ESRA: E-Survey of Road Users' Attitudes – Analysis of Safety Indicators and Predictors of Distracted Driving Behaviour

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ABSTRACT

Background. Driving is a complex, goal-directed task with high perceptual, cognitive, and motor demands. Especially cell-phones and in-vehicle technologies increase driving complexity since they create dual-tasking situations behind the wheel. Distracted driving implies that attention, required for safe driving, diverts toward another competing activity, which may cause failures in hazard detection, information processing, vehicle control, etc. **Objectives.** The current study investigated distracted driving related to mobile-phone use. It aimed to identify a priority problem group and model the determinants of their distracted driving behaviour. **Method.** The data was collected by the ESRA project (E-Survey of Road Users' Attitudes; Torfs et al., 2016; Trigoso et al., 2016). Data was collected in 2015 and 2016, using an internet based self-administered cross-sectional questionnaire from a sample of adults in 25 countries (e.g., Austria, Italy, Belgium, etc.). The total number of reported respondents was 26,643, of which 15,642 were regular car drivers. Four target behaviours related to the mobile-phone use while driving were examined: (1) handheld use (2) hands-free use (3) read text message or email (4) send text message or email. **Results.** "Young male drivers" were the identified problem group. Hands-free-phone use was the most prevalent mobile-phone use behaviour while driving. Relevant predictors were (specific terms between brackets): gender (males), education (middle aged drivers), higher exposure (young and middle aged), higher acceptability (low for hands-free use), attitudes (young), and support for traffic safety policy measures (old). These results can inspire policy-makers and legislation for priority-setting regarding distracted driving, especially for "young male drivers".

1 INTRODUCTION

Driving a vehicle is complex, demanding task requiring full attention of the driver. Any distraction from within or outside a vehicle may impose a threat to the safety of the driver, occupants of the vehicle, or other road users. Distracted driving has been acknowledged as a large and growing road safety problem by the World Health Organization (WHO, 2015). In 2015, 85% of Americans judged driver distraction as the most dangerous threat to road safety, and they were more concerned about it compared to aggressive driving and drunk driving (AAA Foundation for Traffic Safety, 2016). The substantial growth of mobile-phone use while driving, and the increased representation of such drivers in road crashes, also attracted the attention of researchers (Dragutinovic & Twisk, 2005). Mobile-phone use while driving results in all types of distraction, i.e., visual,

physical, auditory, and cognitive. Generally, physical and visual distractions are linked with handheld mobile-phone use, while cognitive and auditory distractions are related to both hand-held and hands-free use. Whether it is hand-held or hands-free, distraction induced by mobile-phone use while driving causes a loss in driving performance, and thus should be avoided (Redelmeier & Tibshirani, 1997; Ross et al., 2014). The current study investigated distracted driving behaviour related to mobile-phone use while driving for data collected during the ESRA project (E-Survey of Road Users' Attitudes (Waves 1+2); Torfs et al., 2016; Trigoso et al., 2016), which queried adults in 25 countries (e.g., Austria, Italy, Belgium, etc.). The objective is to identify a problem group among the participants and model determinants of distracted driving behaviour.

2 METHODS

2.1 The ESRA Project

ESRA is a joint initiative of about 38 countries around the world, aiming to collect a national level comparable data of the road users' attitudes, opinions, and behaviour towards the road risks from active adult drivers. The ESRA-survey assumes fully comparable results among all the participating countries by ensuring a uniform method of sampling, using the same questionnaire, and a uniform programing technique for recording the responses from the participants. The current study analysed the data collected in 2016 from 25 countries during Waves 1+2 of ESRA-1 from 26,643 respondents of which 15642 were regular car drivers. Respondents were aged between 17 and 115 years (M= 44.73 years, SD= 15.11 years).

