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ORIGINAL ARTICLE

Do beliefs differ between frequent and infrequent hand-held and hands-free phone users while driving? A Polish study

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Abstract

Aim Although it is currently legal in Poland to use a hands-free mobile phone while driving, research suggests that it is not significantly safer than using a hand-held mobile phone. The present study used the theory of planned behaviour (TPB) to examine the relationships that three types of beliefs (behavioural, normative and control beliefs) have with the frequency of drivers' hands-free and hand-held mobile phone use.

Subjects and methods The sample comprised 298 Polish drivers (35% females) aged between 18 and 40 years old (mean age: 21.05 years, standard deviation = 2.38).

Results Two multivariate analyses of variance (MANOVAs) were conducted to investigate the differences between the two groups (hand-held and hands-free) of frequent and infrequent mobile phone users, with regard to their behavioural, normative and control beliefs. Significant differences were found in all of the control beliefs for both hand-held and hands-free mobile phone users. Similar normative differences were identified for both hands-free and hand-held mobile phone use, but while three behavioural beliefs differed significantly for hands-free use, no behavioural beliefs were significant for hand-held mobile phone use. Finally, composite measures of the behavioural and control beliefs were predictive of being a frequent hand-held mobile phone user, but none of the three beliefs were predictive of being a frequent hands-free user.

Conclusions These results demonstrate potential directions for behavioural change aimed at reducing or preventing the use of mobile phones while driving.

Keywords Beliefs · Driving · Cell phone · Poland · Theory of planned behaviour · Mobile phone

Introduction

A large number of studies have been conducted in different parts of the world examining distracted driving caused by mobile phone use (Backer-Grøndahl and Sagberg 2011; Klauer et al. 2014; Raman et al. 2014; Rozario et al. 2010; White et al. 2004) and there is now extensive evidence linking mobile phone use with an increased collision risk (e.g. Bener et al. 2010). For example, Bener et al. (2010) found that a high proportion of crashes (73.2%) were related to using a mobile phone while driving. Therefore, it is important that research identifies the characteristics of those most likely to use a mobile phone while driving, as well as the beliefs that underlie mobile phone-related behaviours. However, as in many other areas of psychology, the majority of the research examining the prevalence of using mobile phones while driving, as well as the beliefs underlying this behaviour, are largely limited to the United States, the UK and Australia. To the best of our knowledge, this is the first study in Poland to investigate mobile phone use while driving using the theory of planned behaviour (TPB).

Caird and colleagues meta-analysed a large body of experimental research on the effects of talking on a hand-held mobile phone (Caird et al. 2008) and text messaging (Caird et al. 2014) on drivers' behaviour, finding that both have significant detrimental effects. Evidence of the relationship between mobile phone use and driving behaviour is not restricted to laboratory studies—which, one may argue, lack ecological validity—but also comes from studies exploring the "real"

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world. As early as 1997, Redelmeier and Tibshirani published a case-crossover study showing that talking on a mobile phone increased the risk of crashing by a factor of more than four. However, they did not find a significant difference in the level of risk between hands-free and hand-held modes. Beyond epidemiological research, naturalistic research has provided estimates of increased crash and near-crash risks when using a mobile phone. More specifically, dialling and holding a conversation on a hand-held device were found to increase these risks by a factor of 2.79 and 1.29, respectively (Klauer et al. 2006). While the latter estimate did not reach statistical significance, these figures are both relatively similar to the total proportion of road accidents accounted for by both of these activities: 3.58% for dialling and 3.56% for holding a conversation. A more recent study on novice drivers reported that the estimated increased risks among novice drivers were 8.32 for dialling, 0.61 for talking and 3.87 for texting or using the Internet (Klauer et al. 2014). This is particularly concerning as research has found that young people are more likely to use a mobile phone while driving (Tucker et al. 2015).

