



## “I Snapchat and Drive!” A mixed methods approach examining snapchat use while driving and deterrent perceptions among young adults



Verity Truelove\*, James Freeman, Jeremy Davey

Queensland University of Technology (QUT), Centre for Accident Research and Road Safety – Queensland (CARRS-Q), K Block, 130 Victoria Park Road, Kelvin Grove, 4059, Australia  
University of the Sunshine Coast, 90 Sippy Downs Dr, Sippy Downs QLD 4556

### ARTICLE INFO

#### Keywords:

Phone use while driving  
Social media use while driving  
Deterrence  
Enforcement  
Novice drivers  
Driver distraction

### ABSTRACT

This research utilised a qualitative and quantitative study to examine a sample of young drivers' perceptions of deterrent forces, both legal and non-legal, for the behaviour of phone use while driving. First, focus groups were conducted with 60 drivers between the ages of 17 and 25 years who resided in Queensland, Australia. This qualitative study utilised an inductive approach to elicit participants' perceptions without omitting important ideas. Legal sanctions were associated with low perceptions of enforcement certainty. Meanwhile, the only non-legal sanction to emerge was the concept of “safety”; many participants were deterred from using their phone while driving for fear of injury or death to themselves or others. The types of social media most likely to be engaged in were explored and sending videos or photos via the application Snapchat emerged as the most common social media application used among the sample. Consequently, the subsequent quantitative study focused on deterrent forces associated with Snapchat use while driving. A survey was utilised with a separate sample of young drivers aged 17–25 years ( $n = 503$ ). The impact of the threat of legal sanctions on Snapchat use while driving was examined through classical deterrence theory and Stafford and Warr's (1993) reconceptualised deterrence theory. The non-legal factor of perceived safety was also included in the quantitative study. None of the classical deterrence variables (e.g., certainty, severity and swiftness) reached significance while all the reconceptualised deterrence variables (e.g., direct and indirect punishment and punishment avoidance), as well as perceived safety, were significant predictors of Snapchat use while driving. It is suggested that perceptions of certainty of apprehension need to be increased for phone use while driving. The findings show the current impact of deterrent initiatives for phone use while driving as well as provide the first examination of deterrents for the specific mobile phone behaviour of Snapchat use while driving.

### 1. Introduction

Young drivers, aged between 17 and 25 years, are largely over-represented in road crash statistics. For example, young drivers are represented in over 20% of road crashes in Australia (AGDIRD, 2017) yet make up only approximately 12.8% of the population (Australian Bureau of Statistics, 2017). Worryingly, the rate of road deaths for this age group has further increased in Australia by 17.1% between 2015 and 2016 (AGDIRD, 2017). Worldwide, road traffic injuries are the leading cause of death for young people (World Health Organisation, 2015). Distraction while driving is one behaviour which has been found to significantly increase the risk of road crashes (Klauer et al., 2006; Neyens, and Boyle, 2008) and phone use while driving is one of the most common and dangerous causes of such distractions (Backer-Grøndahl and Sagberg, 2011; Klauer et al., 2006; Basacik et al., 2011).

Of particular concern, phone use while driving behaviour is most common among this high-risk age group (Ismeik et al., 2015; Oviedo-Trespalacios et al., 2016, 2018b; Poysti et al., 2005; Walsh et al., 2008). It has also recently been identified that drivers in this age group have higher problematic phone use scores, which is linked to mobile phone use while driving (Oviedo-Trespalacios et al., 2019c).

As phone use while driving behaviour presents a large concern for the safety of young drivers, it is imperative that factors that effectively deter these drivers from this dangerous behaviour are identified. These results can contribute towards informing appropriate countermeasures that are effective in reducing this dangerous behaviour and consequently, road crash rates. However, when research has explored deterrence measures in relation to phone use while driving behaviours, the focus has primarily been on hand-held and hands-free calls or texting while driving (Ehsani et al., 2014; Goodwin et al., 2012; Johal

\* Corresponding author.

E-mail address: [verity.truelove@hdr.qut.edu.au](mailto:verity.truelove@hdr.qut.edu.au) (V. Truelove).

<https://doi.org/10.1016/j.aap.2019.06.008>

Received 24 August 2018; Received in revised form 29 April 2019; Accepted 12 June 2019

Available online 28 June 2019

0001-4575/ © 2019 Elsevier Ltd. All rights reserved.

et al., 2005; McCartt et al., 2010). With the emergence of smartphones, the accessibility of social media applications has become a further area of mobile phone distraction while driving, however, research is yet to explore the deterrence factors that may influence this behaviour. This can be considered a large oversight in view of the different processes, cognitive loads and intentions associated with this behaviour compared to other types of phone use while driving. As such, this study will address this research gap by first identifying the deterrent factors for hand-held phone use while driving and the prevalent social media while driving behaviours among the high-risk age group of young drivers (aged 17–25 years) in a qualitative analysis. Secondly, a quantitative analysis of the factors identified in the first study will be utilised. The quantitative phase of the study will specifically examine the impact of the deterrent factors on the prevalent phone use while driving behaviour identified from the focus groups.

### 1.1. Social media applications on smartphones and associated risks

With the emergence of social media applications on smartphones (e.g. Snapchat, Facebook, Twitter), drivers are faced with further temptations to distract them from the driving task. Research has provided a clear link between crash risk and phone use while driving (Basacik et al., 2011; Gliklich et al., 2016; Klauer et al., 2006; Oviedo-Trespalacios et al., 2016). Furthermore, it has been found that young drivers specifically were more likely to be severely injured if they were distracted by their cell phone compared with being distracted by in-vehicle devices or through their own inattentiveness (Neyens, and Boyle, 2008). These results are concerning and further highlight the need for effective countermeasures when also considering that this age group has the highest rates of phone use while driving compared to all other age groups (Ismeik et al., 2015; Oviedo-Trespalacios et al., 2016).

There are three types of distractions that can occur while driving; visual, physical and cognitive (Backer-Grøndahl and Sagberg, 2011), the combination of all three distractions in phone use while driving can be referred to as visual-manual distraction; this can be applied to the use of smartphones to access social media applications while driving. The visual-manual task of texting while driving has received a lot of attention surrounding the danger of this behaviour. Texting while driving has been found to increase lane deviation compared to drivers that are not distracted (McKeever et al., 2013). Additionally, compared to other phone use while driving tasks, texting while driving has a higher subjective workload (Young et al., 2014), which can naturally detract from a motorist's ability to safely operate a moving vehicle. Furthermore, in an analysis of naturalistic driving study data, compared to other types of phone tasks, visual-manual phone tasks had the strongest influence on safety critical events (Fitch et al., 2017). While engagement in a simple visual demand task, as well as hands-free phone use has been found to result in lower driving speed (Engström et al., 2005; Jamson and Merat, 2005; Oviedo-Trespalacios et al., 2018a), more time spent on visual-manual phone interactions have been found to increase driver speed (Oviedo-Trespalacios et al., 2018a). This was suggested to occur because of the reduction in speedometer monitoring. The study by Oviedo-Trespalacios et al. (2018a) also found more variability in lateral lane position with more time spent focusing on visual-manual phone tasks while driving.

Research has recently started to explore the dangers of social media use while driving specifically. In a simulator study, updating social media status has been found to increase reaction time and cause a detrimental effect to participants' control of the vehicle (Basacik et al., 2011). Additionally, in another simulator study, text-based social media (in this study text-based social media was identified as reading and writing tasks specifically in Facebook or via text messages) has been found to decrease driving performance by taking up attentional and memory demands (McNabb and Gray, 2016).

In regards to frequency, a number of studies have considered the extent to which drivers use social media while driving (e.g. Braitman,

and Braitman, 2017; George et al., 2018; Tian and Robinson, 2016). Tian and Robinson (2016) found drivers (of all ages) frequently engage in calling, texting and social media use while driving. Meanwhile Braitman and Braitman (2017) specifically focused on young drivers and found that the phone use while driving behaviours this cohort engaged in included hand-held and hands-free calls, texting, programming music, using a Global Positioning System (GPS), accessing the internet for traffic and banking matters as well as reading social media. A recent study of 288 Australian drivers aged 17–25 years examined the different types of mobile phone use while driving behaviours among young adults and it was found that, while driving, out of the social media behaviours, 61% of participants had accessed Facebook, 47% accessed Snapchat, 30% accessed Instagram and 4% accessed Twitter (Gauld et al., 2017). More recently, George et al. (2018) identified that young drivers frequently used music applications on their phone, played Pokémon Go, used Snapchat to send pictures or videos, used GPS applications as well as used texting and calling functions on their phone while driving.

With the increasing integration of social media use via smartphones into society and the prevalence of this behaviour among young drivers (Gauld et al., 2017), there is a clear importance in determining the social media applications used while driving among this age group and the effective deterrents so that countermeasures for these behaviours can be implemented.

### 1.2. The threat of legal sanctions

As social media use while driving is an emerging behaviour that has been found to have clear connections to crash risk, there is a need to establish the effectiveness of current countermeasures to reduce these behaviours. As most countermeasures are based on deterrence theory, this is a clear starting point. Deterrence theory is based on the idea that individuals will not commit an offence if they believe the punishment will be certain, severe and swift (Beccaria, 1764/2007Beccaria, 2019Beccaria, 1764/2007; Bentham, 1780/1970Bentham, 2019Bentham, 1780/1970). A more recent reconceptualization of this theory has also been established, in which an individual can be deterred via a combination of 1) direct punishment, 2) indirect punishment (i.e. experienced via someone the individuals knows, such as a friend or family member), 3) direct punishment avoidance (in which an individual commits the crime but is not caught for it) and 4) indirect punishment avoidance (somebody an individual knows commits the crime and is not caught for it) (Stafford, and Warr, 1993). In Queensland, the jurisdiction in which this study was implemented, it is illegal for drivers of all licence types to use a hand held-phone while driving; if they are caught, the punishment for these drivers includes 3 demerit points and a \$391 AUD fine for the first offence (Queensland Government Department of Transport and Main Roads, 2016). Furthermore, under the graduated driver licensing system in Queensland, learner drivers and those with a provisional 1 licence are banned from using any phone function while driving, including hands-free phone functions. The punishment for violating this rule is the same as above. Drivers aged under 25 who are on their provisional 2 licence or open licence are allowed to use hands-free phone functions.

