4. Distracted and Drowsy Driving

Overview

Distracted driving and drowsy driving are common, though both are difficult to define, measure, and sometimes observe. Both distracted and drowsy driving result in large part from lifestyle patterns and choices. For these reasons, few behavioral highway safety countermeasures have been shown to reduce distracted or drowsy driving, although a number of new countermeasures are currently being developed and evaluated.

Distracted driving has received a great deal of attention in recent years. The U.S. Department of Transportation held two distracted driving summits in Washington, D.C., developed a *Blueprint for Ending Distracted Driving* (NHTSA, 2012). Although much of the attention and research has concentrated on cell phones and texting, this is just one of many potential distractions behind the wheel. For example, NHTSA hosted a technical meeting in 2015 to discuss cognitive distraction or mind-wandering. Until recently, attention and research on drowsiness has primarily concentrated on commercial truck drivers, but the problem is far more widespread. NHTSA initiated a new effort to address drowsy driving by hosting a forum in 2015 and releasing the 'Drowsy Driving Research and Program Plan" in 2016.

A related issue that is emerging as a growing safety concern is distracted pedestrians using cell phones and electronic devices in the roadway environment. A recent literature review from NHTSA found that, based on the limited amount of research done on pedestrian distraction, distraction is associated with a small but statistically significant decrease in pedestrian safety (Scopatz & Zhou, 2016). This issue is discussed in more detail in Chapter 8.

Problem size and characteristics: distracted driving. Distraction occurs when a driver's attention is diverted away from driving to some other activity. A distraction can be produced by something a driver sees or hears, some physical task not directly involved in driving such as eating or operating the car radio, or mental activities such as conversations on a cell phone (Goodwin et al., 2005, Section III).

It is clear that the public perceives driver distraction to be a serious traffic safety issues. In 2013, AAA Foundation surveyed 3,103 U.S. residents and found that 9 in 10 (88%) say distracted driving is a "somewhat" or "much bigger" problem today compared to three years ago, and 89% believe drivers talking on cell phones are a "somewhat" or "very serious" threat to their personal safety (AAA Foundation, 2013). In 2015, AAA Foundation repeated this survey with 2,442 U.S. residents and found that almost the same number proportion or percentage (85%) say distracted driving is a "somewhat" or "much bigger" problem today compared to three years ago, and 86% believe drivers talking on cell phones are a "somewhat" or "very serious" threat to their personal safety (AAA Foundation, 2016). Similarly, in 2012 NHTSA conducted 6,016 telephone interviews and asked respondents how safe they would feel in a variety of situations in which they are passengers in vehicles operated by drivers who are engaged in other activities while driving. NHTSA found that about two-thirds (66%) would feel "somewhat" or "very" unsafe if the driver was to "talk on a cell phone while holding the phone" and almost all (95%) would feel

"somewhat" or "very" unsafe if the driver was to "read e-mails or text messages" or "send text messages or emails (Schroeder, Meyers, & Kostyniuk, 2013).

Although people are concerned about distracted driving, they frequently admit to engaging in such behaviors behind the wheel. In the 2013 AAA Foundation survey, two-thirds (67%) of respondents admitted to talking on the phone while driving during the past 30 days (AAA Foundation, 2013). A third (35%) admitted to reading text messages while driving, and a fourth (26%) had sent text messages. The AAA Foundation conducted another survey in 2015 and found that more than two-thirds (69.9%) of respondents admitted to talking on the phone while driving during the past 30 days (AAA Foundation, 2016). Two in five drivers (42.3%) admitted to reading text messages while driving in the past 30 days, and nearly one-third (31.5%) had sent text messages. These findings show that the problem has worsened since the 2013 survey. The AAA Foundation summarized their findings by observing that a substantial number of drivers have a "Do as I say, not as I do" attitude with regard to distracted driving – they view these behaviors as dangerous, but engage in them nevertheless. The 2012 NHTSA survey also asked about a variety of behaviors related to distracted driving (Schroeder, Meyers, & Kostyniuk, 2013). Among the behaviors that drivers reported doing at least sometimes:

- 80% talking to other passengers;
- 68% adjusting the car radio;
- 47% eating or drinking;
- 40% making or accepting phone calls;
- 36% interacting with children in the back seat;
- 35% using a navigational system;
- 25% changing CDs, DVDs, or tapes;
- 20% using a smartphone for driving directions;
- 14% reading e-mail or text messages;
- 10% sending text messages or email;
- 9% personal grooming.

The role of distraction in crashes can be difficult to determine because pre-crash distractions often leave no evidence for law enforcement officers or crash investigators to observe and drivers are understandably reluctant to admit to having been distracted during a crash. According to NHTSA's NCSA, there were 3,179 fatalities in distraction-affected crashes in 2014 (NCSA, 2016). This represents an increase of 8.8% from the 3,197 fatalities in 2014. Ten percent (3,196) of all fatal crashes are distraction-affected crashes (NCSA, 2017). Distracted-affected crashes is a new measure that focuses on distractions that are most likely to affect crash involvement such as distraction by dialing a cell phone or texting and distraction by an outside person/event (NHTSA, 2015).

