Discussion Paper

Addressing the Problem of Distracted Driving and its Impacts to Road Safety

Ministry of Public Safety and Solicitor General

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EXECUTIVE SUMMARY

Evidence from a convergence of research has shown that driver distraction, of all types, is associated with approximately 25 per cent of crashes and results in a significant cost to society in terms of tragic loss of life, serious injuries and resulting monetary costs.

Driver distraction takes on many forms and the associated risk to public safety ranges from minimal impact to a significant impairment of a person's ability to focus on the driving environment.

The evidence from peer reviewed and replicated research demonstrates that activities such as talking on a cell phone and manipulating electronic devices are on the end of a continuum of distractions that require significant amounts of attention being diverted away from driving tasks. Such activities are correlated with crashes as demonstrated by multiple observational and epidemiological studies.

In both simulated and real driving environments, the use of electronic devices has been shown to result in crashes and near misses. Drivers fail to process approximately 50 per cent of the visual information in their driving environment when they are using electronic communication devices. Evidence also concludes that there is no difference between the cognitive diversion associated with hands-free and hand-held cell phone use.

E-mailing, text messaging, manipulating electronic devices and reading information on them are also behaviours at the end of the spectrum of activities that result in significant cognitive and visual distraction and that contribute to crashes.

Talking to a passenger in the vehicle versus talking to someone through electronic means and who is not in the vehicle does not cause the same level of distraction. Reasons for the difference include: the passenger is aware of the driving situation; the passenger can serve an additional look-out for hazards; the passenger can adjust speech, tone and conversation to the driving environment; conversations in the physical absence of the other person tend to contain fewer pauses and longer utterances impacting the level of distraction; and cell phone conversations suppress brain activity necessary for attention to perceptual input.

At the other end of the spectrum there is no evidence that listening to the radio or a book on tape degrades driving performance. This finding underscores that not all distractions are alike and that there is clearly a continuum of distractions.

New and young drivers, particularly those aged 16 – 24, are a high-risk age group with a road fatality rate approximately double that of other drivers. This age group has a high adoption and utilization rate of new technologies including cellular phones, texting devices and interactive music players. A combination of inexperience, a tendency toward greater risk-taking and a significantly higher than average use of electronic devices combine to make this group of drivers particularly vulnerable.

BACKGROUND AND CONTEXT

The issue of driver distraction has been steadily and consistently growing in tandem with the increasing use of technological devices such as cellular phones, BlackBerry™ devices, MP3 Players, DVD's, GPS units and other electronic devices. Recently, there have been reports of people watching movies while driving. The proliferation of electronic devices exacerbates existing distractions that, while typically result in less distraction, also contribute to the overall problem.

The best estimate is that driver distraction is involved in about 25 per cent of vehicle crashes[1]. Many other estimates have been made and while some dramatically exceed this amount, this estimate remains the best one based on a convergence of various studies and field literature reviews. This means that in British Columbia, driver distraction of all types is associated with approximately 117 deaths each year and about 1,400 hospitalizations. The loss of life, the serious injuries that result in life-long disabilities and the toll on families cannot be measured. The financial impact to society associated with these deaths and injuries approaches $1 billion annually or an estimated 0.5 per cent of the province's Gross Domestic Product[2].

While the use of electronic devices is likely the largest concern due to their frequency, duration, and level of cognitive and sometime visual distraction, there are other forms of driver distraction. Examples of these other distractions are eating, drinking and personal grooming while driving. Certainly, any behaviour that takes away a driver's attention from the driving task is a problem and makes the overall issue more multi-faceted.

The public is beginning to demand changes to address the overall issue of driver distraction and several recent polls show strong public support for government intervention and new regulation.

Municipalities have lobbied for changes. The Union of British Columbia Municipalities (UBCM) passed resolutions in 2003 and 2004 asking the province to amend the *Motor Vehicle Act* to ban cellular phone use while driving.

The British Columbia Medical Association (BCMA) has passed resolutions in 2004, 2005, 2006 and 2008 asking the province to respond to this issue and have cited epidemiological research showing a fourfold increased crash risk for drivers when using a cell phone.

The Health Officers Council of British Columbia wrote to the government in November 2008 and asked for a cell phone law, that health authorities develop worker policies that restrict phone use while driving and that motor vehicle collision investigations be modified to better measure the role of cell phone use in collisions.

The British Columbia Automobile Association and the Insurance Bureau of Canada have both urged the province to prohibit cell phones while driving for novice drivers. These

organizations believe this would represent an important first step in acknowledging and responding to the problem.

In October 2006, Ipsos Reid Public Affairs conducted a survey on a number of road safety issues[3]. Among the opinion survey questions were some related to driver distraction. The poll found that perceptions of driver distraction were highest for electronic devices and cell phones. The next highest category was eating and drinking while driving. The survey also found that 85 per cent of those surveyed supported a ban on cell phones while driving: either hand-held only or both hand-held and hands-free.