The application of deterrence-based countermeasures has been demonstrated to be effective in reducing death and injury associated with road crashes, particularly in the area of random breath testing and drink driving (Homel, 1988; Szogi et al., 2017; Watson, and Freeman, 2007). However, the effect of deterrent-based processes on social media mobile phone use while driving has not been widely explored, especially for the high-risk group of young drivers. Most of the literature surrounding phone use while driving and deterrence has examined the overall differences before and after a ban on hand-held phone use while driving has been implemented, and these studies have provided mixed results. More specifically, some studies found the rate of severe crashes (Ehsani et al., 2014) and insurance claims (Highway Loss Data Institute,

2010) increased, as opposed to decreased, after this law was implemented. In contrast, some studies of observed hand-held phone use while driving rates found either no significant difference before and after these laws were put in place (Foss et al., 2009; Goodwin et al., 2012), or they did find a significant decrease in this behaviour after the implementation of this legislation (Johal et al., 2005; McCartt et al., 2010). These studies occurred outside of Australia, in the United States and the United Kingdom, and have not explored how specific countermeasures are effective in deterring drivers, particularly young drivers, from illegal phone use while driving. In addition, these studies have assessed the banning of hand-held phone functions overall, which is likely to be obscuring the results, as there are different intentions and processes attached with each type of phone function (Gauld et al., 2014; Prat et al., 2015; Tian and Robinson, 2016). The deterrent impact of legal countermeasures on social media use while driving specifically has yet to be explored.

### 1.3. The impact of social forces

More broadly, the threat of legal sanctions has not proven to be a panacea in the reduction of road death tolls and a range of deterrence models have now been expanded to include the impact of a range of non-legal sanctions. This is especially important for the behaviour of phone use while driving due to the difficulty in enforcing this restriction (Farris, 2011). Additionally, there has been research showing legal deterrence to have less of an impact on younger drivers (Bushway et al., 2013; Freeman et al., 2017; Sampson, and Cohen, 1988), which is a further reason to explore the possible impact of social sanctions on enhancing rule compliance. Research which has started to look at phone use while driving in general has found intention to use a phone while driving is connected to attitude and pressure from significant others (Waddell and Wiener, 2014) as well as perceived benefits of the behaviour (White et al., 2010). However, the non-legal mechanisms that influence the behaviour of social media use while driving has yet to be explored in the literature, therefore it is unknown which mechanisms may have an effect on this behaviour.

### 1.4. The current study

Due to the large gap in the literature pertaining to the specific countermeasures by which young drivers are most effectively deterred from phone use while driving, this study undertook an exploratory approach to gain an understanding of young drivers' perceptions of rule compliance and specific countermeasures relating to the behaviour of hand-held phone use while driving. In addition, the use of social media on mobile phones has become more integrated into everyday use over recent years, yet there has been little research examining the different types of this behaviour that are most prevalent while driving. Consequently, this study also explored the types of social media while driving behaviours which are prevalent among the young driver population. The results from the qualitative study informed the measures for the subsequent survey which gave a quantitative examination of the identified deterrence variables.

## 2. Study 1: focus groups

The first component of the study involved focus groups. The following research questions were developed which this study aimed to address:

- 1 What are the legal and non-legal factors that deter young drivers from using a hand-held phone while driving; and
- 2 What are the types of social media phone use while driving behaviours which young drivers are most likely to engage in?

## 3. Method

### 3.1. Participants

Sixty young Queensland drivers ( $M_{age} = 20.50$  years,  $SD = 2.69$ ; 40 females) were recruited through email, snowball sampling or were self-selected first year psychology students. The incentive consisted of a \$50 gift voucher, or first year psychology students could choose between the gift voucher or course credit. Drivers were between the ages of 17 and 25 years and held either a provisional (P1 or P2) or an open Queensland licence. P1 licence holders can only reach this licence stage when they are 17 years of age, after completing 100 h of supervised driving practice and passing a driving test, while P2 licence holders reach this licence stage by holding their P1 licence for one year and passing a hazard perception test. The P1 licence stage is the first licence stage where the driver is permitted to partake in unsupervised driving. In addition to the above requirements, drivers on their provisional licence are also required to adhere to a number of additional driving restrictions (e.g. a zero alcohol restriction) that are not required on an open licence. Licence class of participants consisted of 23 P1 licence drivers, 18 P2 licence drivers and 19 open licence drivers.

### 3.2. Procedure and materials

Before each focus group commenced, participants were given an information sheet to read through, a consent form to sign and a short demographic survey to fill out. The focus groups took between 40 and 90 min and were moderated by the first author (VT). There were 11 focus groups in total. Focus groups consisting of between 4 and 8 participants were scheduled (there was 1 group of 2 and 1 group of 3 due to last minute cancellations or no-shows). The focus groups took place between February and May 2017. Participants completed a short demographic survey at the start of the focus group. The focus group discussion was then guided with semi-structured interview questions, which are included in Appendix A in Supplementary material. These questions focused on the legal and non-legal deterrents for illegal phone use while driving behaviours, as well as identifying what type of social media use while driving behaviours participants thought were most prevalent among young drivers. Ethical approval for this study was obtained via the University Research Ethics Committee.

### 3.3. Data analysis

A thematic analysis was utilised to analyse the data. Inter-rater reliability was addressed via the analysis of data by a researcher outside of the project, who made minor adjustments to the codes and themes. This analysis followed the six phases of thematic analysis: familiarisation, coding, searching for themes, reviewing themes, defining and naming themes and writing up the themes (Braun, and Clarke, 2006; Clarke et al., 2015). The first author (VT) transcribed the data verbatim soon after they were finished, enabling familiarity with the content. They were then re-read another two times before coding started, to fix any typing errors and to further gain an understanding and familiarity with the content. Data analysis occurred sequentially, which meant the authors could identify when data saturation was reached (i.e. when no new data relating to the research questions was collected from participants), and data collection could be terminated (Hancock et al., 2009; Mason, 2010). It is crucial the issue of saturation is considered in qualitative research, and should be the guide with which a researcher bases their sample size (Mason, 2010).

## 4. Findings

The themes which emerged included: 1) The restriction on hand-held phone use while driving is difficult to enforce, 2) The legal consequences of fine and demerit point loss for using a hand-held phone

while driving act as a deterrent, 3) Perceptions of safety of self and others is a deterrent for hand-held phone use while driving, and 4) Using Snapchat while driving was prevalent among young drivers. The results are discussed within each theme. In order to aid in the explanation of themes, raw data from the transcriptions are included (Clarke et al., 2015; Finch and Lewis, 2003). A quote from a male begins with ‘M’ and a quote from a female begins with ‘F’.

**Theme 1.** The Restriction on Hand-Held Phone Use while Driving is Difficult to Enforce

In regard to the deterrent impact of legal sanctions, an important theme emerged that reveals the sample believe phone restrictions are difficult to enforce. The difficulty in enforcing this phone restriction is expressed in the comments below:

*M: And there are probably so many grey areas too, say you look at your phone for a second, a cop pulls you over, and say you were going to be texting, you say oh I was just picking up a phone call, let me off*

*F: It's like, well, it's obviously fine, like the cops aren't actually around and then they'll be on their phones*

*F: It's not enforced very well.*

There appeared to be a general idea that being apprehended using a phone while driving can only occur if: (a) there is a police presence and (b) the transgression can clearly be observed. As such, participants demonstrated the view that if they wanted to use their phones while driving, they could easily do so and avoid punishment. These results could be considered in relation to the ‘punishment avoidance’ component of Stafford and Warr’s (1993) reconceptualised deterrence theory which stipulates that if an individual breaks the law, yet is not caught and punished for doing so, they are more likely to offend in the future.

**Theme 2.** The Legal Consequences of Fine and Demerit Point Loss for using a Hand-Held Phone while Driving act as a Deterrent

While a number of participants reported that they believe the rule of not using a hand-held phone while driving is not well enforced, there were 9 mentions of cameras that can record phone use while driving (e.g., perceptions of apprehension certainty, consistent with Classical Deterrence theory (Beccaria, 1764/2007; Beccaria, 2019; Beccaria, 1764/2007; Bentham, 1780/1970; Bentham, 2019; Bentham, 1780/1970). These perceptions had some influence on the perceptions of enforcement for phone use while driving. This is demonstrated in the comments below:

*M: And there's cameras now that can get you doing it*

*F: It's just these cameras that sit up like at an angle up high and you can see from that angle onto like the drivers like lap so if you've got your phone there then it will record you doing that*

It is interesting that participants mentioned the use of cameras as a deterrent for this behaviour. The Australian state of New South Wales passed new legislation allowing cameras that can catch phone use while driving in July 2018 and are planning on rolling out these cameras from January 2019. However, these cameras have not yet been implemented in Queensland, where these participants reside. These perceptions can be applied to the classic psychological ‘Hawthorne effect’ to the findings. This effect demonstrated that performance is increased when motivated by the attention an individual receives when being observed (Roethlisberger, and Dickson, 1939; Sedgwick, and Greenwood, 2015), so when applied to these results, increases in perceptions of monitoring for phone use while driving may result in increases in rule compliance for this behaviour.

