.66
Male	72.34
<i>Driving experience (time)</i>	
Up to 1 year	27.66
2 years	35.11
3 years	25.53
More than 3 years	11.70
<i>Driving experience (mileage)</i>	
Up to 1000 km	18.08
1000÷5000 km	44.68
5000÷10000 km	15.96
10000÷50000 km	9.57
50000÷100000 km	5.32
100000÷200000 km	5.32
Above 200000 km	1.06
<i>The involvement in traffic accidents</i>	
Yes	32.98
No	67.02

The majority of participants had driving experience less than 3 years. Regarding alcohol consumption, the results indicated that much more attention should be paid to incidence of such kind of behaviour. 56.38% of young drivers operated the vehicle under the influence of alcohol (Fig. 2). Another issue to which a special consideration should be given is related to the usage of hands-free devices while driving. The results have shown that even 58.51% of young drivers used hands-free devices occasionally, while 41.49% have never used it at all. It is interesting that there were no respondents using the hands-free device every time while behind the wheel (Fig. 3).

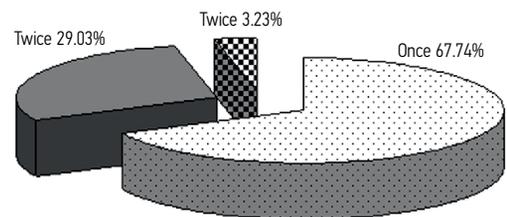


Fig. 1. Traffic accidents involvement

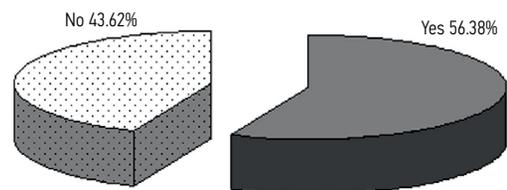


Fig. 2. Driving under the influence of alcohol

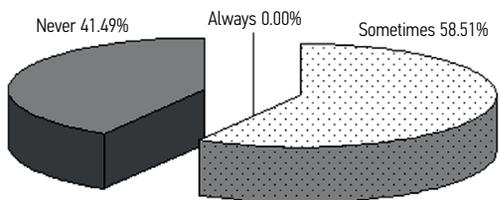


Fig. 3. Hands-free devices usage while driving

This research, similar to the other findings in the literature, has shown that the use of hands-free device does not have much impact on driving safety. In fact, considering the drivers who used hands-free devices, the percentage of those who were participants in a car accident is similar to those drivers without traffic accidents (Fig. 4). Calculating the correlation between the usage of hands-free device and traffic accident involvement applying Fisher’s exact test, the above mentioned conclusion was confirmed (there was no significant correlation). The relationship between the mobile phone usage while driving and crash rate is shown in Fig. 5. As could be seen, a group of drivers who always use mobile phone while driving were most prone to participate in traffic accidents. Interestingly, the lowest rate of traffic accidents did not occur in a group of drivers who never