2.1.1 Questionnaire

A web-based self-administered questionnaire (SAQ) was used for the data collection. The questions included cover the socio-demographic information, the mobility and exposure to the traffic, road safety in general, acceptability of unsafe traffic behaviour, support for road safety policy measures, self-declared (unsafe) behaviour, attitude towards (unsafe) behaviour, subjective safety and risk perception, behaviour of other road users, involvement in road crashes and enforcement.

2.1.2 Measures

Four target behaviours related to the mobile phone use while driving in the ESRA questionnaire include (1) using a handheld mobile phone for calls (2) using a hands-free mobile for calls (3) using a mobile phone to read a text message or email (4) using a mobile phone to send a text message or email. Our target behaviours and other relevant questionnaire sections are: socio-demographic information, acceptability of behaviour, support for the road safety measures, self-declared behaviour, attitude towards (unsafe) traffic behaviour, and subjective safety and risk perception.

2.2 Data Analysis

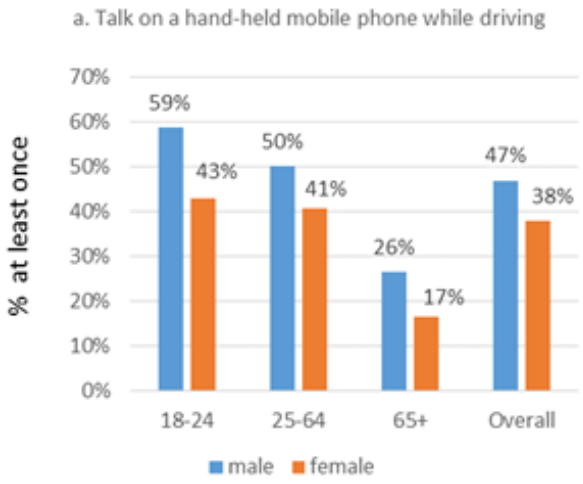
The analysis used the characteristics of the drivers to predict the likelihood of distracted driving. A binary logistic regression was used to predict the likelihood that the driver will engage in the behaviours related to the mobile phone use while driving. Initially, an interlaced descriptive analysis determined the problem group. The association between the dependent variable and the independent (psychological) variables was assessed by

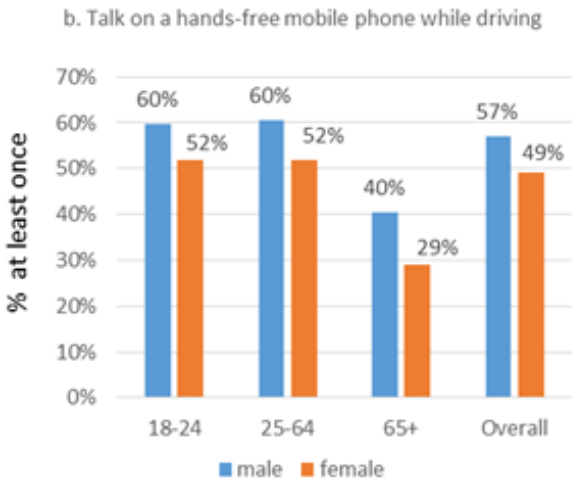
bivariate correlations. The variables used by the current study include the background information and the psychological variables associated with the drivers. Gender, age, educational level and the frequency of drivers were the background information used. The psychological variables comprised of the acceptability of the unsafe behaviours, the attitude towards unsafe driving behaviours and the support shown by the study participants to the traffic safety policy measures. The self-declared behaviour related to the use of mobile phone while driving in the last 12 months was the dependent variable. A summary of the results is provided in the following section.

3 RESULTS

3.1 Three-way Cross Tabulation (gender*age-group*self-reported behaviour)

Plotting percentage of the respondents using mobile phone while driving for different age-groups and genders in a three-way cross tabulation analysis gave an early warning of the problem road users' group. The bar charts revealed that more male than female drivers have reported to talk on handheld and hands-free mobile phone while driving. All three age-groups have shown similar behaviour of male drivers when compared with female drivers. Similarly, greater percentage of male drivers than female drivers have used mobile phones for reading and sending emails and text messages while driving during last year. Drivers aged 18-24y have used a mobile phone for talking (handheld) and for reading and sending text messages and emails more than middle-aged and old-aged drivers (25-64y and 65 plus years respectively). However, similar percentage (60%) of young and middle-aged drivers reported using hands-free mobile phone while driving. All these results were validated by a chi square test of significance. The results are reported in figure 1.





