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Texting, Drugs and Driving: A "Triple Threat" To Driving Safety?

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Abstract

Driving is an important task that demands the full attention of the driver. There are many different factors that can compromise driving performance and lead to vehicle crashes. Perhaps two of the most common, yet also the most dangerous, are drug (including alcohol) influences on driving and distractions using handheld devices like cell phone calls and/or texting. Although each of these driving disruptors has been studied separately and has been shown to adversely affect driving performance, there is a paucity of data regarding the effects of these driving disruptors when combined. Given the explosion of handheld electronic devices, and the likelihood that drivers are using these devices when they are driving, it is not surprising that reports of crashes relating to this 'triple threat' combination of drugs (including alcohol), texting and driving are on the rise and in the news. Clearly, this 'triple threat' of texting, drugs and driving is a problem that requires research attention.

Keywords: Texting; Driving; Drugs; Alcohol; Marijuana; Distractions

Drinking and Driving is a Serious Problem

Driving a motor vehicle is an important task that demands the full attention of the driver. Previous studies have reported on the adverse effects of alcohol (ethanol; EtOH) on driving performance; these studies have included epidemiological studies, real-world driving, simulator studies, and a variety of functional studies examining one or more component of the skills required for driving [1]. Many effects of EtOH adversely affect driving performance, including visual disturbances, incoordination, delayed reaction time, as well as increased aggression and risk-taking [2-4].

The legal limit for Driving While Intoxicated (DWI) exhibits rather wide variation across national jurisdictions. In much of the US and Canada, the legal limit for intoxication is 0.08% EtOH in blood, whereas in much of Europe the legal limit is considerably lower at 0.05% or below [5,6]. Although the good news is that the frequency of alcohol-related crashes and alcohol-related driving deaths has dropped dramatically over the past 30 years [7], alcohol continues to be a major problem on the roads; in the United States, approximately 40% of all traffic fatalities involved alcohol at BAC > 0.01% [5]. This figure was considerably lower (only 18%) in Sweden, where the legal limit for BAC, 0.02%, also is considerably lower (NHTSA, 2000). This is consistent with the finding by Longo et al. [8] that the Odds Ratio (OR; control = 1.0) for an alcohol-related crash is approximately 2.0, 6.0 and 10.0 as BAC values range from low (BAC = 0.00-0.049%), moderate (BAC = 0.50-0.0.79%), and high (BAC = 0.08-0.149%), respectively. Consistent with this, the occurrence of alcohol-related fatal crashes in Maine declined after the legal limit for BAC (for drivers with a previous DUI conviction) was reduced from 0.08% to 0.05% [9].

Texting/Cell Phone Use and Driving is a Serious Problem

In 2011, approximately 30% of drivers in the United States had read or sent text or e-mail messages while driving at least once in the past 30 days [10]; this figure had increased to nearly 35% in a 2012 survey [11]. Texting is a more dangerous distraction than cell phone use [12-14]. The "Urban Dictionary" uses the term 'intexticated' to describe people who drive while sending text messages on their phones [15]. Klauer et al. [12] have found that the duration of eye glances away from the roadway correlates with the odds ratio for having a crash or near-crash (100 car study). Indeed, Strayer et al. [16] have suggested "In fact, when controlling for driving difficulty and time on task, cell-phone drivers may actually exhibit greater impairments (i.e., more accidents and less responsive driving behavior) than legally intoxicated drivers".

Quite different from alcohol and driving, the statistics regarding texting and driving crashes are trending in the opposite direction, with an increase in texting while driving crashes over the past 10 years. In 2011, at any given daylight moments, over 600,000 drivers in the United States were texting while driving [17]. Indeed, a recent report on National Public Radio has suggested that for many individuals, texting has become an addiction, i.e., something that individuals cannot abstain from doing, even in inappropriate situations [18].

In recent years, several car manufacturers have introduced in-vehicle voice-to-text technology as an alternative to hand-held texting. Yeager [19] compared attitudes regarding driving safety and also actual driving performance with respect to hands-free texting (e.g., Siri, Vlingo), hand-held texting and no texting at all. The majority of survey respondents were of the opinion that in-vehicle sync systems and voice-to-text applications would be safer than hand-held texting. However, in actual driving performance tests, hand-held texting and hands-free texting (Siri, Vlingo) all increased driver response times compared to the no texting baseline condition and decreased the percent of time that the drivers' eyes were on the road. One criticism regarding the driving component of the study by Yeager relates to the

subjects' lack of familiarity with the hands-free technology. In more recent studies, hands-free texting has been shown to be less disruptive than hand-held texting, although hands-free texting is still more disruptive than no texting at all [20]. Moreover, although a precise figure is not available, it remains the case that many cars on the road are not equipped for hands-free texting. Thus, hand-held texting while driving continues to be a significant and dangerous example of distracted driving.

Drunk Texting Crashes: The New 'Triple Threat'?