The Canadian Traffic Injury Research Foundation (TIRF) published findings in 2007 from a poll showing that 70 per cent of Canadians considered distracted driving to be a serious problem. This is particularly noteworthy because the same poll, in 2001, showed this number to be just 40 per cent. It underscores the point that attitudes are changing rapidly on this issue as technology continues to proliferate and take new forms.

Several recent polls show strong public support for government intervention and regulation in this area. The most recent poll, conducted by Angus Reid in June 2008, found that 85 per cent of British Columbians support a ban on hand-held cellular phones.

In January 2009 the U.S. based National Safety Council (NSC) publicly called for a nationwide U.S. ban on cell phone use and messaging devices while driving and called on all legislators to take action. The NSC cited studies showing that that driving while talking on a cell phone is extremely dangerous and puts drivers at a four times greater risk of a crash as well as a study from the Harvard Center of Risk Analysis that cell phone use, specifically, while driving contributes to six per cent of crashes.

Researchers at the Insurance Corporation of British Columbia (ICBC) conducted an observational survey, in 2006, to determine the most common causes of distracted driving. The survey observed 69,595 vehicles and concluded the number one cause of observed distraction were cell phones with almost 6 per cent of drivers talking on one while driving[4]. The observational study results support a focus on cell phone use over other types of distractions. In addition to these findings, it should also be underscored that wireless device ownership and subscription rates have increased substantially since 2006 when this survey was conducted.

Throughout the world, countless jurisdictions ban the use of hand held cellular phones while driving and each year more jurisdictions pass new laws. In British Columbia, there are no existing and specific laws that prohibit the use of electronic devices while driving.

With respect to determining the magnitude of the problem of driver distraction, police reporting data is insufficient as police are often unable to determine decisively what was going on in the moments before a crash. Instead, the best data comes from high quality research. This discussion paper will explore the causes of driver distraction and will include a review of some of the most noteworthy peer-reviewed and replicated research undertaken in the field of driver distraction.

A NOTE ABOUT SCOPE

Fundamentally, there are two types of technologies that can distract a driver from the driving task. The first kind is the technology that is built into the vehicle and can take the form of things like built-in cellular phones, IPod™ ports and GPS screens. The second form of distractive technology is simply those things that can be purchased off the shelf and used while driving a motor vehicle. Examples of these are: cell phones, IPods™, BlackBerry™ devices and other wireless devices.

The first area is the responsibility of the Government of Canada, through Transport Canada, which is responsible for regulating the in-vehicle, built-in technologies. The regulation and importation of new vehicles entering the country is the responsibility of the federal government through Transport Canada and the federal *Motor Vehicle Safety Act*. This area is not within the direct purview of this discussion paper. As at October 2007 Transport Canada was in the process of attempting to negotiate a Memorandum of Understanding between the federal government and industry that would set standards for in-vehicle built in technologies that would lessen the impact of driver distraction.

Employers also have responsibilities in this area. In the United States, employers are increasingly being sued and found guilty for allowing their employees to talk on cell phones while driving on company business. In several high profile cases involving deaths and serious injuries, U.S. employers were successfully sued for amounts in the $1 - $2 million range.

The focus of this discussion paper is largely related to the mandate and authority of the Government of British Columbia. That mandate relates to the regulation of drivers including the provincial *Motor Vehicle Act* that governs the rules of the road and other road safety provisions. It is under the authority of the provincial *Motor Vehicle Act* that it is possible to create provisions related to distracted driving or to make a condition of licensing where a driver must not engage in a particular activity. In this vain, the province has authority to regulate the use while driving of any technological device whether built into a vehicle or purchased after-market.

THE PROBLEM

A great deal of research, much of it expensive and high quality, has taken place all over the world to better understand the role of driver distraction in vehicle crashes. The conclusions are consistent – with the best evidence suggesting that distracted driving contributes to about 25 per cent of vehicle crashes each year. Where driver distraction plays a part, wireless electronic devices are the number one source of distraction.

At the same time the problem is not limited to driving alone. Use of cellular and other electronic devices by pedestrians is a growing problem. In order to be safe on the roads, pedestrians need to be focused on the physical road and vehicle environment around them. Pedestrians are clearly at increased risk when impaired by electronic devices.

Driver distraction is impacting vulnerable road users who have the least amount of protection in the event of a crash: pedestrians, cyclists and motorcyclists. These three groups of road users suffer from visibility issues, other driver processing issues and a general lack of crash protection – in other words they are physically smaller and may not have good lighting systems; their presence is not mentally processed by drivers to the degree that vehicles are; and they have little or no protection in the event of a crash, i.e., no protection from a vehicle crumple zone, a seat belt or an air bag.