In a recent observational study, the rate of mobile phone use among drivers of passenger vehicles in Poland was found to be 4.1% (Bany et al. 2014). The proportion of individuals using mobile phones while driving was the highest among people aged 18–24 years old (4.4%), whereas the oldest drivers (aged above 60 years old) engaged in this behaviour the least often (1.8%). In addition, the frequency of using a mobile phone while driving was higher among female drivers (4.8%) than among males (3.9%). Using a hand-held mobile phone while driving is illegal in Poland and, if caught, drivers can be punished with a fine and penalty points on their licence. Only calling using Bluetooth or a hands-free device is permitted. Poland is a country where the number of road fatalities is very high. In 2015, according to the police statistics, there were a total of 32,967 road crashes (Symon 2016). Although the number of road fatalities is decreasing (from 5534 deaths in 2001 to 3202 in 2014, according to the World Bank 2015), there is still much to be done in road safety to bring Poland in line with other European Union (EU) countries. One approach to improve these figures has been using social media campaigns to educate people about the risks associated with using a mobile phone while driving (the campaign title, *Nie przy(dzwoń) za kierownicą*, literally translates as *Do not crash behind the wheel*, but its pun on the Polish words for "phone" and "hit" and would be more accurately translated to mean *Do not call for a crash*).

Apart from the increased crash risk, using a hand-held mobile phone also entails the risk of being fined by the police, since it is an offence in Poland. The way for Polish drivers to avoid this risk is to use their mobile phone in hands-free mode, although epidemiological studies (Backer-Grøndahl and Sagberg 2011; Redelmeier and Tibshirani 1997) and a meta-analysis (Caird et al. 2008) suggest that this may not ameliorate the detrimental effects of mobile phone-related distraction or crash risk. Nonetheless, it appears that drivers tend to perceive talking on a hand-held phone as significantly riskier than talking on a hands-free phone (e.g. Prat et al. 2015; White et al. 2004).

The effects of using a mobile phone on drivers' behaviour behind the wheel, as well as the individual characteristics associated with these behaviours, are issues of undeniable interest and practical importance. Studying the psychological variables underlying this risky behaviour is an important first step in designing informed countermeasures and programmes. In a handful of studies (e.g. Bazargan-Hejazi et al. 2017; Nemme and White 2010; Prat et al. 2015; Rozario et al. 2010; Walsh et al. 2008; White et al. 2010), scholars have used the TPB approach (Ajzen 1991) as a framework by which to investigate the psychological factors underlying mobile phone use while driving. The TPB postulates that intentions are the basic determinant of volitional behaviours, along with perceived behavioural control (an individual's perceived capability to perform a particular behaviour). This theory also hypothesises that three constructs underlie the formation of intentions: the attitude towards a particular behaviour (how an individual evaluates it), the subjective norm (an individual's perception of social approval or disapproval of a given behaviour) and the already mentioned perceived behavioural control.

Previous research has evaluated whether TPB constructs were predictive of intentions and actual behaviour for a variety of target behaviours that fall into the general category of using a mobile phone while driving, including: general mobile phone use (Walsh et al. 2008), calling and texting (separately; Walsh et al. 2008), reading and sending text messages (separately assessed; Nemme and White 2010; Prat et al. 2015), initiating behaviours (making calls and sending text messages) and responding behaviours (answering calls and reading text messages) (Waddell and Wiener 2014), as well as concealed texting behaviour (Gauld et al. 2014a, b). Leaving aside the diversity in the operationalisation of the dependent variable, the two studies that assessed behaviour prospectively revealed intention but not perceived behavioural control to be predictive of texting while driving (Gauld et al. 2014b; Nemme and White 2010). The results regarding the relationship between intentions and its determinants, as posited by the TPB, are more heterogeneous, although partial support for this relationship has been found for some constructs.

The majority of studies using this theoretical framework have analysed the role of these constructs (and, in some cases, additional constructs) in explaining a range of behaviours and intentions related to mobile phone use while driving. However, according to the TPB, there are three types of beliefs that are the antecedents of the three predictors of intentions. Specifically, behavioural, normative and control beliefs are considered to be the underlying determinants of attitudes, subjective norms and perceived behavioural control.