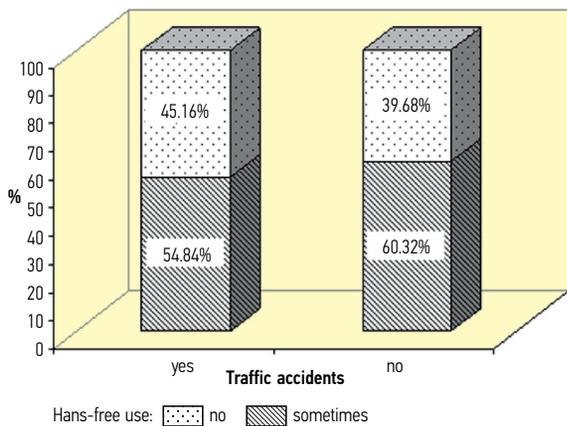


Fig. 4. Hands-free devices usage and traffic accidents

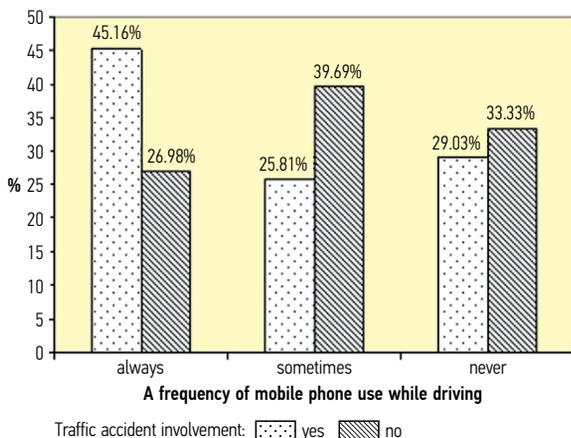


Fig. 5. The frequency of mobile phone usage and traffic accidents involvement

use cell phones while driving, but within the group who use them occasionally. Within the group of young drivers who have never used cell phones while driving, the number of those who were involved in accidents and those who were not, was almost the same.

Most respondents who were involved in one or two traffic accidents used mobile phones while driving. The percentage was 61.91% and 66.67%, respectively. All of the respondents who participated in three traffic accidents always use mobile phones while behind the wheel (Fig. 6). This finding supports the thesis that the increased usage of mobile phone while driving indicates a higher risk of traffic accident.

Regarding the relationship between driving under the influence of alcohol and the use of cell phones while driving, it should be noted that in the group of drivers who drove under the influence of alcohol, 25% of them did not use cell phones. The number of those who use phone behind the wheel regularly and those who use it occasionally is equal. On the other hand, considering the group of drivers who did not consume alcohol while driving, 46.67% of them did not use mobile phone as well (Fig. 7).

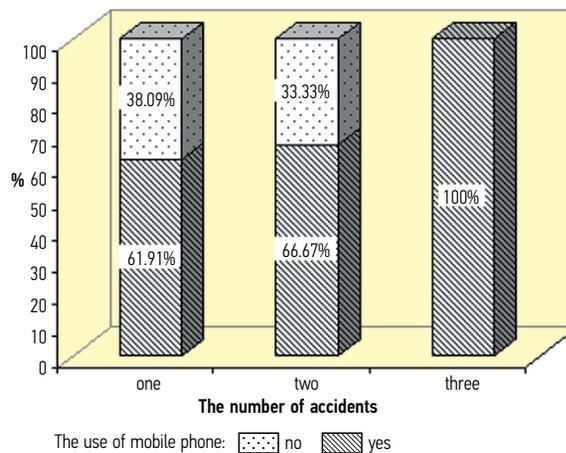


Fig. 6. The usage of mobile phones and the number of traffic accidents

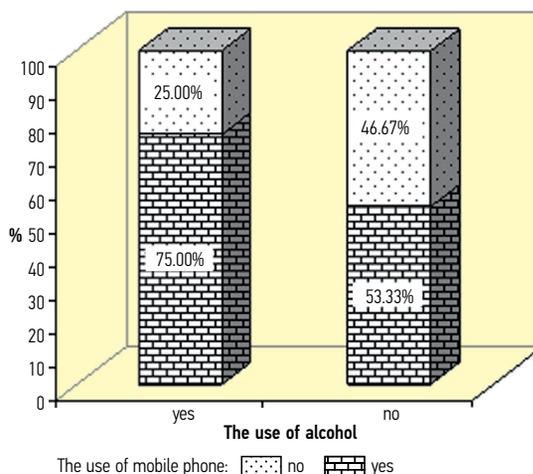


Fig. 7. Alcohol consumption and mobile phones usage while driving

The results of Chi-square-test indicated that the group of drivers who did not drive under the influence of alcohol significantly differs from those who use alcohol regularly or occasionally ($\chi^2 = 11.139, df = 4, p > 0.02$). These drivers are the most safe road users because they are sober while driving, and at the same time almost half of them do not use mobile phones. Unsafe road users combine two types of unsafe behaviour – drinking and using cell phones while driving. Drivers who sometimes drive under the influence of alcohol fit a uniform distribution considering the frequency of mobile phones use. Thus, drivers choose their preferred driving style; if they are unsafe drivers, they combine various types of unsafe behaviour. The same stands for a safe driving style as well.