Because of these factors, vulnerable road users are more susceptible to vehicle drivers that may be distracted. Driver distraction delays reaction time and when reaction time is delayed, even for a few seconds, the consequences can be dramatic and can make the difference between life and death in the event of a crash. Children, as pedestrians and cyclists, are even more compromised since research shows that before the age of ten they simply do not have the cognitive, spatial skills and decision-making to use the road system safely and even after that age they are more likely to engage in road use behaviours that put them at increased risk[5].

There are various forms of driver distraction with varying impacts on driver impairment. Passive listening to a radio has been proven relatively harmless but technologies that require or allow for interaction are problematic – technological distraction fits this category and has been growing rapidly with the growing use of cell phones and more recently wireless laptops, BlackBerry™ devices, MP3 players and even portable DVD players. Indeed, many vehicles are now equipped with built-in technologies (known as Bluetooth™ technology) that send the indirect message that all of this represents the norm.

The past two decades have seen a drastic increase in the number of wireless subscribers in Canada. By 2008 there was an unprecedented number of wireless subscribers in Canada and unprecedented volumes of text messages sent each day. Even by 2006, according to Statistics Canada, well over one-half of Canadians became subscribers to mobile or wireless devices with subscription rates continuing to increase every month. Increasing use and exposure rates of wireless devices are impacting the communication culture and the driving environment.

Driver distraction is a significant and over-arching problem with many dimensions. It may be that driver distraction is at least to some degree a symptom of a larger problem: a collective thinking and culture that continues to view road fatalities and injuries as "accidents" – as events that are inevitable and defy possible solutions. It may not be widely understood that road fatalities and injuries can be drastically reduced with the right set of crash countermeasures – some of them simple. Similarly, it may not be well known that governments around the world are working toward ambitious targets to reduce the numbers of people killed and injured on their roads and many governments have already made significant progress in achieving those goals and targets.

PERCEPTION FAILURE WITH RESPECT TO THE LAW OF LARGE NUMBERS

A major underlying problem relating to road safety in general, and driver distraction included, is perception failure with respect to the law of large numbers. There is, more often than not, no immediate connection between a risky behaviour and its real consequences. A simple example of this is that a driver may talk on a cell phone and drive and get away with this behaviour for a long period of time without incident. After awhile it becomes tempting for that driver to begin to believe that the behaviour is risk-free. However when such a distraction is proven to remove attention from the driving task, the law of large numbers dictates that crashes will occur and these events will contribute to the annual toll of vehicle crashes, fatalities and injuries.

Daily bad driving habits are often not captured by any immediate negative feedback such as speeding tickets or the consequences associated with a crash. What drivers may often fail to grasp is that when things do go wrong, the consequences can be catastrophic and then multiplied many times over by the similar actions of others. The implication of this is that if crash numbers are to be reduced, there must be a concerted effort to reduce risk wherever possible.

RESEARCH OVERVIEW

Large numbers of studies have been carried out over the past few decades on driver distraction and therefore the issue benefits from a large number of high quality and peer-reviewed studies.

There are many different kinds of studies – each with their own limitations and benefits – designed to provide new insights into crash contributing factors. To help understand what crashes in the real world are correlated with, there are probably two methods of inquiry that are best able to provide this kind of information: these are naturalistic studies and epidemiologic investigations. To understand causation, experimental studies represent the best sources of information. These three types of studies are summarized here:

> **1) Naturalistic studies**, e.g., direct observational studies that use cameras to capture information on what was happening in or around a vehicle when a crash occurred;
> **2) Epidemiological methods** with reliance on descriptive data, e.g., studies that rely on cell phone company records to establish phone use at the actual time of a crash and compare that with data related to a non-crash time period; and
> **3) Experimental studies**, e.g., in road safety these studies generally randomly introduce a specific driver distraction (intervention) and measure its impact on some measure of driver performance (outcome) on a certain group (population) and compare that with the same driver performance measure when no such distraction intervention was introduced (counterfactual). These types of experiments enable conclusions related to causation.

Both of the first two methods provide good data about crash contributing factors and correlations in the real world between distraction and crashes or incidents such as sudden evasive manoeuvres. There have been some good investigations using these two methods with respect to cell phone and electronic device use and some of these studies provide the best available information about the problem.

Naturalistic and epidemiologic studies show correlation and not causation. In addition, the underlying reason that any driver chooses to use a distracting device may be linked to a larger and more complex set of causes, e.g., psychological, social, cultural and demographical.

Other types of experimental and simulated studies provide good information including evidence about causation, such as the degree of impairment that a distraction causes, or its impact on driver decision-making processes and response times. One of the limitations of experimental studies is that they are typically simulated and therefore the degree to which they are approximations of what goes on in the real world is not exactly known.

Taken together, all three of these studies – naturalistic, epidemiologic, and experimental – significantly shape and enhance our understanding of the problem. The driver distraction problem benefits from good research of all three types and the convergence of their conclusions and findings provide the basis for evidence based decision-making.