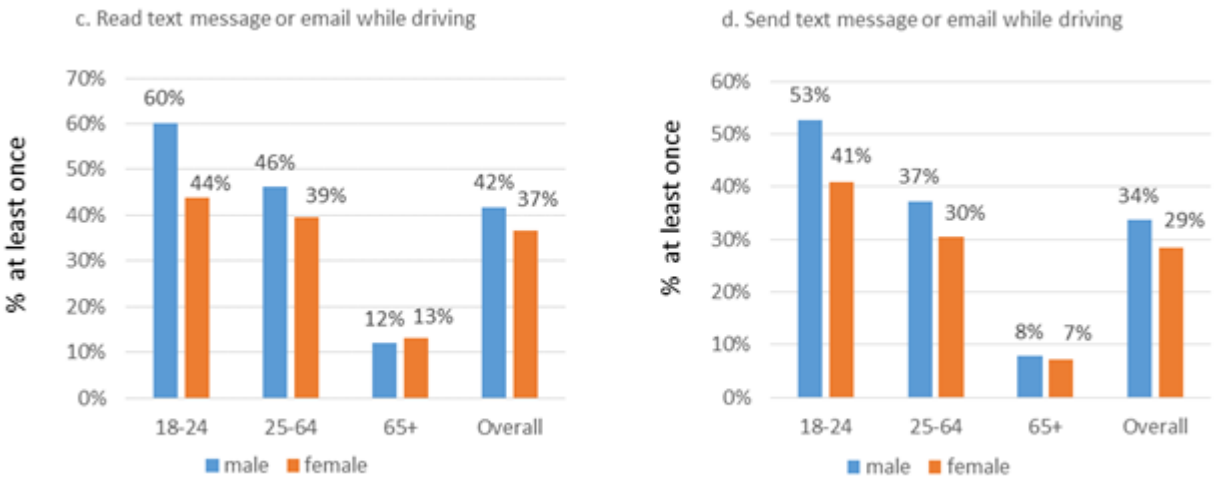


Figure 1 - Self-reported behaviour related to mobile phone use while driving by age-group and gender. Notes: (a) percentage that use a mobile phone while driving at least once in the past 12 months (b) no weights used.

3.2 Binary Logistic Regression Models for Talking on Handheld and Hands-free Mobile Phone While Driving

Male drivers are more likely to report mobile phone use while driving than their female counterparts, i.e., lower odds ratio for females to perform behaviours related to mobile phone while driving (handheld: 0.78, hands-free: 0.75, read and sending text message/email: 0.86 both, where $p<0.001$). Age also has a significant effect as it decreases the likelihood of (a) handheld use for middle-age drivers (Odds ratio: 0.90, $p<0.01$) and for old-age drivers (Odds ratio: 0.44, $p<0.01$), (b) hands-free use for old-age drivers (odds ratio: 0.55), (c) reading a text message/email for old-age drivers (odds ratio: 0.14) and (d) sending a text message in case of both middle-age (odds ratio: 0.53) and old-age drivers (odds ratio: 0.07). For all these results, $p<0.001$. Results further suggest a strong negative effect of the age on reading and sending text message/email than on the hands-free and handled mobile use while driving (Table 1). Higher educational levels increases the likelihood of using mobile phone by 1.23 for handheld, 1.54 for hands-free, 1.53 for reading and 1.51 for sending text message/email while driving for Bachelor's degree holders and 1.25 for handheld, 1.43 for hands-free, 1.57 for both reading and sending text message/email while driving for Master and above degree holders (for all results, $p <0.001$). Frequent drivers are more likely to use a mobile phone while driving. E.g., the odds of a person who drives four days or more per week are 3.29 times higher to talk on handheld mobile than the one who drives only a few days per year. Similar results were observed for hands-free (Odds ratio: 3.66), reading a text/email (Odds ratio: 4.06) and sending a text and email (Odds ratio: 3.39) for drivers with four or more days of driving per week. For respondents driving 1-3 days per week or only a few days per month, the odds ratio (1.45 and 2.17 respectively) was relatively lower than the more frequent group (four or higher number of driving days, Odds ratio: 3.29) but higher than those who travel only few days a year. An increase in the likelihood for the hands-free use and reading and sending text messages and email was also observed (Table 1).