There is no doubt that mobile phone use while driving increases the risk of being participated in traffic accidents. However, the question is whether there is a difference in the accidents' consequences depending on the frequency of mobile phones usage while driving. The results of the study confirm the existence of these differences.

The injuries and material consequences of traffic accidents occur in all three groups of drivers – those who use mobile phones while driving always, occasionally or never. What makes the difference between those three categories of drivers is the percentage share of certain types of consequences. There is certainly the least amount of consequences within the group of drivers who do not use mobile phones (Fig. 8). Furthermore, 100% of drivers using mobile phones while driving reported a combination of injuries, material and mental consequences of accidents. All these categories of consequences are not present in the group of drivers who occasionally used mobile phones while driving, or did not use it at all. On the other hand, mental consequences of traffic accidents occurred strictly within the group of drivers who had only occasionally used mobile phones. This probably indicates that occasional use of mobile phones has a negative impact on driver's mental status, perhaps more when compared to drivers who regularly use mobile phones.

If we exclude the frequency of mobile phone usage as a factor and focus only on accident consequences depending on whether the drivers use a mobile phone or not while driving, we could get a clearer picture of the impact of mobile phone use on traffic safety (Fig. 9). It could be seen that for the group of drivers who use cell phone while driving all the combinations of accident consequences occurred. Drivers who did not use mobile phone while driving reported only injuries and material consequences, and what is important as well, in a small percentage. Obviously, the use of mobile phones while driving, did not only increase the risk of traffic accident, but affected the complexity of their consequences.

As mobile phone ownership rises rapidly worldwide, the use of mobile phones in vehicles also becomes increasingly common. This study, as many others have tried to determine how many drivers use mobile phones while driving.

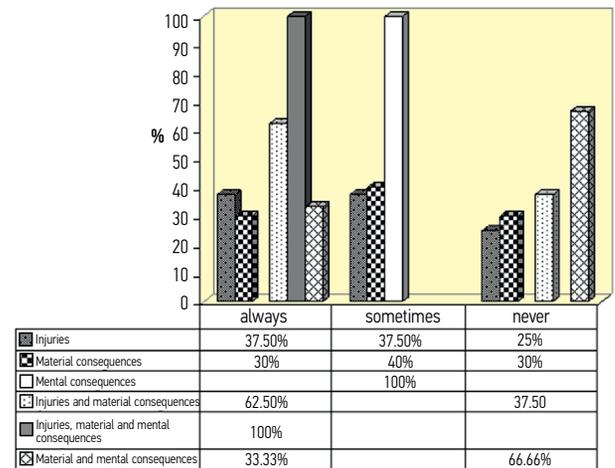


Fig. 8. The frequency of mobile phone use and traffic accidents consequences types

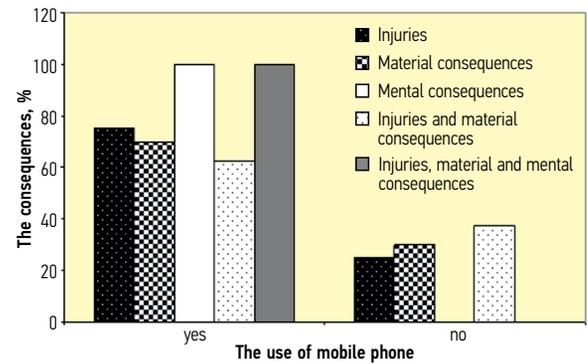


Fig. 9. Mobile phone usage and traffic accidents consequences

Previous studies have shown that drivers who use mobile phones while driving have a higher crash risk than those who do not. It was concluded that mobile phone use increases drivers' crash risks by a factor of four, with the same risk associated with the use of hand-held phones as for hands-free devices (Dragutinovic, Twisk 2005; McEvoy *et al.* 2005). In addition, younger inexperienced drivers are more prone to distraction, potentially resulting in greater impacts on driving performance than for mature drivers (Brace *et al.* 2007).