The risks posed by specific distracted driving behaviors are beginning to be understood thanks to naturalistic driving studies that use onboard sensors and cameras to capture data right before crashes as well as during normal driving situations. The recently completed Second Strategic Highway Research Program Naturalistic Driving Study (SHRP 2 NDS) included 3,500 participants, 35 million miles of continuous driving data, and 905 injury and property damage only (PDO) crashes. As such, it provided the first opportunity to perform a direct analysis of the crash risk associated with various observable distractions compared to regular driving (Dingus et

al., 2016). In the table below, a change in risk greater than 1 represents an increase in crash risk due to the secondary task, while a change in risk less than 1 represents a decrease in crash risk. For example, interacting with a handheld cell phone increases the risk of a crash 3.6 times compared to model driving. The table also shows baseline prevalence of the distraction in terms of the percentage of time drivers engaged in a distracting task while driving.

Type of Distraction	Change in Risk (Odds Ratio)	Baseline Prevalence
Total cell (handheld)	*3.6*	*6.4%*
Cell dial (handheld)	12.2	0.1%
Cell text (handheld)	6.1	1.9%
Cell reach	4.8	0.6%
Cell browse	2.7	0.7%
Cell talk	2.2	3.2%
Total in-vehicle device	*2.5*	*3.5%*
In-vehicle device (other, e.g. touchscreen)	4.6	0.8%
In-vehicle climate control	2.3	0.6%
In-vehicle radio	1.9	2.2%
Reading/writing (including tablet)	9.9	0.1%
Reaching for object (other than cell phone)	9.1	1.1%
Looking at outside object	7.1	0.9%
Eating	1.8	1.9%

Note: All odds ratios statistically different from 1 at the 0.05 level of significance.
Source: Dingus et al. (2016).

Klauer et al. (2014) used a naturalistic study to examine distracted behaviors and their effects on the risk of being involved in a crash or near crash among 42 newly licensed (novice) drivers. Some of the findings are shown in the table below. Novices were eight times more likely to be involved in a crash or near crash when dialing a cell phone and seven times more likely to be involved in a crash or near crash when reaching for a cell phone. While the novice driver study had far fewer participants than the SHRP 2 NDS study above, it demonstrated that the risks posed by various types of distraction are problematic for young drivers just as they are for the general driving population.

Estimated Change in Crash Risk When Engaging in Secondary Tasks, Newly Licensed (Novice) Drivers

Type of secondary task	Change in risk
Using a cell phone	
Dialing	8.3
Reaching for phone	7.1
Texting	3.9
Reaching for object (other than cell phone)	8.0
Looking at outside object	3.9
Eating	3.0

Note: All odds ratios statistically different from 1 at the 0.05 level of significance.
Source: Klauer et al. (2014).

Given the possible visual, manual, and cognitive attention changes caused by secondary tasks while driving, none of the distractions listed in the tables above is easily addressed. Moreover, it

is important to note that many of the studies on distracted driving and its consequences were conducted prior to the proliferation of smart phones, navigation apps and devices, and built-in technologies. Consequently, it is possible that distraction-related crashes will escalate as the prevalence, diversity, and use of new technologies continues to increase.

Problem size and characteristics: drowsy driving.
Drowsy driving shares some characteristics with distracted driving in that it can cause drivers to be less responsive to the driving events in a way that potentially increases the risk of crashing. In addition, drowsy driving is another behavior that almost everyone acknowledges is potentially dangerous, but in which many drivers still engage. However, an important difference between these behaviors is that drivers may not realize they are drowsy are until it's too late (i.e., because of medicine or health issue), whereas by deliberately engaging distracting actions, drivers know they are being unsafe. Several studies across the past two decades have estimated the portion of the population who have fallen asleep at the wheel through self-reporting. A 2010 survey of 2,000 U.S. residents found 41% of drivers reported having ever fallen asleep or nodding off while driving (AAA Foundation, 2010). Four percent of drivers reported falling asleep while driving in the past month, while 11% had done so within the past year. A similar, more recent study found that nearly all drivers (97%) believe it is unacceptable to drive while excessively drowsy, yet 32% admitted to having driven while too tired to easily keep their eyes open in the past 30 days (AAA Foundation, 2016). A Centers for Disease Control and Prevention survey of over 90,000 U.S. residents found that 4% reported having fallen asleep while driving at least once in the past 30 days (Wheaton, Chapman, Presley-Cantrell, Croft, & Roehler, 2014). NHTSA surveyed 4,010 drivers in spring 2002 and found 11% reported that they had nodded off while driving during the past year (Royal, 2003). Of those who nodded off, 66% said they had 6 or fewer hours of sleep the previous night.