100-Car Naturalistic Study

In 2006, the U.S. National Highway Traffic Safety Administration (NHTSA) published the results of the 100-Car Naturalistic Study[6]. The study was inspired by the notion that the key to the development of effective crash countermeasures was a better understanding of pre-crash causal and contributing factors of crashes. This research effort was initiated to provide comprehensive detail about driver behaviours, environment, driving context and other factors that were associated with critical incidents, near crashes and crashes.

The study was the first of its kind to collect real data on what was happening in and around a vehicle in a real-life or "naturalistic setting." The study used unobtrusive mini cameras hidden inside cars and monitored 100 drivers for a period of one year. This expensive and new data collection method resulted in the following data set contents:

- Approximately 2 million vehicle miles;
- Almost 43,000 hours of driving;
- 241 primary and secondary drivers;
- 12 – 13 months of data collection; and
- Five channels of video including information on what the vehicle was doing and other vehicles and other information around the vehicle.

This data collection approach resulted in information on:

- 82 crashes (contact with another vehicle, pedestrian, etc);
- 761 near-crashes (conflicts requiring a rapid and severe evasive manoeuvre); and
- 8,295 incidents (conflicts requiring an evasive manoeuvre).

The study found that various forms of driver distraction contributed to 78 per cent of crashes and 65 per cent of near crashes. The authors noted that of all study participants, only 7.5 per cent never experienced an event of any severity. In contrast, 7.4 per cent of drivers had many incidents as well as three or four actual crashes. This information underscores the fact that there are overwhelming differences between the best drivers and the worst drivers with the worst ones contributing very disproportionately to the crash numbers.

Of the distractions captured, wireless technical devices were the number one distraction correlated with crashes, near crashes and incidents. Wireless devices were, in turn, broken down into sub-categories with dialling a hand-held cell phone and talking/listening on a phone leading as the two most frequent problematic activities.

Association between Cellular-Telephone Calls and Motor Vehicle Collisions, Donald A. Redelmeier, M.D., and Robert J. Tibshirani, Ph.D.

This Canadian investigation published in 1997 relied on access to actual cell phone records and used an epidemiologic method, a case–crossover design, to study whether using a cellular telephone while driving increases the risk of a motor vehicle collision[7]. This case-crossover design means that in this study the control group was the same driver and the same car but simply on another non-crash day. This design meant that a number of confounding variables could be effectively controlled for.

The study involved 699 drivers who had cellular telephones and who were involved in motor vehicle collisions resulting in substantial property damage but no personal injury. Each person's cellular-telephone calls on the day and time of the collision and during the previous week were analyzed through the use of detailed billing records.

A total of 26,798 cellular-telephone calls were made during the 14-month study period. The risk of a collision when using a cellular telephone was four times higher than the risk when a cellular telephone was not being used. The relative risk was similar for drivers who differed in personal characteristics such as age and driving experience; calls close to the time of the collision were particularly hazardous; and units that allowed the hands to be free offered no safety advantage over hand-held units.

The study concluded that the use of cellular telephones in motor vehicles is associated with a quadrupling of the risk of a collision during the brief period of a call.

Role of Mobile Phones in Motor Vehicle Crashes Resulting in Hospital Attendance: A Case-Crossover Study

Similar to the Canadian study cited above, this Australian study published in 2005 also utilized a case crossover design and relied on access to actual cell phone records[8]. The study involved 456 drivers who owned or used mobile phones and had been involved in road crashes necessitating hospital attendance between April 2002 and July 2004, and involved interviewing drivers and their medical records after the crash occurred.

The study found very similar findings to the Canadian study – that driver's use of a mobile phone up to 10 minutes before a crash was associated with a fourfold increased likelihood of crashing and resulting in hospital attendance. Risk was raised whether or not a hands-free device was used. Increased risk was similar in men and women and in drivers under age 30 as well as over age 30. The authors point out that given that new vehicles are increasingly becoming equipped with Bluetooth™ technology, features that facilitate voice activation and cellular communication, and the proliferation of cell phone usage generally, there is real risk of increasing numbers of crashes due to cell phone use while driving.

Effects of Cellular Telephones on Driving Behaviour and Crash Risk: Results of Meta-Analysis – And a Note About Hands-free Versus Hand-held Cell Phone Usage

This report, published in 2004 and led by the University of Calgary (UofC), involved a review of literature and an analysis of scientifically credible epidemiological and driver performance studies[9]. It involved obtaining articles covering the period 1969 – 2004 and then focusing on 15 epidemiological studies and 22 performance studies in order to answer key study questions.

The results of this review included the conclusion that conversations on both hand-held and hands-free cell phones influence driving performance. Based on the available data, driver performance did not differ between hand-held and hands-free cell phones.

The UofC report revealed there is little or no public safety benefit to hands-free cell phone use. While some voice recognition systems may help to mitigate the distraction associated with actual dialling, once the conversation has begun there is no difference between a hands-free cell conversation and a hand-held cell conversation. It is believed that the reason for this is related at least in part to the nature of the distraction itself: talking to someone who is not also in the vehicle to see what is going on around them.