In addition to cameras, enforcement of phone use while driving was also mentioned to occur directly through police. This was perceived as an effective deterrent to the extent that drivers believed police were in the area. Examples of these comments are included below:

*F: Obviously if you know there's going to cops there then you're not going*

*to be on your phone.*

*F: There's a woman that we work with who was saying, she was on her red Ps and the police caught her on her phone*

*F: My friends have been told off by a cop, like pulled up next to them and been like don't do that*

The legal consequences of using a phone while driving did act as the primary deterrent for a number of participants, despite some participants perceiving it to not be well enforced. This is illustrated in the comments below:

*F: I think at the back of your mind you still know it's dangerous but legally you're more worried about that [laughs]*

*M: In the end I think legal is always the way to stop people because no one's really thinking oh I'm going to crash when I'm doing this.*

**Theme 3.** Perceptions of Safety of Self and Others is a Deterrent for Hand-Held Phone use while Driving

The non-legal deterrents of using a hand-held phone while driving consisted primarily of the fear of harming or killing themselves or others. A number of participants explained they were more deterred by these non-legal consequences than by legal consequences. This is demonstrated by the comments below:

*M: I don't think I've ever been inclined, to be driving along and go, oh I don't think I'm going to check that message because I'm going to get a \$200 fine, instead you'll go, you know, I don't want to get distracted.*

*M: Yeah, dying, crashing into someone else*

*F: Well legal is definitely there but I feel like for most people they're a lot lesser than the physical consequences*

From these comments, it is evident that the legal consequences still have some influence on participants, but the non-legal consequences of safety are more important to them than the legal consequences. This finding is consistent with emerging literature that suggests non-legal sanctions act as a stronger deterrent than legal sanctions among young drivers (Allen et al., 2015; Bates et al., 2017).

**Theme 4.** Using Snapchat while Driving was Prevalent among Young Drivers

Out of all of the different types of social media use while driving (e.g., Facebook, Twitter, Instagram), the use of Snapchat was clearly the most common, and almost the only, type of social media use while driving that was mentioned among participants. Snapchat is a social media application that can only be used on a mobile device, in which users have the option of sharing their photos or videos with other people. Once an individual opens a message via Snapchat, it is deleted after 10 s. However, users have the option of taking a screenshot of an image received through Snapchat, in order to preserve the image for an extended period of time. Snapchat includes a number of filters and emojis, along with text, which can be added to the photo or video before it is sent. Additionally, users can obtain a ‘streak’ by sending a video/photo on Snapchat to someone for a certain number of consecutive days, and the receiver has also sent a video/photo back to the individual on the same days. The ‘streak’ is then operationalised as the number of consecutive days this has occurred. Users also have the option of instant messaging on the application. At the time of the focus groups, the current version of Snapchat would have been either 9.20.6.0 or 9.30.5.0. Participants stated they believed sending a video or photo via Snapchat while driving was prevalent among young drivers 32 times, they stated they know of people who send Snapchat messages/videos/images while driving 33 times, and 3 participants admitted to using Snapchat themselves while driving. Examples of the comments surrounding Snapchat use while driving are as follows:

*F: I Snapchat and drive!*

*M: You see a lot of people are Snapchatting when they drive*

*F: Even my friend on her opens was Snapchatting while driving and she nearly killed us*

*F: I had a friend of a friend who was Snapchatting on like [X] road which is one of those country roads that are just like dead quiet and she crashed and then she still Snapchats, like how did you not learn your lesson from that? So I think even though people know it's going to be very dangerous, they still do it anyway*

Sending a Snapchat while driving was mentioned much more often than viewing a Snapchat while driving, which was only mentioned 4 times in the focus groups. It was commonly stated that the purpose of using Snapchat was to post a video or photo of themselves driving, so this could explain this difference in results.

A comment that was frequently mentioned by participants when discussing Snapchat while driving included a filter on the application that shows the speed they are going. This filter is reported to be commonly used among those who send a Snapchat while driving, where people show that they are speeding and post this for people to see while they are driving. As such, the use of Snapchat while driving could also be connected to the social acceptability of speeding and using a mobile phone while driving. Examples of the use of Snapchat with the speeding filter are demonstrated below:

*F: But they added that thing that shows how fast you're going so of course they're going to*

*F: I think people do it to be cool because I know a girl who was doing 65 in a school zone and then she took a Snapchat of it, I was like are you trying to kill someone here. I think people do it for the Snapchat, like look at me speeding and using my phone*

Snapchat provided a clear purpose for using the application while driving, however other social media applications appear to lack that purpose. This could explain the limited use of other social media sites while driving among young drivers. The lack of other types of social media use while driving is demonstrated through the following comments:

*F: I feel like Facebook and Instagram I don't, like can't be bothered*

*F: I don't think anyone tweets when they drive [laughs]*

*F: I think if you were going on social media you would only go on Snapchat, like you wouldn't go on Facebook or Instagram [participants laugh]*

#### 4.1. Study 1 summary

This study explored the contemporary social media phone use while driving behaviours young drivers are most likely to engage in, as well as the legal and non-legal mechanisms by which young drivers are deterred from hand-held phone use while driving behaviours. Technology continues to evolve, as does the type of technology young drivers are most likely to engage in. Recent research has started to expand beyond general phone behaviours to look at social media use among young drivers (McDonald, and Sommers, 2015). When the different types of social media use while driving have been broken up, Facebook emerged as the most common type of social media for young adults to engage in while driving (Gauld et al., 2017). However, this study has illuminated the change that has occurred in this engagement, with participants actively commenting on their lack of Facebook use while driving, while the use of Snapchat while driving emerged as the most common type of social media being used among young drivers. It has also been revealed that the use of Snapchat serves as further promotion of non-compliance with road safety behaviours, particularly excessive speeding behaviour. These results identified the problem behaviour of Snapchat use while driving, however, a more-in depth analysis is required to provide quantifiable results. As such, a subsequent quantitative study was developed based on these results, with a focus on the behaviour of Snapchat use while driving.

There are a number of unique reasons as to why Snapchat while driving should be the focus for the questionnaire. Firstly, this behaviour

has been shown to be prevalent among young drivers and has clear connections to the driving task (e.g. showing speed or showing something that is viewed while driving) that are not present in other phone behaviours. Secondly, this behaviour involves extensive visual-manual interactions (e.g. filming and sending the Snapchat, activating the speed filter, etc) in comparison to other types of phone use while driving behaviours such as reading messages while driving. As visual-manual phone tasks have been associated with more risky driving behaviour in comparison to cognitive-auditory phone tasks (Fitch et al., 2017; Oviedo-Trespalacios et al., 2018a, 2018b), it is important to examine countermeasures that can effectively deter young drivers from this behaviour. Additionally, Snapchat while driving can be considered to occur more overtly, as it would be difficult to conceal this behaviour due the driver being required to capture either a video or photo while driving. In comparison, sending or reading a text message can occur more covertly, with the phone hidden near the drivers lap (Gauld et al., 2014). Concealed phone use while driving presents an issue when examining the deterrent impact of legal countermeasures on this behaviour, as this is likely to minimise the impact of legal enforcement by decreasing drivers' perceptions of the certainty of apprehension. As a result, further research is needed to examine the impact of legal countermeasures on Snapchat usage while driving in order to identify effective methods to promote rule compliance.

The focus group results identified that legal sanctions had some influence on young driver mobile phone behaviour, however this road rule was perceived as not well enforced. This is consistent with previous research on young driver compliance with road rules (Truelove et al., 2019). Despite this, a number of participants still identified legal deterrents to have the most significant impact on their hand-held phone use while driving behaviour. To further understand the effects of legal sanction on young driver Snapchat use while driving, they will be analysed in the quantitative study using the theoretical frameworks of classical deterrence theory and Stafford and Warr's (1993) reconceptualised deterrence theory. These theories have been utilised to examine the effectiveness of legal deterrents for other road rule violations e.g. speeding (Fleiter, and Watson, 2006; Fleiter et al., 2009; Truelove et al., 2017) and drink driving (Freeman et al., 2015, 2016; Freeman, and Watson, 2009; Homel, 1988; Szogi et al., 2017), therefore, it is timely to apply these theories to the behaviour of Snapchat while driving.

Interestingly, the only non-legal sanction that consistently emerged as an effective deterrent for the behaviour of hand-held phone use while driving was participants' perceptions of safety of self and others as a result of the behaviour. For many participants this acted as a larger deterrent than legal sanctions. As such, it is important that this construct is also included in the quantitative analysis of Snapchat use while driving.

## 5. Phase two: questionnaire

A questionnaire was developed to undertake a quantitative analysis of the deterrent mechanisms associated with Snapchat use while driving, identified from the focus groups. The questionnaire examined participants' demographic variables (age, gender and licence status), perceptions of deterrence and perceptions of safety relating to Snapchat use while driving. It was piloted on 10 young drivers to assess the feasibility of the questionnaire, that is to receive feedback and establish whether the items are understandable and ordered appropriately (van Teijlingen and Hundley, 2002; Vogel, and Draper-Rodi, 2017). This phase of the study aimed to address the research question: 'what are the legal and non-legal mechanisms that deter young drivers from using Snapchat while driving?'

