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The use of mobile phone while driving: Behavior and determinant analysis in one of the largest metropolitan area of Italy

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ABSTRACT

The use of mobile phones while driving is one of the main causes of road accidents and it is a phenomenon in continuous growth. The key aim of this study is to analyse simultaneously knowledge, attitudes, and behavior toward the use of mobile phones while driving in one of the largest and populous metropolitan areas of Italy, Naples. The data acquired from 774 questionnaires - administered to subjects evenly divided by gender and with an average age of 39 years - revealed that 69 % have used their mobile phone while driving at least once in their lifetime. Among those who used the phone, 63.6 % use it to make phone calls while 75.2 % only to answer them; 49.1 % read messages and only 33.3 % write them. It is also notable that 34.1 % do not stop to answer a call and only 10 % do not value the use of headsets while driving as fundamental. The results indicate that cell phone usage while driving is common in the study population, despite many having university-level education and satisfactory risks awareness. The multiple linear regression analysis shows how knowledge is not correlated to the behavior held. On the contrary, attitudes are strongly correlated to knowledge and behavior, meaning that good attitudes bring forth positive behavior. According to the collected data and statistical analysis, it is possible to identify factors that can greatly affect the use of mobile phone while driving and establish targeted prevention programs.

1. Introduction

The World Health Organization declared that traffic accidents are the eighth cause of death worldwide and the first amongst subjects aged 5–29 years, estimating in 2016 that 1.35 million people die as a result of road crashes worldwide annually. The data shows that, with an average rate of 27.5 deaths per 100,000 population, the risk is more than 3 times higher in low-income countries than in high-income countries where the average rate is 8.3 deaths per 100,000 population (WHO Global Status Report on Road Safety, 2018). In 2016, in the European Union (EU) 25, 624 people died in road accidents; across the EU Member States, the highest number of road traffic victims in 2016 were recorded in France (3,477), Italy (3,283), Germany (3,206) and Poland (3,026) (European Road Safety Observatory - Annual Accident Report, 2018).

Italy recorded 3,325 road fatalities in 2018, representing a 1.6 % decrease on the 3,378 fatalities recorded in 2017. The mortality rate is 5.5 deaths per 100,000 population. Since 2010, road fatalities have decreased across all road user groups and age categories, except for the elderly (International Transport Forum, 2019c). According to preliminary data of the first semester of the 2019, from January to June, the number of road accidents with personal injury was 82,048 aand the number of victims 1,505; the mortality index is 1.8 (ISTAT Press Release, 2019). As for fatalities by road user groups, in Italy passenger car occupants are the group most affected by road crashes. In 2018, passenger car occupants accounted for a plurality of road deaths with 43 % of the total; they were followed by motorcyclists (21 %), pedestrians (18 %) and cyclists (7 %). It's important to notice that cars and motorcycles represent, respectively, 72 % and 13 % of the Italian vehicle fleet (International Transport Forum, 2019c), contrary to other parts of the world where riders of motorized two- or three-wheelers are the most numerous (WHO Global Status Report on Road Safety, 2018). According to data processed by ISTAT, in 2018 the economic impact on social costs was 17 billion-euro, equivalent to 1% of the Italian Gross Domestic Product (GDP) (ISTAT Press Release, 2019).

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There are several factors that increase both road traffic crashes risk and their resulting risk of injury or death worldwide. Driving under the influence of alcohol or other psychoactive substances presents significant risk factor for road traffic injuries, while other risk factors can be identified with the following: failure to use safety devices such as motorcycle helmets, seat-belts, child restraints, and distraction, including the use of mobile phones (WHO Global Status Report on Road Safety, 2018). In 2018, in Italy, distraction was presumed to be the primary cause (16.3 %) of road crashes against speeding (10.2 %), alcohol-related DUI (3.9 %) and drug-related DUI (3.2 %) (International Transport Forum, 2019c). One of the most important causes of distraction while driving appears to be the use of a mobile phone (Trivedi et al., 2017).

This study analyses the behaviors enacted by Italian drivers regarding mobile phone use while driving, as well as their level of mobile phone involvement and its frequency of use. The key aim of this study is to analyse knowledge, attitudes, and behavior toward the use of mobile phones while driving in one of the largest and populous metropolitan areas of Italy. Analysis of knowledge, attitudes and behaviors about the risks of mobile phone usage while driving can lead us to identify its determinants in order to obtain the means to sensitize public opinion and improve awareness regarding the correct behavior to adopt while driving.

This paper is structured in several sections: a review of literature, followed by the description of materials and methods used in the study and analysis approach. Next, a summary of the collected results is exposed and in the end a discussion of the findings and the conclusion are presented.

2. Literature review

Analysing the specifics of the data reported throughout the continents, despite the different cultures and policies there are similar risk factors when taking in account road crashes. In Oceania, for example, information obtained by the International Safety Reports show that in Australia speeding seems to be the cause of about a third of all fatal crashes. It is followed by driving under the influence of drugs (18.8 %) or alcohol (18.6 %), together with the constant increase of the use of mobile phones (International Transport Forum, 2019a). In Asia, specifically in China, auto drivers were believed to be responsible for the crash in 92 % of road fatalities: major crash factors were speeding, careless driving, driving without a license, driving in the wrong lane, and driving after drinking alcohol (Zhang et al., 2013). In Vietnam, distracted driving due to mobile phone usage is an increasing problem, since mobile phone related crashes represent 20.5 % of all reported crashes (Truong and Nguyen, 2019). The frequency of fatal crashes on Japanese roads is decreased in recent years so that inappropriate speed causes 3.4 % of road crashes while only 0.8 % were due to the influence of alcohol. Unlike in other countries, in 2018 distraction due to the use of mobile phones was identified as the primary cause in only 0.4 % of all road traffic crashes (International Transport Forum, 2019d). The same Reports in Africa show that inappropriate speed in Morocco is one of the main causes of road crashes (8 % in 2017), but distraction is emerging as an increasing problem for traffic safety: a survey conducted in 2017 revealed that 75 % of drivers admitted to using a mobile phone while driving (International Transport Forum, 2019e). In Ghana, a study by Haadi (2014) indicated that approximately 30 % of road accidents are caused by speeding; other factors leading to death on the road are alcohol and drugs. In the United States of America, distracted driving is an important factor in road crashes, not only concerning mobile phone use or texting, but including also eating, talking to other passengers, adjusting the radio or climate controls; specifically, past research found mobile phone distraction explaining about 25 % of crashes in the US (Mirman et al., 2017; Pless and Pless, 2014). Regarding the remainder of the American continent, for example, in Mexico the use of mobile phones while driving contributed to 20 % of the traffic accidents (Mendez et al., 2019), while a Brazilian cross-sectional population-based study showed use of mobile phones in 27.2 % of participant with 15.7 % of them being involved in an accident (Rios et al., 2020).