Passenger and Cell-Phone Conversations in Simulated Driving

This study published in 2004 investigated how conversing on a cell phone differs from conversing with a passenger[10]. The study involved 96 participants and was carried out in Utah. A driving simulator was utilized and comparisons were made with how well drivers followed task instructions when driving only, when driving and conversing on a cell phone and when driving and conversing with a passenger.

In analyzing driver task accomplishment, the study found that drivers on a cell phone were four times more likely to fail the completion of a driving task than drivers talking with a passenger. This failure is likely explained at least in part by the fact that a driver and passenger are in a shared environment and the passenger is able to make adjustments to speech, tone and conversation depending on what is going on around them. The following table shows the number of study participants that turned correctly at a predetermined exit for two experimental conditions (cell phone and passenger distractions) as well as a control condition where no distraction was introduced.

Table 1. Successful task completion.

	Cell-phone	Passenger	Control
Correct exit	12	21	46
Missed exit	12	3	2

Cell Phone-Induced Failures of Visual Attention During Simulated Driving

This study, published in 2003, was intended to identify whether failures in recognizing the objects in the related experiments were due to visual failure or lack of attention[11]. The results found that participants' eyes fixated on billboards similarly when talking on a cell phone compared to not talking on a cell phone but those talking on a cell phone did not do as well at remembering those signs. Therefore, the results of this experiment indicated that when a driver is conversing on a cell phone their gaze may be at a particular object however they still fail to see it more often than drivers not talking on a cell phone. The result is an induced failure to process visual information. This concept has been coined "inattention-blindness."

Follow up experimental studies conducted by Dr. Strayer et al. at the University of Utah laboratory have revealed that cell phone conversations impair encoding of the brain, reduce attention to perceptual input and suppress brain activity in ways that conversations with passengers do not. A large number of simulated studies carried out as recently as 2007 have supported the inattention-blindness principle through demonstrated changes in the amplitude of certain brain activity that acts as in indicator for higher level cognitive processing. Dr. Strayer has concluded that these and similar findings have clear implications for road safety.

Dr. Strayer et al. also found that dual-task studies assessed the effects of cellular-phone conversations on performance of a simulated driving task and that performance was not disrupted by listening to radio broadcasts or listening to a book on tape. This finding underscores the idea that electronic devices that involve interaction generate worse effects on driver performance.

Cell-Phone Induced Driver Distraction

This experimental study was published in 1997[12]. One of the purposes of the study was to examine the extent to which drivers who talk on their cell phone could refocus their attention from the cell phone to a potentially high risk scenario when needed.

Thirty objects that were varying from high to low risk, (i.e., a child playing in the street was high-risk) were placed in clear view of the drivers. Another 30 objects that were not presented to the driver served for the purpose of establishing a control situation. Drivers were asked to rate the objects in terms of safety risk and remember whether or not the objects had been present while they were driving.

The results of this study suggest that drivers talking on a cell phone are not able to redirect their attention to and create a durable memory of the most important safety hazards. The study supports previous conclusions that driver attention is removed when talking on a cell phone.

Another experiment published in this same article measured actual brain activity related to higher cognitive processing that is sensitive to the degree of attention given to a task. Participants drove on a simulated multilane freeway and followed a pace car that would apply its brake at random intervals. The brain activity of participants was measured and recorded at these braking intervals.

The results of the study found that important brain activity was reduced by 50 per cent when drivers were talking on a cell phone. Dr. Strayer has concluded that cell phone drivers look but fail to see up to 50 per cent of what is in their driving environment[13]. In other words, drivers using a cell phone pay less attention to the surrounding area and fail to register information at a much higher rate than drivers not talking on a cell phone. This suggests that drivers using a cell phone will be less able to react to situations that demand a quick response because of the diversion of attention.

A Comparison of the Cell Phone Driver and the Drunk Driver

The objective of this research was to determine the relative impairment associated with conversing on a cellular telephone while driving[14]. This University of Utah study published in 2006 relied on a high-fidelity driving simulator to compare the performance of cell phone drivers with drivers who were intoxicated from ethanol (i.e., blood alcohol concentration at 0.08%). Forty adults (25 men, 15 women) participated and their ages ranged in age from 22 to 34 years with an average age of 25 years. All had normal or corrected-to-normal vision and a valid driver's licence with an average of 8 years of driving experience.

The results showed that when drivers were conversing on either a handheld or hands-free cell phone, their braking reactions were delayed and they were involved in more traffic accidents than when they were not conversing on a cell phone. The study concluded that when driving conditions and time on task were controlled for, the impairments associated

with using a cell phone while driving can be as profound as those associated with driving while drunk.