Behavioural beliefs are those that relate to a particular behaviour and its outcomes. Normative beliefs are those that refer to the probability of experiencing the approval or disapproval from different individuals or groups when engaging in a particular behaviour. Finally, control beliefs are those that refer to the presence of factors that may facilitate or deter a given behaviour. Two Australian studies (Gauld et al. 2014a; White et al. 2010) and one in the UK (Sullman et al. 2018) have investigated the issue of mobile phone use while driving, at the level of beliefs. However, the behaviour under investigation was not operationalised in the same way in all of these studies. As stated earlier, Gauld et al. (2014b) defined the target behaviour as concealed texting while driving. They assessed a set of beliefs previously elicited from a small focus group and their results revealed differences in behavioural, normative and control beliefs. More specifically, they found significant differences between high and low intenders in terms of beliefs regarding the benefit of sharing information with others, using time effectively and the degree to which driving in free-flowing traffic would prevent them from engaging in that behaviour. Furthermore, an earlier study, conducted in Australia by White et al. (2010), found that frequent and infrequent users of hand-held and hands-free mobile phones differed in most of the behavioural, normative and control beliefs assessed (the beliefs salient for mobile phone use while driving had been identified in a pilot study). Similarly, the authors of the British study (Sullman et al. 2018) used the same instrument and found significant multivariate effects for behavioural and control beliefs among hand-held phone users, but significant multivariate effects were not found among hands-free users. In terms of behavioural beliefs, White et al. (2010) found that frequent hand-held mobile phone users were more likely than infrequent users to think that their mobile phone use would result in using their time effectively and in obtaining important information, and reported a lower risk of being distracted from driving or fined by the police. Conversely, only the first two of these differences were found by Sullman et al. (2018). However, both White et al. (2010) and Sullman et al. (2018) found that frequent hands-free users were more likely, than infrequent hands-free users, to think that they were using their time effectively. Furthermore, differences in normative beliefs between frequent and infrequent hand-held mobile phone users were found for all individuals or groups of people who were considered (friends, family members, partner, work colleagues, other drivers and police) (White et al. 2010). In contrast, Sullman et al. (2018) only found significant differences for beliefs concerning the approval of the individuals' partner. With regard to the differences between frequent and infrequent hands-free mobile phone users, White et al. (2010) found that they differed in normative beliefs related to their friends, relatives, partner and work colleagues, while Sullman et al. (2018) found differences for all these beliefs except for those related to their partner. With respect to control beliefs, compared to infrequent hand-held users, frequent hand-held mobile phone users in the Australian study (White et al. 2010) thought that the following aspects were more likely to prevent them from using a mobile phone while driving: risk of fines, risk of a crash, lack of a hands-free kit and heavy traffic. All of these, as well as police presence, were also more likely to prevent frequent British hand-held phone users (than infrequent users) from using a mobile phone behind the wheel (Sullman et al. 2018). Frequent Australian hands-free phone users also differed from infrequent users in their control beliefs regarding the risk of fines, demanding driving conditions, the risk of a crash, police presence and heavy traffic, with frequent users considering these circumstances more likely to prevent them from using a mobile phone (White et al. 2010). Conversely, for British drivers (Sullman et al. 2018), statistically significant differences were only found for the risk of fines.

In summary, these three types of beliefs appear to be able to discriminate between people who differed in the extent to which they used a mobile phone while driving, and this can obviously be used to help address the issue, although the specific beliefs that differ may not be the same for all groups of drivers. Furthermore, composite scores on behavioural, normative and control beliefs were significant predictors of having frequently used a hand-held mobile phone while driving, and the latter two measures predicted hands-free phone use in White et al. (2010), whereas for British drivers, the control beliefs composite score was the only predictor of hand-held mobile phone use (Sullman et al. 2018).