### 5.1. Participants

Participants consisted of 503 young Queensland drivers (59.6%

**Table 1**  
Frequencies of Snapchat use while Driving.

Question	Never	Rarely	Sometimes	Often	Nearly Always	Always
How often do you use Snapchat while driving?	421 (83.7%)	49 (9.7%)	16 (3.2%)	7 (1.4%)	1 (0.2%)	1 (0.2%)
How often do you use your phone to send a video or photo via Snapchat while driving?	427 (84.9%)	50 (9.9%)	12 (2.4%)	9 (1.8%)	1 (0.2%)	0

female) aged between 17 and 25 years ( $M = 20.17$ ,  $SD = 2.10$ ). In total, 25.8% of participants had a P1 licence, 39.4% had a P2 licence and 33.6% had an open licence. Participants were recruited in public places (e.g., public recreational areas, public libraries, university campuses and surrounding areas), online and via snowball sampling. Participants were offered the chance to win 1 of 10 \$150 gift vouchers for completing the survey and first year psychology university students were offered either course credit or an entry into the prize draw. A total of 301 participants completed an online survey while 202 participants completed a pen and paper version of the survey. Participants were recruited between September and December 2017.

## 5.2. Materials

The full set of items are presented in Appendix B in Supplementary material. Cronbach's alpha is reported to demonstrate reliability for all variables with more than two items, meanwhile both Cronbach's alpha and Spearman Brown coefficients are reported for variables with two items, consistent with the recommendation from Eisinga et al. (2013). All items for the independent variables were measured on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

### 5.2.1. Snapchat while driving

The questions for Snapchat while driving are based on the focus group results. The dependent variable consisted of two items. Overall hand-held phone use while driving was also asked to provide context to the behaviour of Snapchat while driving. These items were measured on a scale from 1 (never) to 6 (always), with higher scores reflecting greater use of Snapchat. Descriptive items were also developed to assess 1) the most common reason for using Snapchat while driving, 2) the situation drivers would most likely use Snapchat while driving and 3) participants' perceptions of Snapchat use while driving by others. The full set of questions are presented in Table A1 in Appendix B in Supplementary material.

### 5.2.2. Classical deterrence items

The classical deterrence items were based on previous drink driving and speeding research (Freeman et al., 2017; Freeman, and Watson, 2006, 2009; Homel, 1988; Truelove et al., 2017), with the wording changed to reflect the behaviour of sending a Snapchat while driving. There were two items for severity and swiftness. Meanwhile, as certainty of apprehension has been identified to be a more complex variable (Freeman et al., 2017; Truelove et al., 2017), four items were included. The full set of items are presented in Appendix B, Table A2 in Supplementary material.

### 5.2.3. Reconceptualised deterrence items

One item was used for each of Stafford and Warr's (1993) reconceptualised deterrence variables. They were based on established items utilised previously in drink driving (Freeman, and Watson, 2006; Szogi et al., 2017) and speeding research (Freeman et al., 2017). As the law against using a hand-held phone while driving does not differentiate between the different types of phone functions, the question for direct punishment was 'Have you ever received an infringement notice (e.g., ticket) for using your phone while driving?' All other questions referred specifically to sending a video or photo via Snapchat while driving. The full set of items are presented in Appendix B, Table A3 in Supplementary material.

### 5.2.4. Safety

It was identified from the focus group that a major non-legal deterrent for phone use while driving involved the perceived safety of the behaviour. Three items were developed for the survey based on the answers provided in the focus groups. The full set of items are provided in Appendix B, Table A4 in Supplementary material.

## 6. Study 2: questionnaire results

Frequencies and descriptive statistics were used to examine self-reported Snapchat while driving and perceptions towards this behaviour. A hierarchical multiple linear regression was then undertaken to determine the extent to which the legal and non-legal mechanisms predict sending a Snapchat while driving among young drivers. Unless otherwise stated, all statistical assumptions were met.

An independent samples *t*-test was conducted to analyse differences in the dependent variable for online questionnaires ( $M = 1.22$ ,  $SD = 0.56$ ) compared to hard copy questionnaires ( $M = 1.28$ ,  $SD = 0.80$ ) and no significant difference was found,  $t(499.75) = -0.98$ ,  $p = .328$ .

Table 1 presents the responses for the questions asking about the frequency of Snapchat use while driving. In the survey, driving was defined as follows: "Driving includes the whole journey from origin to destination, even when waiting at traffic lights." This definition was utilised in order to be consistent with the current Australian legislation for hand-held phone use while driving, in which all types of hand-held phone use are banned while the vehicle is turned on, this includes while waiting at traffic lights. As presented in Table 1, the majority of participants reported that they never use Snapchat while driving. The dependent variable for further analyses was the combined mean score of these two items. Overall the combined mean score for Snapchat while driving was 1.22 ( $SD = 0.59$ ).

Rates of hand-held phone use while driving in general was also included to provide a comparison with the frequency of Snapchat use while driving. Reported frequency of hand-held phone use while driving was as follows: 213 participants (42.3%) never engage, 168 participants (33.4%) rarely engage, 66 participants (13.1%) sometimes engage, 32 participants (6.4%) often engage, 8 participants (1.6%) nearly always engage and 5 participants (1%) always engage.

Table 2 presents the frequency of reported reasons for using Snapchat while driving, as well as the situations participants stated they

**Table 2**  
Frequency of most common Reasons for Snapchat use while Driving and most common Situations in which to use Snapchat while Driving.

	Frequency
<b>Reason</b>	
To send a video/photo of something I saw while driving	47 (58.0%)
To send a video/photo of myself driving	9 (11.1%)
To relieve boredom	8 (9.9%)
To use the speed filter	6 (7.4%)
To reply to a Snapchat	6 (7.4%)
To keep my streak up	5 (6.2%)
<b>Situation</b>	
While stopped at a red light	104 (71.2%)
While driving on an empty road	35 (24.0%)
While Driving at any speed	5 (3.4%)
In traffic	2 (1.4%)

would most likely use Snapchat while driving, out of the participants who reported using Snapchat while driving at some point. The most common reason to use Snapchat while driving was to send a video/photo of something that was seen while driving ( $n = 47, 58\%$ ). The answer ‘to reply to a Snapchat’ was commonly mentioned as an answer in the ‘other’ category, therefore this was added to the results. More participants answered the question asking what situations they would most likely use Snapchat while driving than the number of participants who stated they would use Snapchat while driving at some point, despite having the option of saying this question is not applicable to them. As the most common answer was to use Snapchat when stopped at a red light, it is possible some participants do partake in this behaviour at traffic lights but believe this did not count as using Snapchat while driving. Two participants mentioned they would most likely use Snapchat while in traffic, as such ‘traffic’ was added to the results.

In response to the question ‘Do you know of people who send videos or photos via Snapchat while driving?’, the findings revealed that the majority of participants ( $n = 348, 69.2\%$ ) knew of someone who sent videos or photos via Snapchat while driving. Of those participants, the majority disagreed with this behaviour ( $n = 251, 72.1\%$ ), followed by felt neutral about this behaviour ( $n = 47, 13.5\%$ ), accepted the behaviour depending on the circumstance ( $n = 42, 12.1\%$ ) and finally perceived the behaviour as acceptable ( $n = 6, 1.7\%$ ).

For the question “have you ever received an infringement notice (e.g. ticket) for using your phone while driving?”, 16 participants responded with yes while 481 responded with no. The means and standard deviations of the of the deterrence variables and safety are presented in Table 3.

A hierarchal multiple linear regression (Tabachnick and Fidell, 2019) was utilised to determine the contribution of the legal and non-legal mechanisms to the prediction of sending a video or photo via Snapchat while driving, as shown in Table 4. The homoscedasticity and normality assumptions were breached, which is most likely due to the low frequency of reported Snapchat use while driving in the higher ends of the questions for the dependent variable, as reported in Table 1 (skewness = 0.44, kurtosis = 0.43). Therefore, a bootstrap with a 95% confidence interval was used on this data, as the bootstrap confidence intervals and significance values do not rely on these assumptions (Field, 2013). The demographic variables of age, gender and licence status were entered into step 1 as control variables. Meanwhile, the classical deterrence items, the reconceptualised deterrence items and the safety items were entered into step 2.

Step 1, which included the control variables, was not statistically significant  $F(3, 472) = 2.18, p = .089$ , with an  $R^2$  of 0.014 and adjusted  $R^2$  of 0.007. However, age was a significant predictor,  $\beta = -.148, p < 0.05, sr^2 = 0.012$ , indicating younger drivers are more likely to use Snapchat while driving. Step 2, which consisted of the legal and non-legal mechanisms, was statistically significant,  $F(11, 464) = 24.15, p < .001$ , with an  $R^2$  of 0.364 and adjusted  $R^2$  of 0.349. The classical deterrence variables, Stafford and Warr’s reconceptualised deterrence variables and the variable of safety were able to explain an additional

**Table 3**  
Means and standard deviations of the independent variables.

	M(SD)
<b>Classical Deterrence</b>	
Certainty	4.79(1.19)
Severity	5.48(1.41)
Swiftness	4.52(1.46)
<b>Reconceptualised Deterrence Variables</b>	
Direct punishment avoidance	2.10(1.67)
Indirect punishment	2.90(1.94)
Indirect punishment avoidance	4.21(1.97)
<b>Non-Legal Variable</b>	
Safety	2.55(1.57)

**Table 4**  
Hierarchal Multiple Linear Regression on Snapchat use While Driving ( $n = 476$ ).

Variables	$\beta$	Sig.	B	BCa 95% CI		$sr^2$
				Lower	Upper	
<b>Step 1</b>						
Age	-.148*	.016	-.041	-.075	-.008	.012
Gender	.003	.942	.004	-.104	.112	.000
Licence Status	.059	.333	.045	-.047	.137	.002
<b>Step 2</b>						
Age	-.104*	.040	-.029	-.057	-.001	.006
Gender	.051	.192	.061	-.031	.152	.002
Licence Status	.026	.605	.020	-.055	0.94	.000
<b>Classical Deterrence Variables</b>						
Certainty of Apprehension	.028	.599	.014	-.037	.064	.000
Severity of Punishment	-.040	.386	-.017	-.055	.021	.001
Swiftness of Punishment	-.031	.481	-.012	-.047	.022	.000
<b>Reconceptualised Deterrence Variables</b>						
Direct Punishment	.111**	.004	.360	-.608	-.113	.011
Direct Punishment Avoidance	.347***	.000	.123	.091	.154	.078
Indirect Punishment	-.121**	.004	-.037	-.062	-.012	.011
Indirect Punishment Avoidance	.085*	.035	.025	.002	.048	.006
<b>Non-Legal Deterrence Variables</b>						
Safety	.318***	.000	.119	.086	.152	.069