Turning Gap Acceptance Decision-Making: The Impact of Driver Distraction

In this Vancouver study published in 2002, 39 persons of all ages were exposed to approximately 100 gaps each in a traffic stream on a test track with a wet surface condition about half the time[15]. The study subjects drove instrumented cars and attempted typical left-hand turns where there is a necessity to judge the gap in oncoming vehicular flow, and other critical factors, in order to make a safe decision about when to turn. In this study, for half of the turns (randomly assigned) drivers were asked to listen to and respond to a complex verbal message. For the other half of the turns, they were not.

According to data from road safety crash profiling, it is noteworthy that left-hand turns are very problematic in North America with respect to collisions with other vehicles and for collisions with vulnerable road users like pedestrians, cyclists and motorcyclists.

Logistical regression analysis was used in order to identify the extent that various factors each influenced turning decision-making. A significant difference was found between the drivers under no distraction and distraction circumstances with respect to whether they took into account the condition of the pavement surface. Those who were distracted by the verbal messages did not take the surface condition into account. The presence of wet conditions should impact the size of the gap as the vehicle would not be able to slow or stop at the same rate as it could if the surface were dry.

On wet pavement, the subjects were judged to have initiated twice the level of potential collisions when distracted by the messages than they did when not distracted. That such an important factor was omitted from the decision process has serious implications for safety. This would suggest that distracted drivers were not able to process all of the information available to them when making important driving decisions. The study also found that those aged 25 – 70 did worse than those under age 25.

This study suggests communication-related distraction adversely affects safe driving decision-making and older drivers are not any better off than their younger counterparts in dealing with these distractions and in fact fared worse.

The Effects of Practice with MP3 Players on Driving Performance

This article in press as of 2007 (not yet reviewed by the editors of the journal) is a study designed to assess the driving degradations associated with using an MP3 player while driving[16]. An MP3 player is a compact electronic device that stores and then plays music, with the use of a headset, and that has buttons on it that are used to select and play a song.

This study examined the effects of repeated IPod™ interactions on driver performance to determine if performance decrements decreased with practice. Nineteen younger drivers

participated in a seven session study in the University of Calgary Driving Simulator (UCDS).

Drivers encountered a number of critical events on the roadways while interacting with an IPod™ including a pedestrian entering the roadway. Measures of hazard response, vehicle control, eye movements, and secondary task performance were analyzed. Increases in perception response time and collisions were found while drivers were performing the difficult IPod™ tasks, which involved finding a specific song within the song titles menu. Over the course of the six experimental sessions, driving performance improved in all conditions but did not return to the baseline level associated with no IPod™ tasks.

At the same time the study authors point out that actual IPod™ use in-vehicles is likely to produce greater performance decrements than those recorded in this study. IPods™ are frequently placed in the lap of the driver or in the center cup holder. Interaction with it is accomplished by holding and looking at it. These results are conservative estimates of actual behaviour as task times did not include the time to pick up the IPod™ or other visual distractions. Many vehicle manufacturers have made integration of IPods™ into vehicles a necessary "lifestyle enhancement" capability.

The multivariate results of this study suggest that access to difficult IPod™ tasks while vehicles are in motion should be curtailed. The authors conclude that vehicle manufacturers and Apple, in cooperation, should lock out these functions, while the vehicle is in motion.

The Effects of Text Messaging on Young Novice Driver Performance

This project, published in 2005, aimed to evaluate, using an advanced driving simulator located at Monash University in Australia, the effects of text messaging on the driving performance of young novice drivers[17]. Twenty participants, between the ages of 18 and 21 years, took part in the study. The simulated driving conditions included a number of events like a pedestrian emerging from behind a parked car or from between traffic lights. Results were compared to a control condition where drivers experienced the same events without text messaging.

The investigation found that retrieving and sending text messages had a detrimental impact on a number of critical safety driving measures. Among the findings were that drivers' abilities to stay in their lane and respond to traffic signs were reduced, drivers spent up to 400 per cent more time with their eyes off the road when text messaging than when not and the number of incorrect lane changes increased by 140 per cent.

The study concluded that more effective measures are needed in Australia to respond to the problem of high numbers of young people who use these devices while driving.

The Effects of Cellphone and CD Use on Novice and Experienced Driver Performance

This study, published in 2007, was prepared by Human Factors North and the University of Calgary and was prepared and funded by the Insurance Bureau of Canada[18]. The report contains findings from two experimental conditions: one in a driving simulator at the University of Calgary and the other using an on-road study in Calgary. These studies found various differences between experienced drivers and novice drivers including the finding from the simulator study that novices wandered more in their lane while conversing on the phone. The on-road study found that novices were aided more frequently with the driving instructor having to apply their passenger-side brake more often.

The study concluded that, overall, the use of a cell phone detrimentally impacted all drivers. At the same time, driving experience also plays a role in drivers' perceptions of hazards and that these conclusions are consistent with the growing recognition that novice drivers lack experience to recognize hazards and threats. Novice drivers perform even more poorly than experienced drivers when electronic distractions are present.