The present study

The present study set out to investigate the frequency of mobile phone use while driving in Poland and to find out whether Polish drivers who frequently use a mobile phone while diving differ from infrequent mobile phone users on their behavioural, normative and control beliefs. In order to maximise comparability, we decided to use the same questionnaire as the two previous studies on this specific behaviour (White et al. 2010; Sullman et al. 2018).

Method

Procedure

Approval for the present research was obtained from the university's ethics committee and participation was completely voluntary. Participants received no remuneration or points for taking part in the study and it took about 20 min to complete the questionnaire. Two techniques were applied for collecting the data. First, we approached undergraduate

students during a lecture at the University of Technology in Rzeszów, a city in the south of Poland. Second, we passed the questionnaires on to those who had a driving licence via the snowball sampling procedure. Data collection took place using the pencil-and-paper method and the response rate was estimated to be 80%. The research project received approval from the institutional review board of the John Paul II Catholic University of Lublin.

Participants

The sample comprised 298 Polish drivers (105 females and 193 males) aged between 18 and 40 years old (mean age, $M_{age} = 21.05$ years; standard deviation, SD = 2.38). Most of the participants were single (86.8%), 9.2% were dating, 2.4% were married, 1.0% were separated and 0.7% were widowed. As far as the highest educational level is concerned, the majority of the sample (83.1%) had secondary school education and 84% were university students.

Measures

We used the questionnaire designed by White et al. (2010), which was translated into Polish by bilingual people. The back-translation procedure was applied in order to ensure high reliability of the measure. Hands-free device ownership and usage frequency were also assessed, the latter of which was measured using a scale which ranged from 1 = hands-free all the time to 7 = hand-held all the time. In line with Sullman et al. (2018), those who used a phone in hands-free mode to any extent were classified as hands-free users. The frequency at which the participants answered or made calls and sent or read messages were separately assessed using the following response options: more than once a day, daily, once or twice a week, once or twice a month, once or twice in 6 months, once a year and never. As in White et al. (2010), these categories were collapsed into three categories (once a day or more often, less than once or twice per week and never). We assessed behavioural beliefs by asking the participants about the likelihood that their phone use while driving would result in three positive and three negative outcomes. Regarding normative beliefs, the participants were asked to rate the likelihood that significant others (e.g. friends, family members or the police) would approve of their phone use while driving. Lastly, to provide information about their control beliefs, the participants rated the extent to which several factors (e.g. risk of a crash, police presence) would prevent them from using a mobile phone while driving. These were answered on a Likert scale, which ranged from 1 = extremely unlikely to 7 = extremely likely. These were summed and the item scores for each type of beliefs (after reversing the scores for negative behavioural beliefs) were averaged. The values of Cronbach's alpha for these scales were as follows: 0.86 for behavioural beliefs, 0.48 for normative beliefs and 0.90 for control beliefs. These three composite measures were used as independent variables to predict the frequency of mobile phone use in logistic regression analyses.

Results

Mobile phone use while driving

When asked if they owned a hands-free kit, 85.6% of the participants answered "no". Of those who answered "yes", 31% always used it while driving, 21.4% usually used a hands-free kit, 23.8% used a hands-free kit and a hand-held phone equally often, 9.6% usually used a hand-held phone and 14.3% always used a hand-held phone while driving.

Slightly less than one-third of drivers (30.2%) reported answering calls while driving, this being the most common phone-related behaviour performed. Somewhat less common behaviours were making calls and reading text messages, reported by 25.5% and 26.7% of drivers, respectively. Sending text messages was the least common phone-related behaviour performed daily or more often (23.1%).