Note. CI = Confidence Intervals,  $sr^2$  = semi partial correlation squared, B = unstandardized B, BCa = bias corrected and accelerated bootstrap, \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

34.9% of the variance. However, none of the classical deterrence items were able to significantly predict the behaviour of Snapchat while driving. Though, direct punishment from the reconceptualised deterrence theory was a significant predictor,  $\beta = .111, p < .01, sr^2 = 0.011$ . However, this result is in the opposite direction than expected; in response to the question ‘have you ever received an infringement notice (e.g. ticket) for using your phone while driving’, the answer ‘yes’ was coded as 1 and the answer ‘no’ was coded as 0. This indicates that drivers who have been caught and punished for using their phone while driving are more likely to use Snapchat while driving. The indirect punishment variable was also significant predictor of Snapchat while driving,  $\beta = -.121, p < .01, sr^2 = 0.011$ , indicating that participants who have friends who have used Snapchat while driving and have been caught, are less likely to use Snapchat themselves while driving. Additionally, indirect punishment avoidance was a significant predictor of Snapchat while driving,  $\beta = .085, p < .05, sr^2 = 0.006$ , indicating that participants who have friends who have used Snapchat while driving and have not been caught are more likely to use Snapchat themselves while driving. The final significant predictor from the reconceptualised deterrence variables was direct punishment avoidance,  $\beta = 0.347, p < 0.001, sr^2 = 0.078$ , indicating that participants who use Snapchat while driving and have not been caught and punished for this behaviour, are more likely to send videos or photos via Snapchat while driving. Safety was also a significant predictor,  $\beta = .318, p < .001, sr^2 = 0.069$ , indicating that the higher perceptions participants have of being able to safely use Snapchat while driving, the more likely they were to partake in this behaviour.

## 7. General discussion

This study, to the best of the authors’ knowledge, is the first to explore the deterrent mechanisms associated with the behaviour of Snapchat use while driving. The deterrence mechanisms associated with this behaviour were first identified in the qualitative phase of the study, while the subsequent quantitative phase operationalised these variables and produced quantifiable results. The aim of the first study

was to identify the deterrent factors for hand-held phone use while driving and the prevalent social media while driving behaviours among young drivers. Meanwhile, the second study aimed to identify the legal and non-legal mechanisms that deter young drivers from using Snapchat while driving.

### 7.1. Snapchat while driving

The focus group results identified that Snapchat was the social media phone behaviour most engaged in by young adults when driving. This was associated with the clear purpose of using this application while driving, which is not present in other types of social media. The most common reason reported for using Snapchat while driving was to send a video or photo of something they saw while driving. Other reasons included to use the Snapchat speed filter, to send a video or photo of themselves while driving, to relieve boredom, to reply to someone or to keep their streak up. While the quantitative study identified that the majority of participants do not use Snapchat while driving, 79 participants (15.8%) did report using Snapchat while driving at some point. Further, the majority of participants reported knowing someone who does use Snapchat while driving but most of those participants disagree with this behaviour. However, it is concerning that 27.3% of participants reported feeling either neutral about this, agreed with the behaviour depending on the circumstance or out rightly agreed with the behaviour. The majority of participants reported they are most likely to use Snapchat while stopped at a red light. This is an encouraging result and is consistent with the results from [George et al. \(2018\)](#) as well as previous research that has found drivers can self-regulate their phone use while driving behaviour so that they use their phone while driving in low risk situations, such as traffic lights ([Oviedo-Trespacios et al., 2019a](#)). This was followed by using Snapchat while driving on an empty road, while driving at any speed and while driving in traffic. These results highlight the problem behaviour of Snapchat use while driving.

### 7.2. Deterrence theories and snapchat while driving

An important finding was the lack of impact associated with legal deterrence. None of the classical deterrence variables reached significance. Historically, research has found the certainty of apprehension construct to have a strong influence on reducing offending behaviour for a number of criminal offences (e.g., [Grasmick et al., 1983](#); [Silberman, 1976](#); [Teevan, 1976](#); [Von Hirsch et al., 1999](#)). However, when this has been applied to road rule violations, this variable has not had such a strong influence ([Fleiter and Watson, 2006](#); [Fleiter et al., 2009](#); [Truelove et al., 2017](#)). Therefore, a lack of significance for the certainty of apprehension construct is not surprising when it is also applied to the behaviour of Snapchat use while driving. This result may be explained by a perceived lack of enforcement with this law, as identified in the focus group results. This is also consistent with previous research on young driver perceptions of deterrence when applied to road safety ([Allen et al., 2015](#); [Bates et al., 2017](#)). The lack of cameras in Queensland, Australia that detect phone use while driving is likely to have an influence on these low perceptions of legal deterrence, as this was the primary method of detection identified by participants in the focus groups despite their lack of implementation in the jurisdiction. The lack of significance for the severity classical deterrence variable may be connected to the lack of significance in the certainty of apprehension variable. It has been suggested that if an individual perceives a low chance of apprehension certainty for committing a criminal offence, then the severity of punishment for that offence will not have a large impact on the individual because they believe it is unlikely they will be caught and punished ([Grasmick, and Bryjak, 1980](#); [Howe, and Loftus, 1996](#)). Additionally, previous road safety research has found the relationship between severity of punishment and road rule compliance to be tenuous ([Freeman et al., 2016](#); [Homel, 1988](#); [Szogi](#)

[et al., 2017](#); [Truelove et al., 2017](#)).

The insignificant swiftness result is consistent with previous road safety research ([Fleiter, 2010](#); [Fleiter, and Watson, 2006](#); [Szogi et al., 2017](#); [Truelove et al., 2017](#)). It has been acknowledged that penalties are not delivered in a swift manner ([Babor et al., 2003](#); [Davey, and Freeman, 2011](#)), which can help explain the insignificant results. The large gap between being apprehended for an offence and receiving the punishment is an area that should receive more attention. [Beccaria \(1764/2007\)](#) [Beccaria, 2019](#) [Beccaria \(1764/2007\)](#) explained that a swift punishment should be entertained as it connects the idea between crime and punishment much more strongly within society, therefore the larger the delay between the two, the larger they are separated within people's minds. Additionally, psychological models of behavioural change have illustrated that the time between a stimulus and a response can be vital in the learning of new behaviours ([Skinner, 1938](#)).

While the classical deterrence items did not reach significance, indirect punishment from the reconceptualised deterrence theory ([Stafford, and Warr, 1993](#)) was a significant predictor, indicating that drivers whose friends have used Snapchat while driving and have been caught, are less likely to use Snapchat themselves while driving. This is an encouraging result as this means perceptions of enforcement can be increased through the experiences of others, and this can significantly impact the offending behaviour. Direct punishment reached significance, however this was in the opposite direction than expected, indicating that drivers who have been caught and punished for phone use while driving are more likely to participate in Snapchat use while driving. This can be considered an emboldening effect, in which the direct punishment variable is identifying participants who are steadfast in their phone use while driving behaviour, therefore the punishment for this behaviour occurs most often among those participants ([Allen et al., 2015](#); [Piquero, and Pogarsky, 2002](#)). In addition to the above results, indirect punishment avoidance was also a significant predictor, which indicates that knowing a friend who uses Snapchat while driving who has not been caught for the violation, significantly influences that individual to also use Snapchat while driving. Furthermore, the behaviour of using Snapchat while driving themselves and not being caught and punished (i.e., direct punishment avoidance) was also a significant predictor. While, to the best of the authors' knowledge, research has not yet applied the reconceptualised deterrence theory to phone use while driving, previous research in drink driving has found similar results for direct punishment avoidance ([Armstrong et al., 2005](#); [Freeman and Watson, 2009](#); [Piquero and Paternoster, 1998](#); [Szogi et al., 2017](#)). However, indirect punishment avoidance had not reached significance in the above studies. The significant indirect punishment avoidance result in this study may be due to the social nature of Snapchat, which may not necessarily be present in drink driving. Furthermore, there are major differences in the type of violations between drink driving and Snapchat use while driving. Based on the road rule violation definitions by [Scott-Parker et al. \(2010\)](#), drink driving can be considered a fixed violation (i.e. it remains stable throughout the journey in the vehicle) while Snapchat while driving is a transient violation (i.e. it does not remain fixed and can occur at multiple times in the vehicle's journey). Additionally, there is no method available to avoid detection of drink driving when breathalysed, whereas it can be considered easy to avoid detection for using Snapchat while driving. The lack of enforcement for Snapchat while driving may also be connected to the punishment avoidance results, as this significantly influences young drivers to continue using Snapchat while driving if they have participated in this behaviour and not been caught.

As both indirect punishment and indirect punishment avoidance were significant predictors, the impact of peers on Snapchat use while driving is an important area to explore in future research, as Snapchat is a social behaviour. Previous research on general mobile phone use while driving identified that perceived peer approval of this behaviour significantly influences individuals to plan to use their phone while driving ([Waddell and Wiener, 2014](#); [Walsh et al., 2008](#)). This study only

examined the factors of indirect punishment and indirect punishment avoidance, therefore future research could focus on the specific impact of social pressure on Snapchat use while driving, especially as this study also identified that this behaviour has mixed perceptions of acceptance among young drivers.