Driver's Exposure to Distractions in their Natural Environment

This research, published in 2005, relied on unobtrusive video camera units in the vehicles of 70 volunteer drivers over one-week time periods to study drivers' exposures to distractions[19]. Results were compiled into a detailed taxonomy of distractions along with important contextual variables. Results showed distractions to be common with the most common one eating and drinking while driving (including food and drink preparations). This was followed by reaching for an object or manipulating vehicle controls. These distractions were frequently associated with decreased driver performance.

The study has constraints including the fact that it was unable to align findings around these distractions with their actual role in crash causation. These naturalistic study findings do, however, underscore the prevalence of eating and drinking while driving.

NEW AND YOUNG DRIVERS

Road crashes are the number one cause of injury induced death for young people up to age 25. Throughout the world as well as in British Columbia, fatality and injury rates for young people aged 16 – 24 are typically more than double that of other drivers.

At least part of the reason for this relates to neuroscience findings that reveal the part of the brain responsible for risk management and decision-making is not fully developed until age 25. In addition, there are other biological differences, including levels of testosterone, that are correlated with sensation-seeking and other risk-taking behaviours in younger people.

While the reasons for a higher crash rate for this age cohort are multi-faceted, the advent and growth of electronic devices and their use while driving has been detrimental and has

added to the problem. Young drivers in the age category 16 – 24 have the highest rates of cell phone use of any age group and more young drivers use cell phones, at any given moment on the roads, than all other age groups combined. The same research demonstrates that the overall pattern of results indicates that novice drivers perform poorer relative to experienced drivers[20]. Like all drivers, new and young drivers are unable to adapt to the use of any interactive electronic device and its demands while driving. A combination of inexperience, a tendency toward greater risk-taking, and a significantly higher than average use of distracting electronic devices makes this group particularly vulnerable.

In addition to this, the use of electronic devices including cellular phones, MP3 players and texting devices by young people under age 25 continues to increase dramatically each year.

At present, the British Columbia Graduated Licensing Program places restrictions on Learner and Novice drivers in the first 2½ - 3 years of learning to drive. Examples of current restrictions include zero blood-alcohol-content (0 BAC) and limits on the number of passengers. At this time, there are no restrictions on the use of electronic communication or interactive music players during this period.

COSTS OF DISTRACTED DRIVING

Along with the tragedy and consequences of death and serious injuries, there are the costs of road crashes to society which include disruptions to family incomes, insurance costs, property damage, court costs, police costs, legal costs, hospital costs, rehabilitation costs and other indirect costs of crashes. No single ministry or agency, board, commission, industry segment or citizen bears all of the costs of road crashes – the costs are shared among these various sectors. The return on investment opportunity for addressing driver distraction is potentially significant.

The cost of road crashes in British Columbia is conservatively estimated at $3.6 billion annually based on widely accepted estimates from the World Health Organization and others who have found that road crashes typically cost a jurisdiction about 2 per cent of its Gross Domestic Product. A more recent estimate by Transport Canada establishes road crash costs at approximately $8.8 billion annually for British Columbia alone.

INTER-JURISDICTIONAL APPROACHES

Countless jurisdictions all over the world have laws that prohibit the use of cell phones while driving or who prohibit the use of other electronic devices while driving. British Columbia does not at this time have any specific legislation of this type.

Canada

All Canadian jurisdictions have sections of legislation to address a general category of "driving without due care and attention" and "driving without consideration." The wording of these sections is similar from one jurisdiction to the next. Most provinces and territories have regulations restricting the use of certain types of visual display devices in vehicles, most commonly television screens. For most jurisdictions, these regulations have been in place for many years; some have been updated to reflect modern types of display screens while others have not. While these laws are good, they are generally used for more serious offences and are rarely, if ever, used to enforce everyday driver distraction issues.

Quebec, Nova Scotia and Newfoundland and Labrador each prohibit the use of hand-held cellular telephones while driving for all drivers. Alberta, Manitoba and Ontario each have legislative bills or proposals in progress on the issue. In Ontario, Bill No. 118 (*Countering Distracted Driving and Promoting Green Transportation Act, 2008*) passed Third Reading on April 22, 2009. In Manitoba, Bill No. 5 (*The Highway Traffic Amendment Act Promoting Safer and Healthier Conditions in Motor Vehicles*) passed First Reading on November 27, 2008.

Legislation that bans only hand-held cell conversations conflicts with the research that has consistently found no difference in the degree of distraction between hand-held and hands-free cell conversations. As a result, these laws may not provide the expected benefits and may even generate harmful indirect impacts such as a false sense of security for those who talk on hands-free devices while driving.

New Drivers

Prince Edward Island prohibits new drivers from using cellular phones or any type of handheld electronic device while operating a vehicle.

United States

In the United States, there are various types of distracted driving legislation with increasing attention being given to addressing a number of distractions, e.g., electronic devices, reading, writing, personal grooming, interacting with pets or having unsecured cargo or engaging in other activities that cause distractions. Not unlike the situation in Canada, all U.S. states consider reckless and aggressive driving illegal.