We found significant differences in the frequency of mobile phone use while driving between hands-free users and those who only used a hand-held phone for making phone calls ($\chi^2(2) = 9.605$, $p = 0.008$). The proportion of hands-free users who reported making calls once a day or more often was higher than that of hand-held phone users (see Table 1), while the contrary was true for those who reported never using a mobile phone to make calls while at the wheel. No significant

Table 1 Percentage of participants using a mobile phone while driving by handset type

	Hands-free	Hand-held
Answering a call	$n = 29$	$n = 233$
Once a day or more often	44.8	28.3
Less than once or twice per week	37.9	45.9
Never	17.2	25.8
Making a call	$n = 34$	$n = 254$
Once a day or more often	50.0	26.1
Less than once or twice per week	35.3	39.9
Never	14.7	34.0
Reading text messages	$n = 35$	$n = 254$
Once a day or more often	40.0	28.3
Less than once or twice per week	40.0	40.9
Never	20.0	30.7
Sending text messages	$n = 34$	$n = 252$
Once a day or more often	35.3	21.4
Less than once or twice per week	32.4	34.5
Never	32.4	44.0

differences were found for answering calls ($\chi^2(2) = 3.447$, $p = 0.178$), sending text messages ($\chi^2(2) = 3.497$, $p = 0.174$) and reading text messages ($\chi^2(2) = 2.610$, $p = 0.271$).

Behavioural, normative and control beliefs

Hands-free mobile phone users

Three separate one-way (frequent user vs. infrequent user) multivariate analyses of variance (MANOVAs, one for each type of belief) were performed for hands-free phone users. Two of the results reached statistical significance: behavioural (Pillai's trace = 0.412, $F(6, 26) = 3.039$, $p = 0.022$) and normative beliefs (Pillai's trace = 0.469, $F(6, 26) = 3.820$, $p = 0.007$), whereas the analysis performed on control beliefs (Pillai's trace = 0.370, $F(6, 24) = 2.345$, $p = 0.063$) did not reach significance at the critical level of 0.05 (Table 2).

The analysis of univariate effects revealed significant differences in three of the six specific behavioural beliefs: infrequent mobile phone users considered themselves more likely to get distracted as a result of phone use, as well as believing that they were more likely to be involved in a crash and to be caught and fined by the police. Likewise, differences were found in three specific normative beliefs among hands-free users, with frequent users believing it to be more likely that their phone use while driving would be approved of by their friends, family and work colleagues. There were significant differences in all the beliefs measured, with infrequent users believing that these factors (risk of fines, demanding driving conditions, risk of a crash, police presence, lack of a hands-free kit and heavy traffic) were more likely to prevent them from using their phone while at the wheel.

In order to examine the impact of beliefs on the frequency of either hands-free or hand-held mobile phone use, we performed logistic regression analyses (see Table 3).

The results of the logistic regression analyses showed that the mix of behavioural, normative and control beliefs reliably distinguished frequent and infrequent users of hands-free mobile phones ($\chi^2 = 13.100$, $p = 0.004$), accounting for 46.8% of the variance in correctly classifying 74.2% of the participants. However, none of the predictors reached statistical

Table 2 Mean values for beliefs according to handset type and frequency of use (daily or more often vs. less than daily)