These findings have important implications. Young drivers have low perceptions of enforcement certainty for the behaviour of Snapchat use while driving and as such, legal deterrents do not have a significant impact on their behaviour. Therefore, increasing perceptions of enforcement is necessary to allow the legal countermeasures to have a deterrent impact. Increased police presence, installing cameras that can catch phone use while driving or implementing media campaigns that increase perceptions of enforcement are some possible suggestions.

While the implementation of cameras to detect phone use while driving appears to be a promising solution (and will soon commence in the state of New South Wales), particularly in increasing perceptions of certainty of apprehension and enhancing a stronger deterrent effect, there is the problem of drivers concealing their behaviour. The significance of this problem will (in part) be elucidated by the level of technological advancement (and accuracy) of cameras utilised to address the problem. This issue is particularly important given that [Gauld et al. \(2014\)](#) found that among young drivers aged 17–25 years, sending and reading text messages as well as making and answering a phone call frequently occurred in a concealed manner. More specifically, keeping the phone in a low position, for example in the passenger seat or the lap of the driver, was reportedly drivers' preferred strategy for avoiding detection for texting and calling activities while driving ([Oviedo-Trespalacios et al., 2017](#)) and is used to increase drivers' exposure to these phone behaviours while driving ([Oviedo-Trespalacios, 2018](#)). It has also been found that drivers who engage in concealed phone use while driving behaviour also engage in visual-manual tasks more frequently ([Oviedo-Trespalacios, 2018](#)). Using the phone in a concealed manner while driving is more demanding and takes additional attention away from the driving task, resulting in further dangers associated with this behaviour ([Alconera et al., 2017](#)). This presents a concern for the legal countermeasures of police and cameras that detect phone use while driving behaviour. Based on this, it could be suggested that only cameras that are able to detect concealed phone use while driving should be implemented. However, the broader "general deterrent" effect of such an approach cannot be dismissed, as even the threat of apprehension has been shown to have a salutary effect on road safety. Other potential solutions involve technology that automatically detects the phone use via radio frequencies ([Oviedo-Trespalacios, 2018](#)). Meanwhile, detecting concealed phone use while driving is a larger issue for police. This highlights the importance of implementing additional non-legal countermeasures, for example media campaigns, that can target this behaviour.

When considering these implications, it is important to note that technology is rapidly changing, although the underlying constructs of the task may prove to be consistent (e.g., elevated distraction, the need for texting/type, etc). It is necessary to keep up to date with the emerging technology that can provide additional distraction while driving. However, due to the constant changes in technology, legal countermeasures may not need to be restricted to any specific phone behaviours such as Snapchat. Instead, the results of the impact of legal countermeasures on Snapchat while driving from this study highlight the importance of increasing perceived certainty of apprehension for hand-held phone use while driving overall, especially since Snapchat while driving can be considered a more visible phone behaviour compared to other types of phone use (e.g. texting).

Another issue to consider when examining legal countermeasures is the self-regulation of phone use while driving. [Oviedo-Trespalacios et al. \(2019a\)](#) identified that strategic self-regulation in which drivers decide to use their phone in less dangerous situations such as traffic lights may be encouraged as opposed to using their phone in more dangerous driving situations. However, a number of factors need to be

considered here including an analysis of the safety of using certain phone functions in these scenarios, the impact on road congestion, as well as the impact this would have on drivers' perceived legitimacy of the law and danger associated with the behaviour. Other potential solutions to phone use while driving may include voluntary applications that block social media and other dangerous phone functions while driving, however the voluntary nature of these applications presents a barrier to their effectiveness in reducing distracted driving ([Oviedo-Trespalacios et al., 2019b](#)).

### 7.3. Safety and snapchat while driving

Young drivers' perception of safety associated with sending videos or photos through Snapchat while driving also had a significant impact on this behaviour. Specifically, participants who had higher perceptions relating to safely being able to use Snapchat while driving were more likely to partake in the behaviour. This is in contrast with a previous study, which examined hand-held mobile phone use while driving generally, and it was identified that even though frequent users view the perception of risk associated with this behaviour as high, they still continue to use their phones while driving ([White et al., 2010](#)). It was suggested that this may be due to participants perceiving the benefits of using a hand-held phone while driving outweighing the risks. The benefits of using Snapchat while driving may not be perceived as high as other hand-held phone behaviours, for example calling and texting, which may help in explaining the differences in results. However, when considering the comparability of this study, it is important to note that participants were of various ages and not restricted to drivers aged under 25 years. It should also be noted that different constructs were used to measure this behaviour; this study measured perceived ability to safely use Snapchat while driving while the study by [White et al. \(2010\)](#) examined perceived risk of an accident. Future research should examine the perceived benefits of using Snapchat while driving to gain a further understanding of this behaviour. In addition, it would be beneficial for future research to utilise a comparison of the behaviour of Snapchat use while driving with other phone functions.

The results from this study highlight the necessity of increasing awareness of the dangers associated with Snapchat use while driving, as these perceptions had a significant impact on behaviour. A focus on increasing awareness of risks for phone use while driving in general may be warranted as it is likely this non-legal factor also impacts engagement in other types of phone use while driving behaviours. This will also make such a campaign more feasible.

### 7.4. Limitations

A limitation that needs to be acknowledged is that participants for both the focus groups and questionnaire were recruited from the Australian state of Queensland, excluding rural and remote areas, which may not be representative of the wider population. In addition, both the focus groups and questionnaire consisted of self-report data. As such, there is the possibility of self-report bias. Furthermore, there is also the possibility of group bias effects for the focus groups, in which participants conform to the opinions of others ([Morgan, 1996](#)). In an effort to control for this, at the beginning of each focus group, all participants were told to give their own opinion, even if it was different from others. While the group setting does provide a limitation, it also gave an opportunity for participants to interact with each other; this was to help obtain the social understanding of the topic under study, as well as to allow participants to challenge each other and have the opportunity to refine what they have to say, which is beneficial to the research, especially when trying to ascertain participants' perceptions ([Forrester, 2010](#); [Lewis, 2003](#); [Ritchie, 2003](#)). A further limitation is the lack of comparison between other types of social media use in the survey. Due to the evolving nature of technology, it may be of merit to consider this issue in future research. Additionally, the two items for

Snapchat use while driving may be considered to involve some different components of the behaviour, as one question asked about frequency of using Snapchat in general while driving and the other question asked about frequency of sending a video or photo via Snapchat while driving. This is something to consider in future research. However, for this study, these items may be considered to reliably reflect the behaviour of sending a video or photo via Snapchat while driving as 1) the focus groups identified few (i.e. four) participants reported that Snapchat is used for any reason other than sending a video or photo while driving, 2) the Cronbach's alpha and Spearman-Brown coefficient is strong for these items and 3) the reported frequency for both items is very similar.

## 7.5. Conclusion

The results offer an important addition to the existing literature, which had yet to explore Snapchat use while driving and the types of deterrents that are effective in decreasing this behaviour among young adults. Snapchat while driving was associated with unique purposes compared to other social media behaviours and other phone uses in general. This highlights the necessity of separating this behaviour from other types of phone use while driving. It is suggested that increasing perceptions of certainty of apprehension for phone use while driving is an important area that can be applied to phone use while driving behaviours in general, to increase compliance with this restriction. This study provides areas for the development and modification of countermeasures surrounding Snapchat use while driving which may reduce the rate of road trauma among young drivers.

## Conflict of interest

Nothing declared.

## Acknowledgement

This research was funded by the Australian Research Council Discovery Scheme and the Institute of Health and Biomedical Innovation, Australia research student funding.

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.aap.2019.06.008>.