Countless U.S. states have legislation prohibiting drivers from using hand-held cellular phones while driving.

Washington State passed new legislation on the use of hand-held cell phones by drivers. The restriction is on the use of any electronic device that is held to the driver's ear while the vehicle is in motion as well as any use of an electronic device to read, write, or send

text messages while driving. The new legislation is staged with the text messaging provisions taking effect January 1, 2008 and the cell phone provisions on July 1, 2008.

New Drivers

The following U.S. states, as at March 2008, along with the District of Columbia, regulate the use of cell phones by new drivers: Colorado, Connecticut, West Virginia, Delaware, Maine, Nebraska, Maryland, Minnesota, New Jersey, North Carolina, Rhode Island, Tennessee and Texas.

Highlights from Other International Jurisdictions

In Australia, states and territories have authority to regulate driver distraction and do so through a variety of laws. The most general law relates to drivers not having proper control of the vehicle. In 1988, the Australian state of Victoria became the first major jurisdiction to ban the use of cell phones by drivers. Other states and territories now have a similar law. In addition, Australian states also regulate television receivers and visual display units in motor vehicles. Specific wireless technologies and the use of wireless technologies by specific types of drivers are also regulated in Australia.

Since 2003 drivers in the United Kingdom have been prohibited from using their cell phone or any other mobile electronic device or electronic organizers while driving. This legislation also applies to drivers stopped in traffic jams or waiting at traffic lights. Cell phone usage is allowed while driving if a hands-free mobile phone device is properly used. Drivers can still be prosecuted under this legislation if they drive without due care and attention while using a hands-free device. Offenders may be charged with a careless driving charge which carries a maximum fine of £5,000; however, new guidelines issued December 26, 2007 allow prosecutors to pursue even harsher penalties. In particular, drivers may now be charged with dangerous driving which carries a maximum sentence of two years in jail.

Some European countries have chosen general forms of legislation to restrict behaviour that may result in distracted driving. For example, their general regulations that deal with the careless or dangerous driving can be applied in the case of mobile phone use. Many European countries also specifically restrict the use of hand-held cell phones by drivers including Finland, The Netherlands, Germany, Denmark and many others.

Germany has specific legislation on the use of hand-held cell phones. In Germany, the use of a cell phone while operating a motor vehicle is prohibited, unless the driver is using a hands-free device. Drivers are only permitted to use the cell phone without the hands-free device if the vehicle’s motor is turned off.

In recognition of the increased risk of traffic crashes related to in-vehicle cell-phone use, Japan and Singapore have prohibited drivers' use of all types of cell phones. More specifically, Japan prohibits drivers from using a mobile telephone, a car phone, or other radio communications while driving a vehicle, except while the vehicle is stopped.

Singapore prohibits drivers from holding a phone with one hand while using it to communicate. This includes making phone calls, paging someone, receiving a call by pressing the keypad, and reading, writing or sending text messages. Penalties for first time offenders may result in a $1,000 fine and up to 6 months in jail, or both.

OTHER SUPPORTING MEASURES TO ADDRESS THE PROBLEM OF DISTRACTED DRIVING

There are opportunities for public and private sector involvement in arriving at solutions. Many organizations have passed policies that prohibit employees from talking on a cell phone while driving on business. In British Columbia, WorkSafe B.C. and B.C. Hydro have policies that prohibit the use of cellular phones while driving on work-related business. In Alberta, many oil and gas companies have passed policies to prohibit electronic communication while driving and more companies continue to introduce these policies with an increased emphasis on prohibiting hands-free devices as well.

New technology holds promise with respect to providing new kinds of ways to support drivers from not using electronic devices while driving. One example is new GPS-based systems that will have the capacity to manage cell phone calls when the system detects, through GPS, a person is driving and is in motion. These technologies could assist all drivers in managing their cellular phones and other electronic devices while driving.

MOVING FORWARD

Driver distraction is representative of many road safety issues where individual driving behaviours often do not take into account the risks or consequences of being involved in a crash. Where driving habits are not connected with an immediate positive or negative consequence many drivers fail to process risk and modify their behaviour accordingly. The public safety problem occurs where individual behaviours are multiplied by large numbers and result in fatalities and injuries – events that are often not appreciated at an individual level or in the immediate term.

Even a small incremental increase in risk can translate into thousands of crashes when multiplied over a large population as in the case of British Columbia. Similarly, even a small incremental decrease in risk can translate into thousands of avoided crashes with a concomitant result of preventing loss of life and serious injury.

As driver distraction is a complex and multi-faceted problem it is likely that an effective response will involve approaching the problem on a number of levels. International best practice approaches to road safety problems involve a combination of:

- Public awareness and education;
- Government regulation and licensing;
- Roadway design;
- Technological solutions; and
- Enforcement.

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