In Europe, speeding was a risk factor in about 32 % of fatal road crashes in Germany in 2016 and was often cited as a major factor in combination with other high-risk behavior, such as alcohol (7.3 % in 2018) (International Transport Forum, 2019b). According to a Norwegian study, fatal crashes in the years 2011−2015 reported the use of mobile phone as the most frequent source of in-vehicle distraction (2–4 % of all fatal crashes and 7–14 % of inattention-related fatal crashes). Five out of a total of 22 mobile phone-related crashes occurred while reading or sending text messages. A handheld mobile phone (which is explicitly forbidden during driving in Norway) was used in 16 out of the 22 crashes (Sundfør et al., 2019). In Italy, the use of a mobile phone while driving represents one of the main causes of distraction, even though laws take in account penalties and in some cases even driving license withdrawal in case of usage while driving (since 2002 in Italy the use of hand-held mobile phones while driving is not permitted); in 2015−16, according to the "ULISSES" monitoring system, 5.1 % of the drivers used a cellphone while driving (International Transport Forum, 2019c; Trivedi et al., 2017) .

The aforementioned studies demonstrate that distraction is major risk factor in severe road fatalities; also, mobile phone use while driving is one of the main causes of distraction road fatalities and above all it's a rapidly growing problem. Therefore, mobile phone related behavior while driving is an important issue to be studied in order to recognize it as a major health problem worldwide.

2.1. Mobile phone behavior

Mobile phone usage while driving is a worldwide trend for many drivers and it can be used for real-time traffic updates, navigation, or emergency calls, but at the same time other unnecessary applications like social networks can cause further distraction. Driving simulation studies indicate that dual tasking, such as using a mobile phone while driving, can be detrimental to driving performance (Bianchi and Phillips, 2005; Consiglio et al., 2003; Hancock et al., 2003). According to an Australian study, looking for more than 2 seconds at a mobile phone while driving is the most common and frequent habit amongst drivers (Oviedo-Trespalacios et al., 2017). Specifically, prior research shows that the visual, manual, and cognitive distractions associated with text messaging while driving could contribute to higher crash rates, especially for younger drivers (Oviedo-Trespalacios et al., 2017; Skierkowski and Wood, 2012).

The International Trasport Forum for Road Safety in Australia (International Transport Forum, 2019a) reports the constant increase of the use of mobile phones while driving: about 60 % of drivers use a mobile phone to read (32 %) or send (18 %) text messages. An Australian less recent study found that 27 % of drivers text while driving despite the fact that it is illegal in that country (White et al., 2010); in New Zealand more than half (57.3 %) of the sample used a cellphone while driving, at least on occasions (Sullman and Baas, 2004). A study conducted in Hanoi (Vietnam) showed that 8 % of 26,360 riders use a mobile phone while driving (Truong et al., 2016). In Qatar, 11.48 % of drivers use mobile phone behind the wheel (Shaaban, 2014). In a survey carried out in Israel by Tomer-Fishman in 2010 it was found that 81 % reported not sending a text message in the past seven days, 48 % avoided reading an incoming message, 13 % read messages immediately, and 39 % waited to attend to reading while the vehicle was stopped (Musicant et al., 2015). A cross-sectional survey shows that in Ghana 96.4 % of drivers know that the law prohibits the use of mobile phones while driving but the majority (59.6 %) did not routinely comply with the law; among drivers who reported phone use while driving, 44.6 % stated they used a hands-free feature (Donkor et al., 2018). In the United States of America, a research note from the U.S. Department of Transportation in 2018 shows that only 3.2 % of drivers talking on handheld phones, a

percentage increased from 2.9 % in 2017 (National Center for Statistics and Analysis, 2019). In 2015, Huisingh et al. revealed that 31.4 % of drivers talk on the phone and 16.6 % text or dial. In South-America, specifically in Colombia, Oviedo-Trespalacios and Scott-Parker (2017) discovered that 78 % of drivers of age between 15 and 25 make use of a cellphone while driving at least on occasions.

In Europe, studies conducted in different countries report conflicting results on the use of mobile phones while driving with percentages ranging between 9 % and 81 % and averages around 30 %. A recent study conducted in Ukraine, for example, found out that almost a third of the people interviewed reported using their phone on a daily basis to write (22.2 %) or read (38.2 %) text messages while driving (Hill et al., 2019). In United Kingdom, almost 30 % of study participants reported answering calls while driving a daily basis or more (Sullman et al., 2018). In a Spanish university sample, a research found that more than 60 % use a cellphone while driving and that it's mainly used in order to make calls, rather than send SMS (Gras et al., 2007). A study conducted by Pöysti et al. (2005) reports that 81 % of Finnish drivers used their phone in the car at least sometimes, with 9 % using it over 15 min a day; 44 % phone-using drivers admitted having experienced hazardous situations while using a phone. In Italy, few studies have been conducted on the use of mobile phones while driving. Among these, worth mentioning is a recent study conducted by Valent et al. (2020) in the city of Udine (Northern Italy) in which it reports that the prevalence of cellphone use behind the wheel was 9.9 % among drivers that were waiting at a stoplight and 6.5 % amongst those actually moving around the streets; also the type of use has been recorded: texting was 7.2 % at a stoplight and 5.0 % in moving vehicles, while engaging in a phone call was 3.3 % and 3.6 %, respectively. Gariazzo et al. (2018) shows positive associations between road crashes rates and the number of calls, texts, and internet connections, with incremental risks of 17.2 %, 8.4 % and 54.6 % per increases (at 15 min intervals) of 5 calls/100 people, 3 text/100 people, and 40 connections/100 people, respectively, detecting small differences across cities. Another less recent study conducted in Florence, Italy from 2005 to 2009 reported that the average use of a cellphone while driving was 4.5 % (Lorini et al., 2012).