## References

- Alconera, A.M., Garcia, L., Mercado, J.C., Portus, A.J., 2017. A study on the positioning of a mounted mobile phone to reduce distraction while driving among young adults. In: Stanton, N., Landry, S., Di Bucchianico, G., Vallicelli, A. (Eds.), *Advances in Human Aspects of Transportation*, vol 484 Springer, Cham.
- Allen, S., Murphy, K., Bates, L., 2015. What drives compliance? The effect of deterrence and shame emotions on young drivers' compliance with road laws. *Policing Soc.* 1–15. <https://doi.org/10.1080/10439463.2015.1115502>.
- Armstrong, K., Wills, A., Watson, B., 2005. Psychosocial influences on drug driving in young Australian drivers. *Australian Road Safety Research Policing Education Conference*.
- Australian Bureau of Statistics, 2017. 2016 Census – a 'selfie' of Young People in Australia. Retrieved from: <http://www.abs.gov.au/ausstats/abs%40.nsf/mediareleasesbyCatalogue/AC02F0705E320F58CA25817C00016A47?OpenDocument>.
- Australian Government Department of Infrastructure and Regional Development, 2017. *Road Trauma Australia 2016 Statistical Summary*. Canberra.
- Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., et al., 2003. *Alcohol: No Ordinary Commodity*. Research and Public Policy. Oxford University Press, Oxford.
- Backer-Grøndahl, A., Sagberg, F., 2011. Driving and telephoning: relative accident risk when using hand-held and hands-free mobile phones. *Saf. Sci.* 49 (2), 324–330. <https://doi.org/10.1016/j.ssci.2010.09.009>.
- Basacik, D., Reed, N., Robbins, R., 2011. *Smartphone Use While Driving: a Simulator Study* (Report PPR592). The Institute of Advanced Motorists., London.
- Bates, L., Darvell, M.J., Watson, B., 2017. Young and unaffected by road policing strategies: using deterrence theory to explain provisional drivers' (non)compliance. *Aust. N. Z. J. Criminol.* 50 (1), 23–38. <https://doi.org/10.1177/0004865815589824>.
- Beccaria, C., 2007. In: Bellamy, R., Davies, R., Cox, V. (Eds.), *On Crimes and Punishments and Other Writings*. Cambridge University Press, New York.
- Bentham, J., 1970. In: Burns, J.H., Hart, H.L. (Eds.), *An Introduction to the Principles of Morals and Legislation*. The Athlone Press, London.
- Braitman, K.A., Braitman, A.L., 2017. Patterns of distracted driving behaviors among young adult drivers: exploring relationships with personality variables. *Transportation Research Part F: Traffic Psychology and Behavior* 46, 169–176. <https://doi.org/10.1016/j.trf.2017.01.015>.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>.
- Bushway, S., DeAngelo, G., Hansen, B., 2013. Deterability by age. *Int. Rev. Law Econ.* 36, 70–81. <https://doi.org/10.1016/j.irle.2013.04.006>.
- Clarke, V., Braun, V., Hayfield, N., 2015. Thematic analysis. In: Smith, A. (Ed.), *Qualitative Psychology: A Practical Guide to Research Methods*, 3rd ed. SAGE Publications, London, pp. 222–248.
- Davey, J.D., Freeman, J.E., 2011. Improving road safety through deterrence-based initiatives: a review of research. *Sultan Qaboos Univ. Med. J.* 11 (1), 29–37.
- Ehsani, J.P., Bingham, C.R., Ionides, E., Childers, D., 2014. The impact of Michigan's text messaging restriction on motor vehicle crashes. *J. Adolesc. Health* 54 (5), S68–S74. <https://doi.org/10.1016/j.jadohealth.2014.01.003>.
- Eisinga, R., Grotenhuis, M., Pelzer, B., 2013. The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *Int. J. Public Health* 58 (4), 637–642. <https://doi.org/10.1007/s00038-012-0416-3>.
- Engström, J., Johansson, E., Östlund, J., 2005. Effects of visual and cognitive load in real and simulated motorway driving. *Transp. Res. Part F Traffic Psychol. Behav.* 8 (2), 97–120. <https://doi.org/10.1016/j.trf.2005.04.012>.
- Farris, A.M., 2011. LOL? Texting while driving is no laughing matter: proposing a coordinated response to curb this dangerous activity. *Washington University Journal of Law & Policy* 36, 233.
- Field, A., 2013. *Discovering Statistics Using IBM SPSS Statistics*, 4th edition. SAGE Publications Ltd.
- Fitch, G., Toole, L., Grove, K., Soccolich, S., Hanowski, R.J., 2017. *Investigating Drivers' Compensatory Behavior When Using a Mobile Device*. National Surface Transportation Safety Center for Excellence (NSTSC, VTTI), Washington, DC.
- Finch, H., Lewis, J., 2003. Focus groups. In: Ritchie, J., Lewis, J. (Eds.), *Qualitative Research Practice: a Guide for Social Science Students and Researchers*. SAGE Publications, London, pp. 170–198.
- Fleiter, J.J., 2010. *Examining Psychosocial Influences on Speeding in Australian and Chinese Contexts: a Social Learning Approach* (PhD).
- Fleiter, J.J., Watson, B.C., 2006. The speed paradox: the misalignment between driver attitudes and speeding behaviour. *J. Australas. Coll. Road Saf.* 17 (2), 23–30.
- Fleiter, J.J., Watson, B.C., Lennon, A.J., King, M.J., Shi, K., 2009. Speeding in Australia and China : a comparison of the influence of legal sanctions and enforcement practices on car drivers. Paper Presented at Proceedings of the 2009 Australasian Road Safety Research, Policing and Education Conference : Smarter, Safer Directions.
- Forrester, M., 2010. *Doing Qualitative Research in Psychology*. SAGE Publications, London.
- Foss, R.D., Goodwin, A.H., McCart, A.T., Hellinga, L.A., 2009. Short-term effects of a teenage driver cell phone restriction. *Accid. Anal. Prev.* 41 (3), 419–424. <https://doi.org/10.1016/j.aap.2009.01.004>.
- Freeman, J., Armstrong, K., Truelove, V., Szogi, E., 2015. Left on the side of the road? A review of deterrence-based theoretical developments in road safety. *Australasian Road Safety Conference 2015*.
- Freeman, J., Kaye, S.-A., Truelove, V., Davey, J., 2017. Age, gender and deterrability: Are younger male drivers more likely to discount the future? *Accid. Anal. Prev.* 104, 1–9. <https://doi.org/10.1016/j.aap.2017.03.022>.
- Freeman, J., Szogi, E., Truelove, V., Vingilis, E., 2016. The law isn't everything: the impact of legal and non-legal sanctions on motorists' drink driving behaviors. *J. Safety Res.* 59, 53–60. <https://doi.org/10.1016/j.jsr.2016.10.001>.
- Freeman, J., Watson, B., 2006. An application of Stafford and Warr's reconceptualisation of deterrence to a group of recidivist drink drivers. *Accid. Anal. Prev.* 38 (3), 462–471. <https://doi.org/10.1016/j.aap.2005.11.001>.
- Freeman, J., Watson, B., 2009. Drink driving deterrents and self-reported offending behaviours among a sample of Queensland motorists. *J. Safety Res.* 40 (2), 113–120. <https://doi.org/10.1016/j.jsr.2008.12.009>.
- Gauld, C.S., Lewis, I., White, K.M., 2014. Concealing their communication: exploring psychosocial predictors of young drivers' intentions and engagement in concealed texting. *Accid. Anal. Prev.* 62, 285–293. <https://doi.org/10.1016/j.aap.2013.10.016>.
- Gauld, C.S., Lewis, I., White, K.M., Fleiter, J.J., Watson, B., 2017. Smartphone use while driving: What factors predict young drivers' intentions to initiate, read, and respond to social interactive technology? *Comput. Human Behav.* 76, 174–183. <https://doi.org/10.1016/j.chb.2017.07.023>.
- George, A.M., Brown, P.M., Scholz, B., Scott-Parker, B., Rickwood, D., 2018. "I need to skip a song because it sucks": exploring mobile phone use while driving among young adults. *Transp. Res. Part F: Psychol. Behav.* 58, 382–391. <https://doi.org/10.1016/j.trf.2018.06.014>.
- Gliklich, E., Guo, R., Bergmark, R.W., 2016. Texting while driving: a study of 1211 U.S. Adults with the distracted driving survey. *Prev. Med. Rep.* 4, 486–489. <https://doi.org/10.1016/j.pmedr.2016.09.003>.
- Goodwin, A.H., O'Brien, N.P., Foss, R.D., 2012. Effect of North Carolina's restriction on teenage driver cell phone use two years after implementation. *Accid. Anal. Prev.* 48, 363–367. <https://doi.org/10.1016/j.aap.2012.02.006>.
- Grasmick, H.G., Bryjak, G.J., 1980. The Deterrent effect of perceived severity of punishment. *Soc. Forces* 59 (2), 471–491. <https://doi.org/10.1093/sf/59.2.471>.
- Grasmick, H.G., Jacobs, D., Carol, B.M.C., 1983. Social class and social control: an application of deterrence theory. *Soc. Forces* 62 (2), 359–374. <https://doi.org/10.2307/>