	Hands-free			Hand-held		
	Frequent	Infrequent	*p*-Value	Frequent	Infrequent	*p*-Value
Behavioural beliefs	$n = 14$	$n = 19$		$n = 70$	$n = 171$	
How likely is it that your using of a mobile phone while driving in the next week will result in the following?						
Using time effectively	3.36	3.11	0.722	3.59	3.06	0.055
Being distracted from driving	4.29	2.68	0.037	3.70	3.22	0.133
Being involved in a crash	4.93	2.63	0.009	3.48	3.22	0.439
Receiving information (e.g. directions, important news)	3.57	4.26	0.245	4.49	4.39	0.708
Receiving assistance in an emergency	5.21	4.74	0.485	4.79	4.88	0.751
Being caught and fined by the police	4.00	1.90	0.006	3.10	2.94	0.612
Normative beliefs	$n = 14$	$n = 19$		$n = 70$	$n = 171$	
How likely is it that the following people or groups of people would approve of you using a mobile phone while driving in the next week?						
Friends	5.01	4.54	0.120	2.95	4.64	0.041
Family members	3.87	2.95	0.003	2.74	5.07	0.006
Partner/boyfriend/girlfriend	4.56	4.02	0.560	3.68	4.71	0.243
Work colleagues	4.77	3.78	0.001	3.16	5.43	0.003
Other drivers	3.79	3.85	0.946	3.37	3.57	0.788
Police	2.29	1.85	0.112	2.47	3.43	0.253
Control beliefs	$n = 14$	$n = 19$		$n = 69$	$n = 173$	
How likely are the following factors to prevent you from using a mobile phone while driving in the next week?						
Risk of fines	3.50	5.89	0.006	4.94	5.98	< 0.001
Demanding driving conditions (e.g. weather, changing lanes)	3.92	6.42	0.002	5.55	6.51	< 0.001
Risk of a crash	3.67	6.42	0.001	5.28	6.47	< 0.001
Police presence	3.75	6.47	0.001	5.72	6.46	0.001
Lack of a hands-free kit	3.58	5.21	0.033	3.62	4.90	< 0.001
Heavy traffic	4.25	6.37	0.003	4.54	5.99	< 0.001

Table 3 Logistic regressions predicting the probability of frequently using a mobile phone while driving by type of use

Analysis	Variable	β	SE	Wald	*p*-Value	Exp(β)	CI	
							Lower	Upper
Hands-free	Behavioural	− 0.440	0.531	0.687	0.407	0.644	0.228	1.822
	Normative	0.590	0.393	2.252	0.133	1.805	0.835	3.901
	Control	− 0.397	0.393	1.022	0.312	0.672	0.312	1.451
Hand-held	Behavioural	0.279	0.122	5.226	0.022	1.322	1.041	1.679
	Normative	0.125	0.070	3.214	0.073	1.133	0.988	1.299
	Control	− 0.646	0.128	25.477	<0.001	0.524	0.408	0.674

significance, probably due to the restricted sample size that reduced the power of the statistical test.

Hand-held mobile phone users

Two of the three MANOVAs performed for the different types of beliefs yielded significant multivariate effects: behavioural (Pillai's trace = 0.042, $F(6, 235) = 1.715$, $p = 0.118$), normative (Pillai's trace = 0.066, $F(6, 234) = 2.778$, $p = 0.013$) and control beliefs (Pillai's trace = 0.140, $F(6, 235) = 6.356$, $p < 0.001$).

Regarding univariate effects, differences were not found for any specific behavioural beliefs, although a tendency was detected for frequent users to be more likely to believe that their phone use would result in an effective use of time. However, significant differences did emerge for two normative beliefs, with infrequent users considering it more unlikely that their phone use while driving would be approved of by their family and their work colleagues. Finally, we found significant differences between frequent and infrequent users for all control beliefs that were assessed. For all cases, infrequent users reported a higher likelihood that all the factors measured would prevent them from using a mobile phone behind the wheel.

As in the case of hands-free mobile phone users, we ran a logistic regression model for hand-held mobile phone users in order to test whether composite scores on the different types of beliefs were predictive of being a frequent user (vs. infrequent). The model run fitted the data ($\chi^2 = 35.456$, $p < 0.001$). The model explained 20.2% of the variance and correctly classified 74.2% of the participants. Behavioural and control beliefs were significant predictors of the frequency of hand-held mobile phone use while driving. While in the former case higher scores were associated with an increased likelihood of being a frequent mobile phone user while driving, the contrary was true for the latter. A tendency for higher levels of perceived social approval to be associated with higher likelihood of being a frequent user was observed in this Polish sample, although it did not reach statistical significance.

Discussion

In the present study, we investigated the frequency of mobile phone use for several specific behaviours among a sample of Polish drivers and tested whether there were differences in the three types of beliefs underlying the formation of intentional behaviours, according to the TPB (Ajzen 1991). In other words, we examined the phenomenon of distracted driving caused by mobile phone use by applying the TPB.