"Drunk texting" (i.e., texting while drunk) has become a common social behaviour, as evidenced by the popularity (> 12 million views) of the YouTube video "Drunk Texting" by recording artist Chris Brown [21]. Whether by design or not, the song addresses several themes that were academically addressed by Horan in her study of drunken texting: (1) a social lubricant effects, (2) entertainment value, (3) coordination, (4) confession of emotions and (5) sexuality. Given the growing popularity of drunken texting, it is perhaps not surprising that media reports on the 'triple threat' of drunken texting while driving are on the rise. A Google search of "drunken texting crashes" revealed links to more than 10 incidents of the 'triple treat' of drunken texting being associated with crashes. In one of the most notorious recent reports [22], there were multiple links to reports regarding a female driver in Florida who had texted her ex-boyfriend "Drunk driving woo, I'll be dead thanks to you", shortly before crashing her car and killing her passenger. It seems that nobody is immune to this problem, with reports that NASCAR driver Michael Annett [23] and an off-duty Los Angeles Police Officer [24] also were involved in crashes involving drunken texting. Because of the likely increase in the frequency of drunken texting and driving, and the public health concerns associated with this problem, our research group has initiated a series of studies to examine this 'triple threat' of drinking, texting and driving using the driving simulator.

Model Paradigms for Studying Distracted Driving

In their excellent review, Kay and Logan [25] described many of the challenges involved in studying the effects of drugs on driving. They framed their discussion in the context of the Essential Driving Ability Domains (EDAD) model; domains including (1) alertness/arousal, (2) Attention and processing Speed, (3) Reaction Time/Psychomotor Functions, (4) Sensory-Perceptual Functioning and (5) Executive Functions. In our studies, we have used a high-fidelity full-size driving simulator (2001 Chevrolet Impala) and Hyper drive software. This method is sensitive to all five EDADs and thus represents an excellent model for safely studying the effects of drugs (including alcohol) and distractions like texting, alone and in combination, on driving behaviour.

Initial Study-Beer Goggles Potentiate the Adverse Effects of Texting on Driving Performance.

Our research group recently reported that the visual impairment produced by the so-called 'beer goggles' significantly potentiated the effects of texting to disrupt driving. Although beer goggles do not reflect the full range of the effects of ethanol, i.e., no incoordination, no delayed reaction time, no increased risk-taking, no road rage, the beer goggles do provide a level of visual impairment that is a significant part of the effects of ethanol [1,3,26-28]. Driving on a relatively 'easy' road, texting alone resulted in 'lane excursions' (defined as when the center of the car crosses leaves the designated driving lane) in approximately 20% of our drivers. Wearing the 'beer goggles' alone did not dramatically affect driving performance on this relatively easy road (i.e., 0% lane excursions), but the combination of 'beer goggles' and texting was found to produce driving impairment that was significantly worse than texting alone (lane excursions in > 50% of drivers; as shown in Figure 1). Similarly, texting alone increased several measures of inappropriate eye glance behaviour (number of glances away from the phone, mean/median duration of glances, total time with eyes off the road and longest time with eyes off the road), and all of these effects were potentiated by wearing the beer goggles [29]. Figure 1 shows Texting Alone resulted in lane excursions is slightly less that 20% of the drivers (18-25 years old); Beer Goggles significantly increased the frequency of occurrence of lane excursions to greater than 50% of drivers (Chi square = 6.79, df = 1, p = 0.0092). Driving without texting was not associated with lane excursions for either the Control Goggles or the Beer Goggles conditions (data not shown). Data redrawn from Palumbo et al. [29].

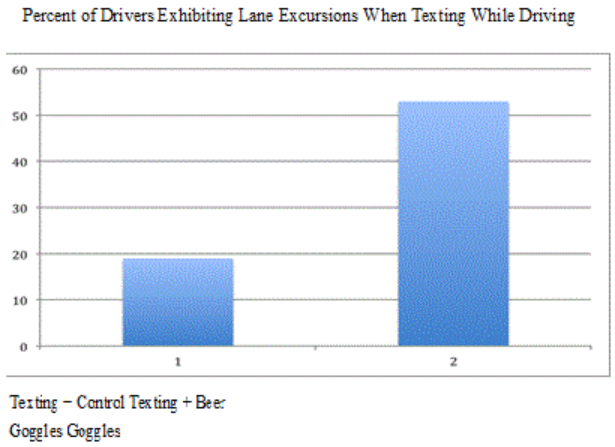

Figure 1: The Frequency of occurrence of lane excursions observed with texting alone versus texting with beer goggles.

Future Studies Regarding this 'Triple Threat': Ethanol, Marijuana (THC), Other Drugs.