- 2578312.
- Hancock, B., Windridge, K., Ockleford, E., 2009. An Introduction to Qualitative Research. The NIHR Research Design Service, Nottingham and Sheffield.
- Highway Loss Data Institute, 2010. Texting laws and collision claim frequencies. Highway Loss Data Institute bulletin 27 (11) Retrieved from. <http://www.iihs.org/iihs/topics>.
- Hommel, J., 1988. Policing and Punishing the Drinking Driver: a Study of Specific and General Deterrence. Springer-Verlag, New York.
- Howe, E.S., Loftus, T.C., 1996. Integration of certainty, severity and celerity information in judged deterrence value: further evidence and methodological equivalence. *J. Appl. Soc. Psychol.* 26 (3), 226–248. <https://doi.org/10.1111/j.1559-1816.1996.tb01848.x>.
- Ismeik, M., Al-Kaisy, A., Al-Ansari, K., 2015. Perceived risk of phoning while driving: a case study from Jordan. *Saf. Sci.* 78, 1–10. <https://doi.org/10.1016/j.ssci.2015.02.011>.
- Jamson, H., Merat, N., 2005. Surrogate in-vehicle information systems and driver behaviour: effects of visual and cognitive load in simulated rural driving. *Transp. Res. Part F Traffic Psychol. Behav.* 8 (2), 79–96. <https://doi.org/10.1016/j.trf.2005.04.002>.
- Johal, S., Napier, F., Britt-Compton, J., Marshall, T., 2005. Mobile phones and driving. *J. Public Health (Bangkok)* 27 (1), 112–113. <https://doi.org/10.1093/pubmed/fdh213>.
- Klauer, S.G., Dingus, T.A., Neale, V.L., Sudweeks, J.D., Ramsey, D.J., 2006. The Impact of Driver Inattention on near-crash/crash Risk: an Analysis Using the 100-car Naturalistic Driving Study Data (Report No. DOT HS 810 594). National Highway Traffic Safety Administration, Washington.
- Lewis, J., 2003. Design issues. In: Ritchie, J., Lewis, J. (Eds.), *Qualitative Research Practice: a Guide for Social Science Students and Researchers*. SAGE Publications, London, pp. 47–76.
- Mason, M., 2010. Sample size and saturation in PhD studies using qualitative interviews. *Forum Qual. Soc. Res.* 11 (3) Retrieved from. <http://www.qualitative-research.net>.
- McCart, A.T., Hellinga, L.A., Strouse, L.M., Farmer, C.M., 2010. Long-term effects of handheld cell phone laws on driver handheld cell phone use. *Traffic Inj. Prev.* 11 (2), 133–141. <https://doi.org/10.1080/15389580903515427>.
- McDonald, C.C., Sommers, M.S., 2015. Teen drivers' perceptions of inattention and cell phone use while driving. *Traffic Inj. Prev.* 16 (2), 52–58. <https://doi.org/10.1080/15389588.2015.1062886>.
- McKeever, J.D., Schultheis, M.T., Padmanaban, V., Blasco, A., 2013. Driver performance while texting: even a little is too much. *Traffic Inj. Prev.* 14 (2), 132–137.
- McNabb, J., Gray, R., 2016. Staying connected on the road: a comparison of different type of smart phone use in a driving simulator. *PLoS One* 11 (2), 1–12. <https://doi.org/10.1371/journal.pone.0148555>.
- Morgan, D.L., 1996. Focus groups. *Annu. Rev. Sociol.* 22, 129–152.
- Neyens, D., Boyle, L., 2008. The influence of driver distraction on the severity of injuries sustained by teenage drivers and their passengers. *Accid. Anal. Prev.* 40 (1), 254–259. <https://doi.org/10.1016/j.aap.2007.06.005>.
- Oviedo-Trespalacios, O., 2018. Getting away with texting: behavioural adaptation of drivers engaging in visual-manual tasks while driving. *Transportation Research Part A* 116, 112–121. <https://doi.org/10.1016/j.tra.2018.05.006>.
- Oviedo-Trespalacios, O., Haque, M., King, M., Demmel, S., 2018a. Driving behaviour while self-regulating mobile phone interactions: a human-machine system approach. *Accid. Anal. Prev.* 118, 253–262. <https://doi.org/10.1016/j.aap.2018.03.020>.
- Oviedo-Trespalacios, O., Hague, M.M., King, M., Washington, S., 2016. Understanding the impacts of mobile phone distraction on driving performance: a systematic review. *Transp. Res. Part C – Emerg. Technol.* 72, 360–380. <https://doi.org/10.1016/j.trc.2016.10.006>.
- Oviedo-Trespalacios, O., Haque, M.M., King, M., Washington, S., 2018b. Should I text or call Here? A situation-based analysis of drivers' perceived likelihood of engaging in mobile phone multitasking. *Risk Anal.* 38 (10), 2144–2160. <https://doi.org/10.1111/risa.13119>.
- Oviedo-Trespalacios, O., Haque, M., King, M., Washington, S., 2019a. "Mate! I'm running 10 min late": an investigation into the self-regulation of mobile phone tasks while driving. *Accid. Anal. Prev.* 122, 134–142. <https://doi.org/10.1016/j.aap.2018.09.020>.
- Oviedo-Trespalacios, O., King, M., Haque, M., Washington, S., 2017. Risk factors of mobile phone use while driving in Queensland: Prevalence, attitudes, crash risk perception, and task-management strategies. (Research Article) (Report). *PLoS One* 12 (9), e0183361. <https://doi.org/10.1371/journal.pone.0183361>.
- Oviedo-Trespalacios, O., King, M., Vaezipour, A., Truelove, V., 2019b. Can our phones keep us safe? A content analysis of smartphone applications to prevent mobile phone distracted driving. *Transportation Research Part F: Psychology and Behaviour* 60, 657–668. <https://doi.org/10.1016/j.trf.2018.11.017>.
- Oviedo-Trespalacios, O., Nandavar, S., Newton, J.D.A., Demant, D., Phillips, J.G., 2019c. Problematic Use of Mobile Phones in Australia...Is It Getting Worse? *Front. Psychiatry* 10 (105). <https://doi.org/10.3389/fpsy.2019.00105>.
- Piquero, A., Paternoster, R., 1998. An application of Stafford and Warr's reconceptualization of deterrence to drinking and driving. *J. Res. Crime Delinq.* 35 (1), 3–39. <https://doi.org/10.1177/0022427898035001001>.
- Piquero, A.R., Pogarsky, G., 2002. Beyond Stafford and Warr's reconceptualization of deterrence: personal and vicarious experiences, impulsivity, and offending behavior. *J. Res. Crime Delinq.* 39 (2), 153–186.
- Poysti, L., Rajalin, S., Summala, H., 2005. Factors influencing the use of cellular (mobile) phone during driving and hazards while using it. *Accid. Anal. Prev.* 37 (1), 47–51. <https://doi.org/10.1016/j.aap.2004.06.003>.
- Prat, F., Gras, M.E., Planes, M., Gonzalez-Iglesias, B., Sunman, M.J.M., 2015. Psychological predictors of texting while driving among university students. *Transportation Research Part F – Traffic Psychology and Behaviour* 34, 76–85. <https://doi.org/10.1016/j.trf.2015.07.023>.
- Queensland Government Department of Transport and Main Roads, 2016. Young Drivers. Retrieved from. <http://www.tmr.qld.gov.au/Licensing/Learning-to-drive/Young-drivers.aspx>.
- Ritchie, J., 2003. The applications of qualitative methods to social research. In: Ritchie, J., Lewis, J. (Eds.), *Qualitative Research Practice: a Guide for Social Science Students and Researchers*. SAGE Publications, London, pp. 24–26.
- Roethlisberger, F.J., Dickson, W., 1939. *Management and the Worker*. Harvard University Press, Cambridge, Ma.
- Sampson, R.J., Cohen, J., 1988. Deterrent effects of the police on crime: a replication and theoretical extension. *Law Soc. Rev.* 22 (1), 163–189.
- Scott-Parker, B., Watson, B., King, M., 2010. The Behaviour of Young Novice Drivers Scale (BYNDS).
- Sedgwick, P., Greenwood, N., 2015. Understanding the Hawthorne effect. *Br. Med. J.* 351. <https://doi.org/10.1136/bmj.h4672>.
- Silberman, M., 1976. Toward a theory of criminal deterrence. *Am. Sociol. Rev.* 41 (3), 442–461.
- Skinner, B.F., 1938. *The Behavior of Organisms: an Experimental Analysis*. Appleton-Century, Oxford, England.
- Stafford, M.C., Warr, M., 1993. A reconceptualization of general and specific deterrence. *J. Res. Crime Delinq.* 30 (2), 123–135. <https://doi.org/10.1177/0022427893030002001>.
- Szogi, E., Darvell, M., Freeman, J., Truelove, V., Palk, G., Davey, J., Armstrong, K., 2017. Does getting away with it count? An application of stafford and warr's reconceptualised model of deterrence to drink driving. *Accid. Anal. Prev.* 108, 261–267. <https://doi.org/10.1016/j.aap.2017.08.006>.
- Tabachnick, B., Fidell, L., 2019. *Using Multivariate Statistics*, 7th ed. Pearson Education, Boston.
- Teevan, J.J., 1976. Subjective perception of deterrence (continued). *J. Res. Crime Delinq.* 13 (2), 155–164. <https://doi.org/10.1177/0022427876013002006>.
- Tian, Y., Robinson, J.D., 2016. Predictors of cell phone use in distracted driving: extending the Theory of Planned Behavior. *Health Commun.* <https://doi.org/10.1080/10410236.2016.1196639>.
- Truelove, V., Freeman, J., Davey, J., 2019. "You can't be deterred by stuff you don't know about": Identifying factors that influence graduated driver licensing rule compliance. *Saf. Sci.* 111, 313–323. <https://doi.org/10.1016/j.ssci.2018.09.007>.
- Truelove, V., Freeman, J., Szogi, E., Kaye, S., Davey, J., Armstrong, K., 2017. Beyond the threat of legal sanctions: What deters speeding behaviours? *Transp. Res. Part F Traffic Psychol. Behav.* 50, 128–136. <https://doi.org/10.1016/j.trf.2017.08.008>.
- van Teijlingen, E., Hundley, V., 2002. The importance of pilot studies. *Nurs. Stand.* 16 (40), 33–36. <https://doi.org/10.7748/ns.16.40.33.s1>.
- Vogel, S., Draper-Rodi, J., 2017. The importance of pilot studies, how to write them and what they mean. *Int. J. Osteopath. Med.* 23, 2–3. <https://doi.org/10.1016/j.ijosm.2017.02.001>.
- Von Hirsch, A., Bottoms, E., Burney, E., Wilkstrom, 1999. *Criminal Deterrence and Sentence Severity: an Analysis of Recent Research*. Hart Publishing, Oxford, UK.
- Waddell, L.P., Wiener, K.K.K., 2014. What's driving illegal mobile phone use? Psychosocial influences on drivers' intentions to use hand-held mobile phones. *Transp. Res. Part F Traffic Psychol. Behav.* 22, 1–11. <https://doi.org/10.1016/j.trf.2013.10.008>.
- Walsh, S.P., White, K.M., Hyde, M.K., Watson, B., 2008. Dialling and driving: factors influencing intentions to use a mobile phone while driving. *Accid. Anal. Prev.* 40 (6), 1893–1900. <https://doi.org/10.1016/j.aap.2008.07.005>.
- Watson, B., Freeman, J., 2007. Perceptions and experiences of random breath testing in Queensland and the self-reported deterrent impact on drunk driving. *Traffic Inj. Prev.* 8 (1), 11–19. <https://doi.org/10.1080/15389580601027360>.
- White, K.M., Hyde, M.K., Walsh, S.P., Watson, B., 2010. Mobile phone use while driving: an investigation of the beliefs influencing drivers' hands-free and hand-held mobile phone use. *Transp. Res. Part F Traffic Psychol. Behav.* 13 (1), 9–20. <https://doi.org/10.1016/j.trf.2009.09.004>.
- World Health Organisation, 2015. *Global Status Report on Road Safety*. Geneva, Switzerland.
- Young, K.L., Rudin-Brown, C.M., Patten, C., Ceci, R., Lenné, M.G., 2014. Effects of phone type on driving and eye glance behaviour while text-messaging. *Saf. Sci.* 68, 47–54.