The acceptability of using a handheld and a hands-free mobile phone while driving increase the likelihood of engaging in these behaviours by 2.81 times ($p<0.001$) and 2.08 times ($p<0.001$) as compared to drivers who do

not accept or who have neutral opinions. Analysis of the acceptability of typing a text message or email and checking/updating social media showed a greater increase in the likelihood to read (Odds ratio: 4.33 and 3.36) and send text messages/email (odds ratio: 4.63 and 4.06). Attitude towards the unsafe behaviours, (i) attention to the traffic decreases when talking on handheld mobile phone and (ii) talking on handheld increase the risk of a crash, both decrease the odds of performing a handheld call while driving by 0.58 and 0.41 times. Drivers who believe that almost all the car drivers occasionally talk on handheld phone while driving are 2.35 times more likely to involve in such calls.

Support for policy measures has shown a decrease in using a mobile phone while driving. E.g., drivers supporting zero tolerance for using mobile phone while driving are 50% (Odds ratio: 0.50, P<0.001) and 53% (Odds ratio: 0.47, P<0.001) less likely to talk on handheld and hands-free mobile phone while driving. Similarly, support for the zero tolerance also decreased likelihood of reading (odds ratio = 0.41, p<0.001) and sending (odds ratio = 0.47, p<0.001) a text message or email while driving.

Table 1 - Binary logistic regression model for using a mobile phone while driving. Notes: (a) unweighted sample used (b) In Slovenia, the question 'talks on a hand-held mobile phone' refers do not limit it to hand-held mobile phone use only but it denotes all types of talking on the mobile phone while driving (c) *** p<0.001, ** p<0.01, * p<0.1

	Odds Ratio			
Variables (Ref)	Handheld talking	Hands-free talking	Read texts/emails	Send texts/emails
Gender (Ref: male)				
Female	0.78***	0.75***	0.86***	0.86***
Age-group (Ref: 18-24)				
25-64	0.90*			0.53***
65 +	0.44***	0.55***	0.14***	0.07***
Educational Qualification (Ref: Primary education/none)				
Secondary education				
Bachelor's degree or similar	1.23***	1.54***	1.53***	1.51***
Master's degree or higher	1.25***	1.43***	1.57***	1.57***
Frequency of driving (Ref: A few days a year)				
A few days a month	1.45***	1.51***	1.80***	1.59***
1 to 3 days a week	2.47***	2.29***	2.66***	2.31***
At least four days a week	3.29***	3.66***	4.06***	3.39***
Personal acceptability (Ref: unacceptable/neutral)				
Talk on a hand-held phone (acceptable)	2.81***			
Talk on a hands-free phone (acceptable)		2.08***		
Type text messages or e-mails (acceptable)			4.33***	4.63***

Social media (e.g.,: Facebook, twitter) (acceptable)			3.36***	4.06***
Attitude towards unsafe traffic behaviour (Ref: disagree/neutral)				
Attention decreases when talking on a hand-held phone (agree)	0.58***	0.46***		
Almost all drivers occasionally talk on a hand-held phone (agree)	2.35***			
People talking on a hand-held phone have a higher risk of an accident (agree)	0.41***			
Support for road safety policy measure (Ref: oppose/no opinion)				
Zero tolerance for any phone (hand-held or hands-free) for all drivers (Support)	0.50***	0.47***	0.41***	0.47***