Beyond the aforementioned aspects, it is necessary to investigate drivers' behavior and try to understand which factors induce these distracting practices. Different research carried out on the subject have explored the frequency of the mobile phone usage while driving (Walsh and White, 2006) or the psychosocial factors associated with mobile phone use while driving (Hill et al., 2019), although didn't analyse at the same time the behaviors relating them to knowledge and attitudes.

2.2. Knowledge, attitudes and behaviors

The literature research demonstrated that behaviors are the results of knowledge, attitudes, or their interaction. There are several approaches to the study of behaviors, one being the Theory of Planned Behavior (TPB), a theory that emphasizes on the connection and interrelation between beliefs and behavior of an individual. Many studies in different fields have used TPB, especially the ones focusing on the relationships between beliefs, attitudes, behavioral intentions and behaviors. Nevertheless, there have been instances of fellow researchers accusing TPB of being based on cognitive processing and have accordingly criticized this theory due to this reason (Ajzen, 1991). More recently, scholars have criticized the theory for not taking in account a person's own needs in relation to certain actions: those needs, in fact, would affect behavior regardless of the natural attitudes expressed by that same individual (Sniehotta et al., 2014). The KAP Survey Model (Knowledge, Attitudes and Pratices, 2011), on the other hand, can be used to reveal the fundamental traits of knowledge, attitude and behavior of a person, while also commenting on that person's ideas regarding the matter. The aim, when applying the KAP Survey Model, is to measure a phenomenon through the use of both questionnaire surveys, the lead collecting quantitative data methodology, and statistical processing of the aforementioned collected information. The main advantage of a KAP survey is to allow, in a single survey, the collection of large amounts of data, to be later subjected to statistical analysis (The KAP Survey Model, 2011). Several studies indeed - not linked to the mobile phone usage while driving - analyse practices as a function of knowledge and attitudes (The KAP Survey Model, 2011). UNICEF, for example, is conducting a knowledge, attitude, and practice survey on COVID-19 (UNICEF Knowledge, Attitude and Practice Survey (Round 2) on COVID-19 response 2020). De Pretto et al. (2015), in a study conducted in Malaysia on the link between atmospheric haze pollution and outdoor sports, show that higher levels of knowledge and concerned attitudes translate into a greater likelihood of engaging in protective practices. Another recent study about smoking knowledge, attitude and practice in Dubai concludes that the majority of never and ex-smokers had good knowledge level and positive attitude toward anti-smoking statements (Alraeesi et al., 2020). Moreover, the simultaneous analysis of knowledge, attitudes and practices was also carried out in two of our previous studies. The first - performed in healthcare personnel about hand decontamination - shows that the positive attitude was significantly higher among older and female personnel and in those with a higher level of knowledge (Nobile et al., 2002). Another of our studies demonstrates that genetically modified foods (GMF) consumption in Italian students depends on the knowledge of the impact of GMF on health and the environment (Montuori et al., 2012).

Hassen et al. (2011) conducted a quantitative cross-sectional study with a sample size of 350 drivers (75 taxi, 103, Baja and 172 private owned car), but the knowledge refers only to the meaning of 10 road signs; moreover, another key limitation of the study was that majority were males (96.9 %). Although Adeola et al. (2016) analysed at the same time knowledge, attitudes and behaviors in a sample of 1238 teenagers, the knowledge referred only to the effects of an educational program carried out before and after the survey. Nevin et al. (2017) analyse simultaneously knowledge, attitudes and behaviors on the use of the mobile phone while driving, but the survey refers exclusively to police officers and a very limited cohort (twenty-six participants).

Therefore, following the increase of mobile phone use while driving and consequent road fatalities, it's fundamental to investigate knowledge and attitudes and their interactions to behaviors in order to develop health education and community-based interventions aimed at developing knowledge and positively changing attitudes.

3. Material and methods

3.1. Participants and procedure

A cross-sectional, survey-based study was employed. From the beginning of June 2019 until the end of January 2020, we surveyed adults in the entirety of the metropolitan city of Naples, Italy, through a questionnaire (available upon request from the corresponding author). The sampling framework for inclusion in the study was that participants had a driver's license, a smartphone, and resided in the metropolitan area of Naples. Participants were recruited from a snowballing of the researchers' family and friends. Snowball sampling was used to include participants in a wider population to increase the representativeness of the sample. The questionnaires were distributed directly to potential respondents in the chosen sampling framework. At the time of filling in the questionnaire it was explained verbally to each participant the aim of the study and that the data collected would respect privacy and anonymity, and no personally identifiable information would be collected. The aforementioned questionnaire consists in basic information about the participant (age, gender, type of driven vehicle, education level, profession, years of driving license and smoke) and three pools of queries focusing on knowledge, attitudes and behaviors concerning the habit and frequency of mobile phones use while driving, for a total of 40 questions. The inclusion or exclusion of additional items in the queries focused on knowledge, attitudes and behaviors was carried out as

recommended by the KAP Model (2011). The steps to develop the KAP model were briefly: i) Constructing the survey protocol; ii) Preparing the survey; iii) Course of the KAP survey in the field and iv) Data analysis and presentation of the survey report. To develop the questionnaire, research questions based on the "Objectives of the study" were first carried out (to develop the research questions, according to KAP Survey Model, 2011, the knowledge was considered as a set of understandings, knowledge and "science" while Attitude as a way of being, a position). After, the research questions were reduced in number by removing those questions that require unnecessary information. When the above step is also done, the difficult questions have been changed/removed (closed questions have been used because one of the most important things that will increase the relevance of the questions is that the questions must be closed questions). Knowledge and attitudes were assessed on a three-point Likert scale with options for "agree", "uncertain", and "disagree", while inquiries regarding behavior were in a four-answer format of "never", "sometimes", "often", and "always". A pilot study was also carried out to test the questionnaire and to verify the reliability of questions. Finally, all the collected questionnaires were digitalized submitting the codified answers in an Excel worksheet (MS Office).

3.2. Statistical analysis

Data reported by the study were analysed using IBM SPSS (vers. 22) statistical software program. The analysis was carried out in two stages. In the first stage, a descriptive statistic was used to summarize the basic information of the statistical units; in the second stage was conducted a Multiple Linear Regression Analysis (MLRA) that is a statistical technique that uses several explanatory (independent) variables to predict the outcome of a response (dependent) variable. The goal of MLRA is to model the linear relationship between the independent variables and dependent variable.