The data above strongly suggest that the 'triple threat' of drugs, texting and driving can be worse than with either disruption alone. Clearly, the findings with beer goggles need to be replicated using ethanol itself. Several questions need to be addressed: (1) does alcohol exposure indeed potentiate the disruptive effects of texting on driving (2) does the interaction persist across a wide range of alcohol exposures (BAC values), or does it occur at a more narrow range of BAC values? Given the relatively high frequency of secondary tasks that drivers are engaged with today, these results may provide important additional evidence in discussions regarding whether the BAC cut-off in the US should be 0.08% (current federal mandate), 0.05%, as suggested recently by the National Transportation Safety Board [30], or possibly even lower. In addition, because the use of alcohol historically is vastly more prevalent than all other drugs, studies with alcohol and texting are needed to serve as a 'reference point' in evaluating data obtained with other drugs.

Another area where the potential impact of this 'triple threat' urgently needs to be examined is in the area of texting and marijuana and driving. For a comprehensive review of the effects of marijuana on

driving, the reader should be directed to Logan et al., Grotenhermen et al., Robbe and O'Hanlon [31-33]. In the US, overall marijuana use has increased dramatically from the 1969 (4%) until 1999 (34%), but has increased only modestly from 1999 (34%) until 2013 (38%). Over the period from 1999 to 2013 there has been a dramatic change in the age distribution of marijuana users, with the percentage of young (18-25 years old) users declining (46% to 36%) and the percentage of older (> 50 years old) users dramatically increasing (25% to 61%) [34]. between medical marijuana and legal marijuana use in several states (Colorado first, followed shortly by Oregon, Washington, Alaska and the District of Columbia), overall marijuana use is likely to increase further. This increased use of marijuana, combined with increased overall frequency of texting while driving translates to an increase in opportunities for the 'triple threat' of marijuana exposure, texting and driving.

Relative to the effects of ethanol (BAC 0.08%, 0.1%), marijuana has rather limited effects on driving performance, with several studies reporting no difference from control [35-37]. More recent studies, however, have demonstrated effects of marijuana on driving performance and also the Odds Ratio for causing a vehicle crash; in these studies the magnitude of the normal marijuana effect typically was dose- or concentration-dependent, yet the magnitude of the effect was considerably lower than that observed with ethanol [31,38]. Anderson et al. [39] have argued that the reduced effect of THC on driving performance compared to EtOH is partially responsible for the decline in traffic fatalities following initiation of medical marijuana across several states, since legalization of medical marijuana is associated with a 10-15% decrease in fatalities in which at least one driver involved had a positive BAC level [39].

With respect to legal cut-off values, in the US there is not universal agreement across states regarding an appropriate cut-off value for THC-impaired driving. In Colorado and the other states in the US where recreational marijuana is recently been legalized, the per se concentration for driving while impaired by THC is 5 ng/ml in whole blood. This value is within the 7-10 ng/ml (in serum; serum concentrations are approximately 2x whole blood concentrations) range proposed by the international working group of Grotenhermen and colleagues [32]. On the other hand, several states use a 1 ng/ml or 2 ng/ml (whole blood) cut-off for impaired driving. In Europe there also is a range of cut-off values across the various countries, with values as low at 0.3 ng/ml in Slovenia, and values as high as 3 ng/ml in Amsterdam; most European countries have a 2 ng/ml or a 1 ng/ml cut-off [40]. Unfortunately, blood concentrations this low have been reported in THC users as long as 24 hours or more post-use [41-44]. Finally, it should be noted that blood concentrations of marijuana often fall before the effect declines, and this negative hysteresis curve may reflect a slower decline in THC concentrations in the brain relative to the blood [41,45] which would be another factor to consider in setting per se cut-off THC values.

Given the relatively high frequency of marijuana use across a wide range of ages [34], combined with the likelihood that these drivers will also be texting while driving, it becomes increasingly important to better characterize the effects of this potential 'triple threat' of marijuana, texting and driving. Although Anderson et al. [46] reported that secondary tasks like performing serial mental math problems did not significantly potentiate the disruptive effects of marijuana on driving performance, one should use caution in generalizing these findings with mental math to all driving distractions, e.g., texting and cell phone use.

Finally, given the fact that many prescription medications (e.g., opioid pain relievers, benzodiazepines, antidepressants, etc.), illegal drugs (e.g., heroin, cocaine), and even OTC medications (e.g. diphenhydramine) can adversely affect driving performance when administered alone [8,25,36,47-53] it would be very important to characterize the nature of the interaction between these drugs and texting behaviour on driving performance.

In summary, there is an extensive and growing literature regarding the detrimental effects of texting on driving safety. Similarly, there is an extensive literature on alcohol use and driving safety, and there is a growing literature on the effects of marijuana, prescription and OTC drugs on driving safety. Given the high frequency of texting while driving, it is likely that drivers might also be under the influence of one or more drugs. Thus, the problem of the 'triple threat' of drugs (including alcohol, marijuana and OTC/Rx drugs), texting and driving is an area of research that is becoming increasingly more important, and continues to need further study.

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