All the participants in our study were novice drivers aging from 19 to 26, with a little driving experience up to 3 years, and 32.98% of them experienced one or more traffic accident. However, the fact is that almost 60% of them drive under the influence of alcohol, 68% use mobile phone during driving, while hands-free devices are never used by nearly 42% of participants. It has to be emphasized that this survey was conducted before the effective implementation of the New Road Traffic Safety Law in Republic of Serbia started. It would be interesting to repeat the same research afterwards to determine whether the legislation shows impact on drivers' behaviour.

Some studies have found that the impairments to driving behaviour associated with mobile phone use are as profound as those associated with drink driving.

Driving impairments resulting from mobile phone use are transient and result in a temporary distraction of attention from the driving task, while the effects of alcohol persist for much longer periods. Furthermore, drivers using mobile phones have some kind of control (pausing the conversation, for instance), while drivers who are intoxicated cannot do much to control their performance. However, our study suggests that cumulative risks from combining those two kinds of unsafe behaviours could occur. This is especially noticed in the group of drivers who participated in traffic accidents. The group of drivers who did not consume alcohol while driving was significantly different from those who drove under the influence of alcohol. Those drivers are the most safe road users because they are sober while driving and at the same time, almost half of them never use mobile phones. Unsafe road users combine two types of unsafe behaviour – driving under the influence of alcohol and using cell phone when behind the wheel. Furthermore, this unsafe behaviour was related to the type of accident consequences. Specifically, the group of drivers who use cell phone reported all combinations of accident consequences, while the drivers who have never used mobile phones while driving experienced only injuries and material consequences to a lesser extent. Young drivers who occasionally drove under the influence of alcohol have shown a uniform distribution in terms of mobile phones usage frequency.

However, assessing the causal relationship between mobile phone use and crash risk is not easy. It is very likely that the incidence of distraction is under-reported in crash studies. Part of the difficulty could be assigned to the fact that information on whether or not drivers were using mobile phones at the time of a crash is rarely recorded.

Some police crash reports identify distraction as a distinct reporting field, while others are based upon the narrative portion of the report. On the other hand, the advantage of survey research lies in the possibility to collect a large amount of data in a relatively short time and with low costs, but, it has been showed that self-reporting of negative behaviour is lower than its actual occurrence.

Conclusion

On the basis of the results of the study the following conclusions could be drawn:

- more than half of young drivers drove under the influence of alcohol;
- more than 40% of young drivers never used hands-free devices;
- hands-free devices did not reduce the percentage of car accidents;
- drivers who always use mobile phone while driving were most prone to participate in accidents;
- the lowest rate of traffic accidents occur within the group of young drivers who use cell phones occasionally;

- 100% of respondents who participated in three traffic accidents use mobile phones while behind the wheel;
- drivers who did not drive under the influence of alcohol significantly differ from those who use alcohol regularly or occasionally, unsafe road users combine two types of unsafe behaviour – drinking and using cell phones while driving;
- 100% of drivers using mobile phones while driving reported a combination of injuries, material and mental consequences of accidents;
- obviously, the use of mobile phones while driving, did not only increase the risk of traffic accident, but affected the complexity of their consequences.

Bearing in mind all the above mentioned, more work is necessary to improve the systematic collection of data on mobile phone use in accidents. More details about driver's activity and behaviour at the time of the crash should be provided, as well as information about the driving manoeuvres preceding and during the crash. This would facilitate conclusions about groups that are the most affected, geographic areas and time periods with the highest accident incidence rate, etc. Without these kinds of data, a successful strategy in the field of traffic safety cannot be created. There could be a suggestion for governments to encourage modification of existing collision reports, such that the prevalence of crashes caused by mobile phone use could be measured. This would lead to a better understanding of the circumstances surrounding collisions. 'Furthermore, although the available evidence suggests that mobile phone use negatively impacts upon a number of areas of driving performance, more research is needed to better understand the impacts of different forms of mobile phone use – for instance, conversation, sending or receiving text messages – on driving behaviour and crash risk in real life settings. It will also shed light on the overall contribution of mobile phone distraction in road traffic crashes relative to other risk factors' (WHO 2011).