Mobile phone use while driving

In light of the results obtained with this sample of Polish drivers, the issue of engagement in mobile phone use while driving appears to be as widespread in Poland as it is in other countries (Bazargan-Hejazi et al. 2017; Musicant et al. 2015; Sullman et al. 2018; White et al. 2010). A substantial proportion of the participants (23–30%) reported engaging in each of the specific activities assessed on a daily basis or more often, which, again, highlights the need to address this important problem which has been found in previous studies in several different countries (e.g. Eby et al. 2006; Papadakaki et al. 2016; Shi et al. 2016). Moreover, a higher proportion of hands-free phone users, compared to hand-held users, reported making calls while driving. In both previous studies (Sullman et al. 2018; White et al. 2010), significant differences were found between hand-held and hands-free users who made calls on a daily basis while driving. Both of these studies also revealed differences in the proportion of drivers who took calls. This was not the case in the present study, in spite of the different proportion of drivers using each phone type that reported answering calls, possibly due to the low sample size of hands-free users. However, in common with the previous research (Sullman et al. 2018; White et al. 2010), we found that a larger proportion of drivers who use mobile phones in the hands-free mode tend to do so on a daily basis. The tendency for hands-free users to use their mobile phones more intensively while driving has previously been reported in other countries (e.g. Sullman and Baas 2004). Interestingly, Musicant et al. (2015) found that the belief that texting compromises safety did not reduce mobile phones use.

Behavioural, normative and control beliefs

Hands-free mobile phone users

Significant multivariate differences in behavioural and normative beliefs were found between frequent and infrequent hand-held mobile phone users, while the results were close to significance for control beliefs. White et al. (2010) found significant differences for all types of beliefs among hands-free users in their Australian sample, while the British study (Sullman et al. 2018) did not find any significant multivariate differences. As to differences at the univariate level for behavioural beliefs, the negative outcomes of phone use (being distracted from driving, being involved in a crash and being caught and fined by the police) were believed to be more likely by frequent users than by infrequent ones. These findings are quite different from those reported by White et al. (2010) and Sullman et al. (2018), who did not find these differences but found others between frequent and infrequent users. Regarding normative beliefs, frequent hands-free users believed that their phone use was more likely to be approved of by their friends and work colleagues (than infrequent users). These findings are much more consistent with those by White et al. (2010) and Sullman et al. (2018), although both also found family members' perceived approval to differ between frequent and infrequent users. In a similar vein to the present results, Rozario et al. (2010) found that the presence of friends in the vehicle was a predictor of intention to use a hand-held mobile phone. Furthermore, research by Nemme and White (2010) found that subjective norms were a significant predictor of intention to send and read text messages while driving.

Finally, infrequent hands-free users were more likely, than frequent users, to think that all the factors assessed would prevent them from engaging in phone use while driving. Fewer differences were detected by White et al. (2010) and Sullman et al. (2018). In the former case, these were not detected for the lack of a hands-free kit and in the latter case, significant differences were only found for the risk of fines. The multivariate analysis, which aimed to investigate the effect of the three types of beliefs together, yielded no significant effects for any of them, although the odds ratios were quite different, which may be due to the very low statistical power. Previous studies, with larger samples, have found normative and control beliefs to be predictive of being a frequent hands-free phone user (White et al. 2010) or an effect close to significance for behavioural beliefs (Sullman et al. 2018). However, the fact that this difference reached statistical significance, despite the small proportion of drivers using hands-free devices, may indicate that these are rather intense hands-free users.