The main results from a MLRA contains the statistical significance of the regression model (p-value < 0.05), the estimation and the statistical significance of the beta coefficients (p-value < 0.05) and the coefficient of determination (R-squared and adjusted R-squared) that is used to measure how much of the variation in outcome can be explained by the variation in the independent variables. Three MLRA were developed including those variables that were potentially associated with the following outcomes of interest:

1) Knowledge about the use of mobile phones while driving (Model 1).
2) Attitudes toward the use of mobile phones while driving a car or a motorcycle (Model 2).
3) Actual Behavior regarding mobile phone use while driving (Model 3).

The dependent variables (Knowledge, Attitudes and Behaviors) had been obtained by adding the scores obtained in the corresponding questions (questions with inverse answers have been coded inversely). The independent variables were included in all models: sex (1 = male, 2 = female); age, in years; education level (1 = primary school, 2 = middle school, 3 = high school, 4 = university degree); number of years of driving license (1= some months, 2= 1−2 years, 3 = 2–4 years, 4 = + 5 years); type of driven vehicle (1 = car, 2 = motorcycle, 3 = car and motorcycle), smoke (1 = smoker, 2 = no smoker and ex-smoker). In Model 2 we added Knowledge to the independent variables and in Model 3 we added Knowledge and Attitudes to the independent variables. In the analysis we considered Attitudes and Knowledge as indexes rather than a scale, it means that each observed variable (A1, …, A12 and K1, …, K12) is assumed to cause the latent variables associated (Attitude and Knowledge). In other terms the relationship between observed variables and latent variables are formative. Therefore inter-observed variables correlations is not required. On the contrary, the relationship between the observed variables (B1, …, B15) and latent variable Behavior could be considered reflective (Cronbach's alpha = 0825). All statistical tests were two-tailed, and results were considered to be statistically significant if the p-values were less than or equal to 0.05.

4. Results

Out of the 826 partecipants, 774 anonymous self-report questionnaires were returned resulting in a response rate of 93.7 %. Table 1 shows the characteristics of the study population: the mean age of the study population is 39.27 years, in 18–90 age range (SD 12.25); most of them are high school graduate or have a post graduate degree, especially

Table 1
Study population characteristics and scores of Knowledge, Attitudes and Behavior.

			Mean		
Study population	N	Percentage	Knowledge	Attitudes	Behaviours
Sex (774)					
Male	354	45.74	27.01	29.09	43.90
Female	420	54.26	26.66	29.41	43.93
Age					
< 30	219	28.29	26.35	29.29	44.36
31 - 35	133	17.18	27.04	28.57	44.39
36 - 40	90	11.63	26.78	29.14	44.08
41 - 45	87	11.24	27.44	29.78	42.78
46 - 50	111	14.34	27.18	29.62	43.20
>51	134	17.31	26.71	29.35	43.94
Vehicle driven					
Car	418	54.01	26.78	29.45	43.77
Motorcycle	142	18.35	26.85	29.29	43.86
Car and Motorcycle	214	27.65	26.89	28.89	44.22
Education					
Primary school	19	2.45	28.74	28.78	42.48
Middle school	55	7.11	25.62	28.96	45.42
High school	378	48.84	26.98	29.48	43.54
University Degree	322	41.60	26.72	29.08	44.20
Profession					
Lawyer	24	3.10	27.25	29.50	43.25
Architect	18	2.33	26.33	29.33	44.34
Engineer	30	3.88	27.80	30.04	42.16
Medicine Doctor	192	24.81	26.53	28.44	45.03
Employee	72	9.30	26.00	27.92	46.08
Business Consultant	18	2.33	25.00	28.67	46.33
Teacher	84	10.85	27.21	30.79	42.00
Dealer	24	3.10	27.50	28.00	44.50
Business owner	18	2.33	29.00	27.67	43.33
Worker	42	5.43	27.86	30.71	41.43
Student	66	8.53	25.64	30.45	43.91
Others	186	24.03	27.16	29.35	43.49
Years of driving license					
Some months	18	2.33	27.67	30.00	42.33
1−2 Years	30	3.88	24.40	31.40	44.20
3−4 Years	37	4.78	25.14	28.54	46.32
>5 Years	689	89.02	27.00	29.19	43.81
Smoke					
Smoker	292	37.73	27.00	29.26	43.74
Ex-smoker	124	16.02	26.82	29.48	43.70
Non-smoker	358	46.25	26.69	29.19	44.12

teachers and physicians. The vast majority (89 %) has been driving for more than 5 years and 54 % of the sample drives a car; only the 27.6 % of the interviewed drives both a car and a motorcycle.

Respondents' knowledge about mobile phone use while driving is presented in Table 2. More than 75 % of the sample population thinks that using a mobile phone while driving is one of the main causes of road accidents and is aware that using a hand-free device or headset reduces the risk of road accidents but 28 % of them is unaware that this practice is forbidden by the law and involves a fine; moreover, 51 % of the sample population knows that a driver's reaction times while using an electronic device are extended by 50 %. Analysing the uncertain category data, it emerges that 52.7 % of the sample is not aware of highway traffic accidents statistics; 49 % is uncertain about the claim regarding that using a mobile phone while driving causes a drop in attention level similar to having a blood alcohol level equal to 0,8 g/l. Interestingly, 30 % of the sample do not know whether the use of hands-free devices while driving entails any penalties. Agreement with the correct responses to the questions regarding knowledge about mobile phone use while driving was statistically significant with "years of driving license" (p-value < 0.001) (Model 1 in Table 5).

In Table 3 attitudes toward the use of mobile phone while driving are shown. Most of the participants think that mobile phone usage nowadays is necessary and more than 50 % think that it is necessary for business. According to 83 % of the sample, it is appropriate to use a headset while driving and 47 % of them thinks that earphones prevent the onset of mobile phone use related diseases. Interestingly, more than 50 % of the sample disagrees with the possibility to raise speed limits and does not consider restrictive the actual regulations regarding the use of the phone while driving; 65.8 % of the responders would never ask directions to a passer-by, although only 28.6 % thinks that the navigator is a first choice optional in a car. Of utmost importance, the results of the regression analysis indicated that positive attitudes were significantly higher among drivers with older age (p-value 0.024) and a higher education level (p-value 0.004) and in those with a higher level of knowledge (p-value < 0.001) (Model 2 in Table 5). Strangely, although in Model 2 (Attitudes) higher knowledge was correlated with positive attitudes, a statistical significance was found between drivers with more "years of driving license" and negative attitude (p-value < 0.001), in contrast with Model I (Knowledge) where "years of driving license" was correlated with a higher knowledge (Model 1 and Model 2 in Table 5).