Another recommendation for the authorities could be to launch a public campaign in order to improve the general awareness of young drivers and other road users of the risks they are facing with when using mobile phones while driving. Many legislative initiatives are based on the assumption that hands-free devices are acceptable, while hand-held devices are not (Törnros, Bolling 2005). The use of hands-free devices could somewhat reduce the risks related to dialling, taking and holding mobile device which could certainly contribute to driving safety. However, these devices do not reduce distraction of attention during the conversation; hence there are still potential risks. Additionally, it could be recommended to design appropriate educational programs for young drivers. In this respect, it would be useful to understand their preferred learning styles (Čičević et al. 2011). Furthermore, as mobile phone use might be regarded as a stressor, it would be wise to find appropriate means for assessing different stress levels that might allow us to establish relevant coping strategies, especially for professional drivers (Dobrodolac et al. 2012a, b).

Currently, it is very popular to implement traffic management measures such as gateways and traffic calming treatments combination for regulating drivers' speed behaviour (Dell'Acqua 2011), since inappropriate speed perception is considered as one of the main characteristics of unsafe driving; as well as new technologies and Intelligent Transportation Systems, in order to prevent traffic accidents.

This study has shown, with no doubt, that mobile phone usage by young drivers while driving increases the risk of traffic accident. Some possibilities for further research is to conduct a study on drivers of other age-categories, to make a distinction between amateurs and professional drivers, to use larger samples from different regions throughout Serbia and to examine the changes in driver behaviour that appear as a result of the implementation of the New Road Traffic Safety Law.