3.3 Binary Logistic Models for Young Drivers

The odds of using a mobile phone while driving for the young female drivers when compared with the young male drivers are reduced (handheld talking; odds ratio: 0.63, hands-free talking; odds ratio: 0.77, read a text message/email; odds ratio: 0.76). Education level is not a predictor of young drivers' behaviour related to mobile phone use while driving except for reading the text messages which shows a significant decrease in the likelihood for the drivers with Master degree (odds ratio: 0.33, $p<0.01$). The frequency of driving and the odds of using a mobile phone while driving have positive relationship. The likelihood of using a handheld mobile phone to talk increases by 3.14 times, hands-free by 5.53 times, reading a text message/email by 4.77 times and sending a text message by 3.36 times for those who drive at least 4 days a week relative to those who drive only few days a year (for all odds ratio, $p<0.001$). Greater increase in the likelihood is observed for the hands-free and reading a text message/email (odds ratio: 5.53 and odds ratio: 4.77, respectively). The personal acceptability of using a mobile phone and the likelihood to engage in such behaviours while driving has shown a positive relation in the developed models. E.g., drivers accepting to talk on handheld and hands-free mobile phone while driving are 3.95 and 1.58 times more likely to perform these behaviours than those who do not accept. Similarly, young drivers accepting to type a text message or email and check or update a social media account are 5.40 times and 3.36 times more likely to read a text message and 3.33 times and 3.14 time to send a text message, respectively. Attitude towards unsafe behaviour is only significant for handheld mobile phone use while driving in our target age-group. People thinking that mobile phone use while behind the wheel decrease their attention to the traffic are 0.37 times (odds ratio: 0.63, $p<0.01$). The odds are increased by 2.57 times for drivers believing that almost all the drivers occasionally talk on handheld mobile phone while driving. When a driver has a highly negative attitude towards the mobile phone use while driving, e.g., it results in increased risk of getting an accident, the odds for these drivers are reduced by 0.62 times (odds ratio: 0.38, $p<0.001$). Drivers with attitude "My attention to the traffic decreases when talking on a hand-free mobile phone while driving" have 0.52 times odds of talking using hands-free mobile while driving. As expected, the support for zero tolerance about using a mobile phone for driving decrease the likelihood by 48% (odds ratio:

0.52, p<0.001), 43% (odds ratio: 0.57, p<0.001), 56% (odds ratio: 0.44, p<0.001) and 48% (odds ratio: 0.52, p<0.001), for handheld, hands-free, and read and send text message using mobile phone while driving, respectively.

Table 2 - Binary logistic regression models for age-group (18-24 years) using a mobile phone while driving. Notes: (a) unweighted sample used (b) In Slovenia, the question 'talks on a hand-held mobile phone' refers do not limit it to hand-held mobile phone use only but it denotes all types of talking on the mobile phone while driving (c) *** p<0.001, ** p<0.01, * p<0.1

	Odds Ratio			
Variables (Ref)	Handheld phone	Hands-free phone	Read texts/emails	Send texts/emails
Gender (Ref: male)				
Female	0.63***	0.77**	0.76**	
Education (Ref: Primary education/none)				
Secondary education				
Bachelor's degree or similar				
Master's degree or higher			0.33**	
Frequency of driving (Ref: A few days a year)				
A few days a month	0.89	1.59	1.78	1.21
1 to 3 days a week	1.99*	3.35***	3.22***	2.31**
At least four days a week	3.14***	5.53***	4.77***	3.36***
Personal acceptability (Ref: unacceptable/neutral)				
Talk on hand-held phone (acceptable)	3.95***			
Talk on hands-free phone (acceptable)		1.58***		
Type texts/e-mails (acceptable)			5.40***	3.33***
Social media (e.g.: Facebook, twitter) (acceptable)			3.36***	3.14***
Attitude towards unsafe traffic behaviour (Ref: disagree/neutral)				
Attention decreases when talking on a hand-held phone (agree)	0.63**			
Almost all drivers occasionally talk on a hand-held phone (agree)	2.57***			
People talking on a hand-held phone have a higher risk of an accident (agree)	0.38***			
Attention decreases when talking on a hand-free phone (agree)		0.52***		
Support for road safety policy measure (Ref: oppose/no opinion)				