Table 2
Knowledge of respondents toward the use of mobile phone.

N.	Statement *(Variables)*	Agree (%)	Uncertain (%)	Disagree (%)
K1	Mobile phone use while driving is the main cause of road crashes	79.07	17.83	3.10
K2	Speeding is the main cause of road crashes	63.57	29.46	6.98
K3	Mobile phone related accidents are more frequent on highways	24.81	52.71	22.48
K4	Mobile phone related accidents are more frequent on urban roads	64.34	28.68	6.98
K5	Using hands-free devices reduces the risk of road crashes	75.19	18.60	6.20
K6	Using hands-free devices does not entail penalties	65.12	30.23	4.65
K7	Reading a message takes an average of eight seconds	37.98	46.51	15.50
K8	Reading a message while driving at a speed of 50 km/h is like traveling 111 m without watching the road	44.96	48.84	6.20
K9	Drivers using a mobile phone have their reaction time extended by 50 %	51.16	44.19	4.65
K10	Mobile phone use while driving reduces focus as a having a blood alcohol content of 0,8 g/l	40.31	49.61	10.08
K11	Using a mobile phone while driving entails driver license withdrawal	60.47	19.38	20.16
K12	Driving while using a mobile phone entails a fine and driver license points reduction	71.32	18.60	10.08

Table 3
Attitude of respondents toward the use of mobile phone.

N.	Statement *(Variables)*	Agree (%)	Uncertain (%)	Disagree (%)
A1	Mobile phone use is nowadays necessary	71.32	19.38	9.30
A2	Mobile phone use is indispensable for my line of work	56.59	18.60	24.81
A3	Mobile use while in traffic alleviates wait times	33.33	16.28	50.39
A4	Using earphones while driving is appropriate	82.95	6.98	10.08
A5	Using earphones while driving is bothersome	13.95	20.93	65.12
A6	Using earphones prevents mobile phone use related diseases	47.29	32.56	20.16
A7	In order to reach a destination, asking for directions is more effective	16.28	17.38	65.89
A8	As an auto vehicle add-on, a navigator is fundamental	28.68	29.46	41.86
A9	Do you think mobile phones should be switched off while driving?	25.58	15.50	58.91
A10	Do you think mobile phone use while driving should be allowed by law?	10.08	8.53	81.40
A11	Do you think speed limits should be raised?	18.60	13.18	68.22
A12	Do you think mobile phone use regulation while driving is restrictive?	13.95	19.38	66.67

Behaviors of respondents are listed in Table 4: interestingly, 31 % state they never use a mobile phone while driving, while 38 % declare that they usually answer a phone call and only 21 % stop the car in order to answer. Regarding text messages, 24 % of the sample admits to reading them, while only 16 % writes them, of which roughly half aged 30 or less. Only 5 % use a mobile phone in order to check their emails while driving and unsurprisingly only 7 % switch off the phone while driving. Respondents mainly seek information about the risks concerning mobile phone use while driving, but only 30 % keep themselves up to date on laws that regulate its use while driving. It is interesting to note that 3.88 % and 4.65 % of the interviewees answered "always" respectively to the questions "Have you ever been in a crash because you were using a mobile phone while driving?" and "Have you ever been fined for using a mobile phone while driving?". These results are strangely high. Presumably, the reasonableness of these results can be justified that the questionnaire was anonymous or also those who responded with "always" have really been in a crash or been fined every time they used their mobile phone while driving. Moreover, these results are in agreement with the data ISTAT 2019. Indeed, an ISTAT 2019 analysis (Istituto di Statistica Nazionale Italiano) reports: "in 2019 the fines in Italy for violations of the Highway Code are 0.21 % for alcohol, 0.03 % for drugs, 0.17 % for the mobile phone.". The results of the regression analysis indicated that positive behavior were significantly higher among drivers with older age (p-value < 0.001), no smoker (p-value 0.001) and, notable, positive attitudes (p-value < 0.001) (Model 3 in Table 5). Fig. 1 shows the Scatter Plot for variables "Knowledge", "Attitude" and "Behavior" related to the variable "Age". As can be seen from Fig. 1, it is not possible to detect any effect of "Age" for the variables "Knowledge" and "Attitude" while there is a direct linear relationship between "Age" and "Behaviour", in particular older people have better behavior. A statistical significance was found between negative behaviors and drivers with more "years of driving license" (p-value 0.003) or a higher education level (p-value < 0.001). No correlation was encountered between positive behavior and "Sex" (p-value 0.086), "Vehicle driver" (p-

Table 4
Behavior of respondents.

N.	Questions	Always (%)	Often (%)	Sometimes (%)	Never (%)
B1	Do you ever use a mobile phone while driving?	14.73	7.75	46.51	31.01
B2	Do you use a mobile phone exclusively for work while driving?	2.33	7.75	38.76	51.16
B3	Do you ever answer phone calls while driving?	24.03	13.95	37.21	24.81
B4	Do you ever start phone calls while driving?	21.71	12.40	29.46	36.43
B5	Do you ever read text messages while driving?	14.73	9.60	24.81	51.16
B6	Do you ever send text messages while driving?	10.85	5.43	17.05	66.67
B7	Do you ever read your emails while driving?	3.10	2.33	12.40	82.17
B8	Do you turn off your mobile phone while driving?	4.65	2.33	9.30	83.72
B9	If you receive a phone call or a text while driving, do you stop to answer?	21.71	13.18	31.01	34.11
B10	Do you use earphones while driving?	31.01	20.93	21.71	26.36
B11	Have you ever smoked while driving?	19.38	9.30	17.05	54.26
B12	Have you ever been in a crash because you were using a mobile phone while driving?	3.88	1.55	4.65	89.92
B13	Have you ever been fined for using a mobile phone while driving?	4.65	2.33	3.88	89.15
B14	Do you ever seek information about the risks of mobile phone use while driving?	40.31	13.18	24.81	21.71
B15	Do you keep yourself up to date on laws that regulate mobile phone usage while driving?	36.43	14.73	27.91	20.93

Table 5
Results of the linear multiple regression.