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References

- Alm, H.; Nilsson, L. 1994. Changes in driver behaviour as a function of handsfree mobile phones – a simulator study, *Accident Analysis & Prevention* 26(4): 441–451. [http://dx.doi.org/10.1016/0001-4575\(94\)90035-3](http://dx.doi.org/10.1016/0001-4575(94)90035-3)
- Brace, C. L.; Young, K. L.; Regan, M. A. 2007. *Analysis of the Literature: the Use of Mobile Phones While Driving*. Monash University Accident Research Centre, Australia. 48 p.
- Brown, I. D.; Tickner, A. H.; Simmonds, D. C. 1969. Interference between concurrent tasks of driving and telephoning, *Journal of Applied Psychology* 53(5) 419–424. <http://dx.doi.org/10.1037/h0028103>
- Brusque, C.; Alauzet, A. 2008. Analysis of the individual factors affecting mobile phone use while driving in France: socio-demographic characteristics, car and phone use in professional and private contexts, *Accident Analysis & Prevention* 40(1): 35–44. <http://dx.doi.org/10.1016/j.aap.2007.04.004>
- Čičević, S.; Tubić, V.; Nešić, M.; Čubranić-Dobrodolac, M. 2011. Young drivers perceptual learning styles preferences and traffic accidents, *Promet – Traffic & Transportation* 23(3): 225–233. <http://dx.doi.org/10.7307/ptt.v23i3.126>
- Cohen, J. T.; Graham, J. D. 2003. A revised economic analysis of restrictions on the use of cell phones while driving, *Risk Analysis* 23(1): 5–17. <http://dx.doi.org/10.1111/1539-6924.00286>
- Dell'Acqua, G. 2011. Reducing traffic injuries resulting from excess speed: low-cost gateway treatments in Italy, *Transportation Research Record* 2203: 94–99. <http://dx.doi.org/10.3141/2203-12>
- Dobrodolac, M.; Markovic, G.; Čubranić-Dobrodolac, M.; Čičević, S. 2012a. A model for allocation of limited resources for technological improvement: a case of courier service, *Inzinerine Ekonomika – Engineering Economics* 23(4): 348–356. <http://dx.doi.org/10.5755/j01.ee.23.4.1502>
- Dobrodolac, M.; Marković, D.; Čubranić-Dobrodolac, M.; Denda, N. 2012b. Using work stress measurement to develop and implement a TQM programme: a case of counter clerks in Serbian post, *Total Quality Management & Business Excellence*. <http://dx.doi.org/10.1080/14783363.2012.704280>
- Dragutinovic, N.; Twisk, D. 2005. *Use of Mobile Phones While Driving – Effects on Road Safety*. SWOV Publication R-2005-12. SWOV Institute for Road Safety Research, Leidschendam, The Netherlands. 55 p. Available from Internet: <http://www.swov.nl/rapport/r-2005-12.pdf>
- Drews, F. A.; Pasupathi, M.; Strayer, D. L. 2004. Passenger and cell-phone conversations in simulated driving, in *Human Factors and Ergonomics Society 48th Annual Meeting: Proceedings*, 20–24 September 2004, New Orleans, Louisiana, 2210–2212.
- Dreyer, N. A.; Loughlin, J. E.; Rothman, K. J. 1999. Cause-specific mortality in cellular telephone users, *Journal of the American Medical Association* 282(19): 1814–1816.
- Hahn, R. W.; Tetlock, P. C.; Burnett, J. K. 2000. Should you be allowed to use your cellular phone while driving?, *Regulation* 23(3): 46–55.
- Haigney, D.; Westerman, S. J. 2001. Mobile (cellular) phone use and driving: a critical review of research methodology, *Ergonomics* 44(2): 132–143. <http://dx.doi.org/10.1080/00140130118417>
- Hancock, P. A.; Lesch, M.; Simmons, L. 2003. The distraction effects of phone use during a crucial driving maneuver, *Accident Analysis & Prevention* 35(4): 501–514. [http://dx.doi.org/10.1016/S0001-4575\(02\)00028-3](http://dx.doi.org/10.1016/S0001-4575(02)00028-3)
- Korpinen, L.; Pääkkönen, R. 2012. Accidents and close call situations connected to the use of mobile phones, *Accident Analysis & Prevention* 45: 75–82. <http://dx.doi.org/10.1016/j.aap.2011.11.016>
- Lamble, D.; Kauranen, T.; Laakso, M.; Summala, H. 1999. Cognitive load and detection thresholds in car following situations: safety implications for using mobile (cellular) telephones while driving, *Accident Analysis & Prevention* 31(6): 617–623. [http://dx.doi.org/10.1016/S0001-4575\(99\)00018-4](http://dx.doi.org/10.1016/S0001-4575(99)00018-4)
- Lissy, K. S.; Cohen, J. T.; Park, M. Y.; Graham, J. D. 2000. *Cellular Phone Use While Driving: Risks and Benefits*. Harvard Center for Risk Analysis, Harvard School of Public Health, Boston, Massachusetts. 100 p. Available from Internet: <http://cellphonefreedriving.ca/media/harvard.pdf>
- Marshall, R. J.; Jackson, R. T. 1993. Analysis of case-crossover designs, *Statistics in Medicine* 12(24): 2333–2341. <http://dx.doi.org/10.1002/sim.4780122409>
- Maclure, M. 1991. The case-crossover design: a method for studying transient effects on the risk of acute events, *American Journal of Epidemiology* 133(2): 144–153.
- Marchione, D. 2007. Employee travel opens up opportunities for accidents and injuries, *Canadian Occupational Safety* 45(2): 18–19.
- McEvoy, S. P.; Stevenson, M. R.; McCartt, A. T.; Woodward, M.; Haworth, C.; Palamara, P.; Cercarelli, R. 2005. Role of mobile phones in motor vehicle crashes resulting in hospital attendance: a case-crossover study, *British Medical Journal* 331: 428–432. <http://dx.doi.org/10.1136/bmj.38537.397512.55>
- McKnight, A. J.; McKnight, A. S. 1993. The effect of cellular phone use upon driver attention, *Accident Analysis & Prevention* 25(3): 259–265. [http://dx.doi.org/10.1016/0001-4575\(93\)90020-W](http://dx.doi.org/10.1016/0001-4575(93)90020-W)
- NHTSA. 1997. *An Investigation of the Safety Implications of Wireless Communications in Vehicles*. National Highway Traffic Safety Administration. Washington, USA. Available from Internet: <http://www.nhtsa.gov/people/injury/research/wireless>