Hand-held mobile phone users

Among hand-held users, multivariate differences were found between frequent and infrequent users in normative and control beliefs, but not in behavioural beliefs. This finding is not consistent with the results obtained by Sullman et al. (2018), who found differences in behavioural and control beliefs but not in normative beliefs, while White et al. (2010) found multivariate differences in all types of beliefs. With regard to specific beliefs, we found no differences in behavioural beliefs in the present study, although believing that phone use results in using time effectively was close to statistical significance. Previous research has shown that the perceived need to use mobile phones while driving was the main determinant of being a frequent phone user and that the majority of phone calls were work-related (Musicant et al. 2015). This and other specific beliefs were found to differ between frequent and infrequent users in previous research (Sullman et al. 2018; White et al. 2010). Significant differences in most assessed normative beliefs were found between frequent and infrequent hand-held users. Specifically, frequent users reported that their friends, family members and work colleagues were more likely to approve of them using a phone while driving. Differences in these normative beliefs, as well as in others, were also found by White et al. (2010). In contrast, Sullman et al. (2018) did not report such differences, although they did find differences in perceived partner's approval. Regarding control beliefs, as was the case for hands-free users, infrequent hand-held phone users were more likely, than frequent users, to think that all the assessed factors would prevent them from engaging in phone use while driving. Sullman et al. (2018) also found differences in all control beliefs between these two groups, while White et al. (2010) reported similar findings, with the exception of police presence.

The analysis run with the three types of beliefs together showed that behavioural beliefs were positive predictors of being a frequent hand-held user, while control beliefs were negatively related to this outcome. Thus, we found that those drivers who believed that mobile phone use would result in better outcomes were more likely to be frequent users, while those who reported higher levels of the control factors assessed were more likely to be infrequent users. Those drivers who believed that the factors assessed were more likely to deter them from using a phone behind the wheel were less likely to be frequent users. White et al. (2010) also reported these two significant relationships, while the results reported by Sullman et al. (2018) only revealed the relationship for control beliefs.

Limitations

One limitation of the present study is the small number of participants in the hands-free users group, which limits the

power of the statistical test for detecting significant differences. The size of the groups of hands-free and hand-held mobile phone users differed. However, this reflects the general trend in Polish society, where the majority of drivers use hand-held devices behind the wheel. As other studies have shown, the problem of using mobile phones is mostly limited to young people (e.g. Yannis et al. 2016). Similarly, the participants in the present study were mostly young. Future research should also include other age groups in order to analyse the differences. It also seems promising to investigate the motives of using mobile phones while driving in different age groups.

Another limitation is the fact that the reliability of the normative beliefs scale was rather low in the present study and should be interpreted with caution. Moreover, beliefs were assessed with regard to mobile phone use while driving in general, rather than with regard to any specific phone-related activities. Furthermore, this study relied on self-reported data, which may have been affected by social desirability bias. Moreover, the methods we used only enabled us to establish the relationships between variables but do not allow for determining causal relationships. Experimental methods should be used in the future to provide a better understanding of this phenomenon. It would also be interesting to examine the impact of other factors, such as the bystander effect, on the use of mobile phones while driving.

Conclusions

This study addressed an important safety issue, the use of mobile phones while driving, and the relationships these behaviours (hand-held and hands-free use) had with three psychosocial beliefs. This study found differences in beliefs between those who frequently used mobile phones while driving and those who did not. The differences were particularly related to control beliefs. Infrequent users believed that these factors (risk of fines, demanding driving conditions, risk of crash, police presence, lack of a hands-free kit and heavy traffic) were more likely to prevent them from using their phone while driving. Moreover, behavioural and control beliefs were significant predictors of the frequency of phone use. Our results shed some light on the differences in beliefs according to the frequency of use and this information appears to be relevant for designing interventions aimed at changing these risky behaviours. The results provide a theoretical framework for the development of effective interventions aimed at reducing distracted driving and increasing roadway safety. This study also highlights the importance of the application of the theory of planned behaviour (TPB) in predicting mobile phone use while driving. It provides evidence that contributes to the understanding of motivational influences on using a mobile phone while driving. These findings may also be helpful to policy-makers, in that they provide a substantive argument for tightening the regulations around this risky behaviour.

Author contributions All the authors made significant contributions to the proposal development, data collection, data analysis and manuscript preparation process of this work. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest No conflict of interest has been reported by the authors.

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