	Coefficients not standardized		Coefficients standardized		
	b	Standard Error	Beta	t	p-value
Model I – Dependent variable: Knowledge					
Age	.003	.008	.014	.334	.738
Sex	−.317	.171	−.068	−1.857	.064
Vehicle Driven	.032	.099	.012	.327	.743
Education	.164	.127	−.049	−1.290	.197
Years of Driving License	.570	.149	.149	3.836	.000
Smoke	−.140	.091	−.055	−1.541	.124
Model II – Dependent variable: Attitudes					
Age	.011	.009	.047	1.161	.024
Sex	.278	.209	.048	1.329	.184
Vehicle Driven	−.232	.121	−.070	−1.912	.056
Education	.112	.155	.028	.723	.004
Years of Driving License	−.688	.183	−.146	−3.749	.000
Smoke	−.017	.112	−.005	−.155	.877
Knowledge	.199	.044	.161	4.500	.000
Model III - Dependent variable: Behavior					
Age	.216	.024	.329	9.095	.000
Sex	.909	.528	.056	1.720	.086
Vehicle Driven	−.150	.306	−.016	−.489	.625
Education	−1.251	.391	−.110	−3.199	.001
Years of Driving License	−1.405	.466	−.107	−3.012	.003
Smoke	.905	.281	.103	3.220	.001
Knowledge	−.214	.113	−.062	−1.895	.058
Attitudes	.705	.091	.252	7.741	.000

value 0.625) and overall “Knowledge” (Model 3 in Table 5).

5. Discussion

This survey reports detailed information on knowledge, attitudes, and behavior regarding the use of mobile phones while driving in a metropolitan area. Our findings show that there is no correlation between mobile phone use while driving and sex of the interviewed, in agreement with several studies (Tontodonato and Drinkard, 2020; Townsend, 2006; Young and Lenné, 2010). The previous research is not homogeneous on the role of sex and cell phone use while driving: some studies found no correlation while others did find it. Furthermore, there are several conflicting results among the studies that found a correlation between sex and cell phone use while driving because some of them found a majority of males while others found the opposite. Adolescent males, for example, engaged in high-risk scenarios of cell phone use while driving (McDonald et al., 2019) and Carney et al. (2015) found that adolescent females engaged in more cell phone use while driving than males. Goodwin et al. (2012) also found that adolescent females were more likely to engage in electronic device use. In the case of text messaging while driving, a recent study defines male drivers as more likely to text rather than female ones (Hill et al., 2019). In a survey conducted in Colombia by Oviedo-Trespalacios and Scott-Parker (2018), it was found that young male drivers reported major engagement in riskier behaviors while behind the wheel than young female drivers. In recent years, gender differences have reduced in every area, from professional to private, witnessing a surge of new behavioural habits in women that until a few years ago were mainly attributable to men. This therefore reflects in the activities that men and women can carry out in various sectors, such as the use of mobile phones while driving. Considering that our sample is consistently distributed by sex (354 male and 420 female), in addition to the geographical area and the time when the studies were conducted, this could explain our results. Consequently, we can conclude that there is no correlation between mobile phone use while driving and sex in Southern Italy, similarly to a recent study conducted by Valent et al. (2020) in Northern Italy. Although not correlated with knowledge, attitudes and behaviors, the “Vehicle Driven” variable was reported because in Italy cars and motorcycles represent 72 % and 13 % of the vehicle fleet respectively (International Transport Forum, 2019c), contrary other parts of the world where motorcyclists or three-wheelers are the most numerous (WHO Global Status Report on Road Safety, 2018).

In light of the elements that may affect the use of mobile phones while driving and its consequential findings so far, focusing on the behaviors adopted by each of the respondents, it is interesting to note how the total reported of those who are actually using mobile phones while driving is equal to 22 %, a smaller percentage compared to the findings from other international studies: Ukraine (34 %; Hill et al., 2019), Spain (60 %; Gras et al., 2007) and Australia (43 %; White et al., 2010). To the question regarding the frequency of mobile phone usage while driving, 31 % has answered “never”; this percentage is significantly higher if compared to 2 % of the interviewed by an American study stating that they never texted while driving under any circumstances (Atchley et al., 2011), while being closer to the 39.9 % found by Gras et al. (2007). Our data is also consistent with previous observational studies performed in