- Pashler, H. 1994. Dual-task interference in simple tasks: data and theory, *Psychological Bulletin* 116(2): 220–244.
<http://dx.doi.org/10.1037/0033-2909.116.2.220>
- Patten, C. J. D.; Kircher, A.; Östlund, J.; Nilsson, L. 2004. Using mobile telephones: cognitive workload and attention resource allocation, *Accident Analysis & Prevention* 36(3): 341–350. [http://dx.doi.org/10.1016/S0001-4575\(03\)00014-9](http://dx.doi.org/10.1016/S0001-4575(03)00014-9)
- Redelmeier, D. A.; Tibshirani, R. J. 1997. Association between cellular-telephone calls and motor vehicle collisions, *The New England Journal of Medicine* 336: 453–458.
<http://dx.doi.org/10.1056/NEJM199702133360701>
- Redelmeier, D. A.; Weinstein, M. C. 1999. Cost effectiveness of regulations against using a cellular telephone while driving, *Medical Decision Making* 19(1): 1–8.
<http://dx.doi.org/10.1177/0272989X9901900101>
- Schiff, W.; Arnone, W. 1995. Perceiving and driving: where parallel roads meet, in Hancock, P. A.; Flach, J. M.; Caird, J.; Vicente, K. J. (Eds.). *Local Applications of the Ecological Approach To Human-Machine Systems*. CRC Press, 1–35.
- Stutts, J. C.; Reinfurt, D. W.; Staplin, L.; Rodgman, E. A. 2001. *The Role of Driver Distraction in Traffic Crashes*. AAA Foundation for Traffic Safety, Washington, USA. 64 p. Available from Internet: <https://www.aaafoundation.org/role-driver-distraction-traffic-crashes>
- Törnros, J. E. B.; Bolling, A. K. 2005. Mobile phone use: effects of handheld and handsfree phones on driving performance, *Accident Analysis & Prevention* 37(5): 902–909.
<http://dx.doi.org/10.1016/j.aap.2005.04.007>
- Transport Canada: Road Safety and Motor Vehicle Regulations Directorate. 2003. *Strategies for Reducing Driver Distraction from In-Vehicle Telematics Devices: A Discussion Document*. TP 14133 E. Road Safety and Motor Vehicle Regulation Directorate Transport Canada. 29 p. Canada: Available from Internet: <http://www.tc.gc.ca/eng/roadsafety/tp-tp14133-menu-147.htm>
- Transport Canada: Road Safety and Motor Vehicle Regulations Directorate. 2005. *Strategies for Reducing Driver Distraction from In-Vehicle Telematics Devices: Report on Industry and Public Consultations*. TP 14409 E. Road Safety and Motor Vehicle Regulation Directorate Transport Canada. 19 p. Canada: Available from Internet: <http://www.tc.gc.ca/eng/roadsafety/tp-tp14409-menu-148.htm>
- Utter, D. 2001. *Passenger Vehicle Driver Cell Phone Use: Results from the Fall 2000 National Occupant Protection Use Survey*. DOT HS 809 293. National Highway Traffic Safety Administration, Washington, USA. 4 p. Available from Internet: <http://ntl.bts.gov/lib/11000/11000/11054/809-293.pdf>
- Violanti, J. M. 1998. Cellular phones and fatal traffic collisions, *Accident Analysis & Prevention* 30(4): 519–524.
[http://dx.doi.org/10.1016/S0001-4575\(97\)00094-8](http://dx.doi.org/10.1016/S0001-4575(97)00094-8)
- Violanti, J. M.; Marshall, J. R. 1996. Cellular phones and traffic accidents: an epidemiological approach, *Accident Analysis & Prevention* 28(2): 265–270.
[http://dx.doi.org/10.1016/0001-4575\(95\)00070-4](http://dx.doi.org/10.1016/0001-4575(95)00070-4)
- Warren, R.; Wertheim, A. H. 1990. *Perception and Control of Self-Motion*. Psychology Press. 680 p.
- WHO. 2011. *Mobile Phone Use: a Growing Problem of Driver Distraction*. World Health Organization, Geneva, Switzerland. 48 p. Available from Internet: http://www.who.int/violence_injury_prevention/publications/road_traffic/distracted_driving_en.pdf
- Wickens, C. D. 1984. Processing resources in attention, in Parasuraman, R.; Davies, D. R. (Eds.). *Varieties of Attention*, Academic Press, 63–101.