Zero tolerance for any phone (hand-held or hands-free) for all drivers (Support)	0.52***	0.57***	0.44***	0.52***

4 DISCUSSION AND IMPLICATIONS

The current study found support for the role of psychological factors in predicting the distracted driving related to the mobile phone use. The study also found that the contribution of the background information was somewhat unstable across the behaviours and this effect was more obvious when the variable age-group was controlled in the logistic regression. This fluctuating role of the background information in predicting odds of using a mobile while driving was also noticed when different age groups were compared. Other findings include that talking on the mobile phone while driving was more common than texting or emailing. Also, the study found that the participants are aware of the hazards associated with the distracted driving.

4.1 Role of the Background Information

Young drivers are more likely to use a mobile phone while driving than the middle-age drivers and the old age drivers. This result agreed to the findings of Kass et al. (2007) and Li et al. (2014) which has informed that with increase in the age, the self-reported distracted driving behaviour decreases. The current study found that the male drivers are more likely to use mobile phones while driving than the female drivers and this finding was common in all age-groups and for all the behaviours studied. Zhou et al. (2009) have also reported similar findings. Billieux et al. (2008) has contradictory findings for the behaviour related to sending text messages where females were found to send more messages. Educational level was a significant determinant for sending text messages in the old age drivers. For the middle age drivers, educational level was a significant predictor of the odds for all the studied mobile phone use behaviours. This finding can be linked to the results of Li et al. (2014). Li et al. (2014) found higher frequency of self-reported distracted driving behaviour with the higher earning. They argued that since income and educational level of the drivers are correlated, there is a chance that education had an indirect effect on the self-reported behaviour. Our analysis further revealed that the odds of using a mobile phone while driving are higher for those who drive frequently. An exception was the lack of a significant association between the self-reported behaviour and the frequency of driving in case of drivers aged 65 plus years. One explanation could be that since young- and middle-age people drive more frequently, the old-age people who drive frequent were reduced to a very small number in the analysis, making the analysis technique unsuitable.

4.2 Efficacy of Psychological Factors in Predicting Distracted Driving

The acceptability of the distracted driving was found to be positively associated with the self-reported behaviour of the participants. Li et al. (2014) also found that the drivers accepting more easily the distracted driving behaviour (all mobile phone use related) were more likely to report engaging in the distracted driving. The respondents' attitude towards the distracted driving and support for traffic safety policy were other useful psychological predictors. This finding followed the results of Li et al. (2014) which suggested that people who were engaged in the distracted driving were less likely to see this behaviour as a serious safety concern. The differences in the capability of the variables to predict odds ratio to involve in the distracted driving varied

across different age groups. By dividing the study sample into three new age-group, a loss of balance was induced into the number of participants in each group. Given the huge size of the middle-age drivers group (25-64y), the number of participant in that group was almost eight to nine times more than the other age-groups. Trigoso et al. (2016) has induced an artificial balance between the sample sizes of different age-groups by using weights and almost equal age-group sizes (i.e. 18-34y, 35-54, and 55+).

4.3 Implications

Results of the current study can inspire policy-makers and legislation for priority-setting regarding distracted driving, especially for "young male drivers". The results showed that attitude towards the unsafe behaviour can be associated with the likelihood of engaging in the distracted driving. The attitude of the drivers towards the (unsafe) traffic behaviour can be included in behaviour change campaigns. Attitudes like engaging in the mobile-phone conversation while driving 'reduces attention to traffic' and 'increases the risk of getting into an accident' can be important campaign targets. These campaigns should be targeted especially to young male drivers, thus including very specific strategies.

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