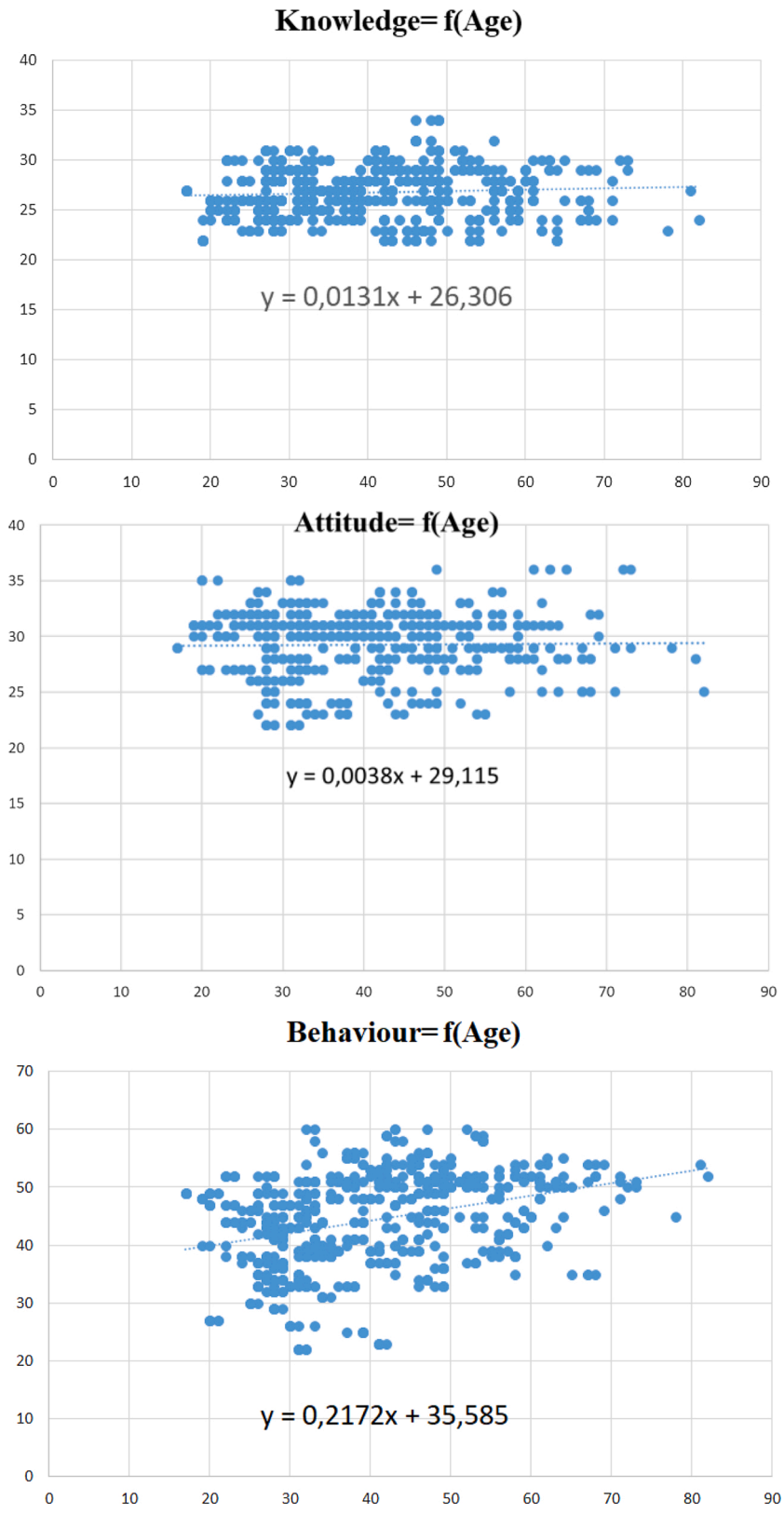

Fig. 1. Scatter plot for variables "Knowledge", "Attitude" and "Behaviour" related to the variable "Age".

the United States, where 31.4 % of drivers answers the phone while 16.6 % sends text messages or makes phone calls (Huisingh et al., 2015); 38 % of our respondents usually answer the phone, while 16 % admit to texting while driving. The data from a sample of Spanish workers, on the other hand, shows 26.9 % texting while driving and 57.9 % making a call. In every case, the least frequent behavior while driving is sending a text message, which is confirmed by other international studies (Hill et al., 2019; Nemme and White, 2010); this suggests that drivers consider texting as leading to a higher level of distraction, which is consistent with previous research on mobile phone distracted driving

(Tison et al., 2011), but it is divergent from another study in which 47 % of adults and more than 50 % of teens admit to text messaging while driving (Llerena et al., 2015).

Another interesting data worth highlighting is that amongst drivers reporting mobile phone use while driving, only 3.88 % had been involved in a road accident while using the phone, a much lower percentage compared to other studies: this is more in line with the 6 % reported by Tison et al. (2011), of which 4 % engaged in a telephone conversation, while greatly diverging from the data about mobile phone distraction that in the United States alone explains about 25 % of road crashes (Mirman et al., 2017; Pless and Pless, 2014).

A statistically significance was found in the correlation between smoking and driving behaviors (Table 5), concluding that smokers have greater tendencies to use a mobile phone while driving. To the best of our knowledge, no other study has found any correlation between these two variables, but this behavior could be in part explained by the fact that those with a previously developed addiction trait (such as smoking addiction), might be likely to be more susceptible to other kinds of addiction such as mobile phone addiction and, consequently, end up being more at risk of engaging in unlawful behaviors. Indeed, Atchley et al. reports that the perceived risk of smoking declines in people that choose to smoke and the riskiness of reckless driving, drinking, and smoking declines in adolescents that engage in those risky behaviors (Atchley et al., 2011). This subject would be an interesting one to investigate with further studies and in order to figure out the reasons that contribute to the establishment of this connection.

Considering the elements of the sample, age distribution ranges from 18 to 90 years, with an average of 39, which made it possible to investigate the correlation between age and the three main focus of this research: knowledge, attitudes and behavior (Table 5, Model I, II and III). A correlation was observed between age respectively with attitude and behavior, and it was observed that it was a positive one: in fact, the older the responders, the better the attitudes and behavior, which is in agreement with a previous study in which was demonstrated that it was in fact young drivers who are more frequently involved in risky behaviors and traffic accidents compared to other age groups (Young et al., 2010). Other studies also confirm this data, suggesting that increasing age was associated with lower mobile phone use (Arvin et al., 2017; Truong et al., 2016 and 2019): this is expected since younger generations arguably are more familiar with mobile devices (Arvin et al., 2017; Atchley et al., 2011). Conversely, this data is not in line with studies in which no significant difference among the different ages has been found (Hassen et al., 2011; Hill et al., 2019; Oviedo-Trespalacios et al., 2017). Another study, by Hallet et al. (2011), observed a correlation between attitude and age, related to the specific question of whether mobile phone use should be allowed while driving and found that with increasing age, that consideration saw a reduction of consents; this question is also present in our study where a high disagreement was found, with 81 % of the sample believing that such use should not be allowed.

The education level is statistically correlated with attitude and behavior while surprisingly not with knowledge, showing how those with greater education have positive attitudes while having an equally incorrect behavior (Table 5, Model I, II and III). Even though it commonly would be expected from those with a higher education degree to have a lower tendency to use a mobile phone while driving due to the fact that they should have a greater awareness of the risks and importance of the rules, this data appears in agreement with other studies such as those by Luis Márquez et al. (2015) and Donkor et al. (2018). Nevertheless, these same findings are contradicted by a study showing instead how drivers with secondary/high school education had a higher chance of risky driving behavior compared to drivers with a university/college degree (Hassen et al., 2011). Regarding this aspect of the study, our findings also agree with previous research that show that the higher the education level, the more likely the interviewed find using a phone while driving necessary, despite the awareness of the danger it entails (Márquez et al., 2015). Generally speaking, the explanation to this phenomenon might be found in the fact that they value their time more than individuals with lesser education (Asensio and Matas, 2008). This kind of belief suggests that the perception of the benefits of using a cell-phone while driving outweigh the risk of this behavior, as previously observed (White et al., 2004). Despite their knowledge on the matter, our interviewed widely agree that mobile phone use while driving is almost a necessity nowadays: according to our collected data, more than 50 % of responders think that mobile phones use while driving is necessary for business, but only a low percentage of them use it solely for work purposes (10 %), unlike other studies in which it was found that 75 % of phone calls were work-related (Musicant et al., 2015) and in which it was found that drivers tend to use mobile phones more for business than for personal reasons (Eost and Flyte, 1998; Walsh et al., 2008).

It is interesting, however, noticing how amongst all the variables considered in the models analysed, the variable years of driving license and, therefore, the experience acquired by the driver, has shown a correlation with all the three main variables under study: specifically, driving experience increases knowledge, which is likely linked to the fact that the more you practice, the more you acquire confidence and knowledge regarding driving in general, together with the rules regulating this activity (Table 5, Model I, II and III). Analysing the behavior adopted by drivers, it was also observed that the more the years of driving experience, the more the tendency to behave inappropriately when driving the phone; according to Mike et al. (2009) and Donkor et al. (2018), in fact, those with more experience tend to adopt risky driving. These findings do not agree with those of other scientific publications in which it was found that those who had more years of experience used the cell phone less and also considered it a greater risk factor (McEvoy et al., 2007; Oviedo-Trespalacios et al., 2017; Sullman and Baas, 2004); Hassen et al. (2011), on the other hand, reported that their study did not find a statistically significant correlation between the two parameters.

According to the resulting of our study, the sample population show a high perception of risk of accidents due to cell phone use while driving, which is demonstrated by the fact that the vast majority of the sample (79.07 %) regards it as the main cause of accidents; this is consistent with results from a recent study by Al-Jasser et al. (2018), while being at odds with older findings (White et al., 2004; Wogalter and Mayhorn, 2005). This is indeed confirmed by the MLRA (Table 5, Model III) which shows how the knowledge in the sample does not influence and is not related to the behavior held, as it has also been shown in another studies (Hassen et al., 2011), where it was noticed how knowledge does not correlate to the dangers of using a mobile phone while driving. On the contrary, attitudes are strongly correlated to knowledge and behavior, meaning that good attitudes bring forth positive behavior, as also demonstrated in a study by Walsh et al. (2008) where it is stated that attitude is the most indicative parameter of the willingness to use a mobile phone while driving; Hassen et al. (2011) also states that risky driving behaviors were found to be due to negative attitudes rather than to poor knowledge. Finally, Zhou et al. (2016) confirmed the positive role of attitudes and safety beliefs in the prediction of mobile phone distracted driving behavior. Conversely, Nguyen-Phuoc et al. (2020) state that in the case of driving a car, attitudes have little influence on the use of mobile phones while driving. Also Gauld et al., in contrast with their similar study carried out in 2014, found that attitude was not a significant predictor of intent to monitor/read interactive social technology on smartphones while driving (Gauld et al., 2014 and 2017). This is even more evident in the case of studies in which despite the good attitudes in this regard and the awareness of the risks, the behavior of the interviewed was not correct (Baig et al., 2018; Harrison, 2011; Ismeik et al., 2015). Our findings, however, show a direct correlation respectively between knowledge and its dependent variable attitude and between attitude and its dependent variable behaviour, although there seems to be no direct correlation whatsoever between knowledge and

behavior (Table 5), which is an interesting fact due to their indirect relationship via the variable attitude. An explanation to this phenomenon might be that, more than knowledge, it's the actual upbringing and socio-cultural background that remarkedly influences upholding of the law and its consequent behavior when it comes to the use of mobile phone while driving. This might be an indicator of how to more effectively set up an educational program: instead of bolstering specific knowledge regarding mobile phone and its use behind the wheel during adult life, when attitudes are already established, teaching future drivers regarding the importance of rules and following the law could be a more efficient method to define attitudes, which in turn will influence the future driver to behave in a more law-abiding fashion. Hence, an interpretation of the results of this survey is the necessity to act on knowledge in early age in order to influence attitudes and consequently future behaviors; however, since it is not possible to modify attitudes during adult life, it would be more appropriate to act directly on behaviors through more restrictive laws and innovative technologies in order to identify the use of mobile phones while driving.

5.1. Limitations

The study was limited by the survey capturing only self-reported behaviors, so that the respondents may have felt pressure to provide socially acceptable answers; however, social desirability bias may have been somewhat allayed since the participants were assured of anonymity and confidentiality. The survey also doesn't include some activities potentially performed with mobile phones by the younger drivers, such as taking selfies or playing games (Postelnicu et al., 2016). Finally, the average age of the studied population is not very high, which can influence the study, since many elders may not own a mobile phone or be able to use all its functions - such as reading email or texting – and as such these additional data might have changed our results.

5.2. Conclusion

The analysed population appears to have good knowledge on the subject together with positive attitudes, and there is a general agreement amongst them that using a mobile phone is considered unacceptable, even though the behaviors employed are knowingly inappropriate according to the Italian laws. Through our research we discovered that the relatively elevated education level of the sample and a greater driving experience (measured in years of driving license) were proven as inversely associated with the behaviors examined, which means that - while the experimental results of this survey can be used for the creation of targeted educational programs, community-based interventions and legal regulations - it might be fundamental to act more directly in order to improve people's behavior while driving. All these measures alone, in fact, may not be sufficient to reduce a phenomenon so deeply rooted in the population. This constantly growing phenomenon closely follows the technological evolution of our society and it's an important indicator of how indispensable the mobile phone is in our daily life, which in return is itself dependent on the increase in the functions that can be performed through it. Considering that - as previously stated - this phenomenon has a strong impact on the increase in road accidents, on the economy and on public health, another solution might be to promote more restrictive regulations establishing a greater number of controls, using not only qualified personnel, but also innovative technologies possibly suitable for detecting real-time hands-on use of the mobile phone while driving.

Author contributions statement

P.M., R.N. and M.T. designed the research; P.M., E.D., A.S., D.D.R., R. N. and A.B. organized and carried out samplings and data collection; P. S., P.M., R.N. and E.D. analyzed the data and performed the statistical analysis. All authors structured the questionnaire, discussed the results and co-written the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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