These surveys provide additional useful information about drowsy driving. Three of the studies found that young drivers and male drivers were more likely than older drivers and female drivers to have dozed off at the wheel (AAA Foundation, 2010; Wheaton et al, 2014; Royal, 2003). Moreover, driving while drowsy does not just occur late at night. About one-quarter of those drivers who admit to nodding off say the most recent incident occurred in the afternoon (noon to 5 p.m.), which might be attributable to circadian rhythms (Royal, 2003). Drowsy driving is also not limited to long trips – roughly half of the drivers who nodded off had been driving for an hour or less.

It's often difficult to determine whether drowsy driving contributed to a crash. Similar to distracted driving, drivers may be reluctant to admit they dozed off following a crash. Current estimates range from 2% to 20% of annual traffic deaths attributable to driver drowsiness, according to the NHTSA Drowsy Driving Research and Program Plan (NHTSA 2016). Annually from 2009 to 2013, there were on average over 72,000 police-reported crashes involving drowsy drivers, injuring more than an estimated 41,000 people, and killing more than 800, as measured by NHTSA's Fatality Analysis Reporting System (FARS) and National Automotive Sampling System (NASS) General Estimates System (GES). However, researchers have inferred the existence of additional drowsy-driving crashes by looking for correlations with related factors such as the number of passengers in the vehicle, crash time and day of week, driver sex, and crash type. A study by the AAA Foundation using data from 1999 to 2013 found that driver

drowsiness may have contributed to 6% of all crashes and 21% of fatal crashes (Tefft, 2014). This estimate suggests that more than 6,000 people died in drowsy-driving-related motor vehicle crashes across the United States last year.

Strategies to Reduce Distracted and Drowsy Driving

The seemingly easy way to reduce distracted or drowsy driving crashes is to convince or require drivers to pay attention to their driving and to get enough sleep. However, these are very difficult goals. Many drivers consider some distractions, such as eating or drinking, listening to the radio, or talking on a cell phone, to be important and common activities and are unlikely to give them up. Drowsy driving may result from lifestyles that include insufficient or irregular sleep (shift workers, for instance) or from medical problems – issues beyond a driver's immediate control. Moreover, studies indicate that drivers themselves are poor judges of the performance decrements that result from distracting activities and from drowsiness (Horrey, Lesch, & Garabet, 2008; Powell & Chau 2010).

Behavioral strategies for distracted and drowsy driving focus on removing some of the underlying causes or promoting awareness of the risks. Currently, few studies have examined whether the standard behavioral countermeasures of laws, enforcement, and sanctions (which are used successfully for alcohol impairment, seat belt use, aggressive driving, and speeding) are effective for distracted or drowsy drivers. However, pilot studies focused on high-visibility enforcement combined with paid and earned media suggest that these elements show promise in reducing the use of hand-held phones and texting (Cosgrove, Chaudhary, & Reagan, 2011). Additionally, standard behavioral countermeasures have been studied with young drivers: some graduated driver licensing provisions help reduce distracted and drowsy driving by limiting the number of passengers, prohibiting nighttime driving, and restricting cell phone use (see Chapter 6, Sections 1.3 to 1.5).

Distracted or drowsy driving that is related to a driver's job may be reduced through employer policies and programs. Links to employer-based resources are available from the Network of Employers for Traffic Safety through trafficsafety.org. The National Safety Council also provides resources to employers, including an online distracted driving course at nsc.org/learn/NSC-Initiatives/Pages/distracted-driving. Drowsy driving caused by medical conditions such as sleep apnea or by drugs or medications may be addressed through policies, communications, and outreach. Similarly, communications and outreach may be useful in raising awareness of specific distraction or drowsiness issues among certain high-risk populations. However, it is unknown if any of these strategies have been evaluated.

There are a variety of environmental and vehicular strategies to address distracted and drowsy driving. Rumble strips, both on the shoulder and the centerline, have demonstrated their effectiveness in preventing crashes associated with inattention or drowsiness (Persaud, Lyon, Eccles, & Soika, 2016). Other roadway improvements, such as wide and visible edge lines, more easily visible road signs, and better lighting at night can help drivers who are not fully alert. Vehicular strategies also can address driver distraction and drowsiness. Collision avoidance technologies such as lane departure warning, crash-imminent braking, and forward collision

warning; and vehicle-to-vehicle and vehicle-to-infrastructure communications technologies hold promise for reducing crashes among drivers who are drowsy or inattentive (IIHS, 2012; IIHS, 2014c). Such technologies, once available only in luxury brands, are now offered in many new vehicles. Additionally, in-vehicle technology in the future may be able to detect driver distraction or drowsiness, by monitoring driver performance and then alerting drivers (Donmez, Boyle, & Lee, 2007; May & Baldwin, 2009; Papadelis et al., 2007; Sahayadhas, Sundaraj, & Murugappan, 2012; Brown, Lee, Schwarz, Fiorentino, & McDonald, 2014). On the other hand, built-in technologies such as navigation and entertainment systems in vehicles may create more potential distractions. NHTSA developed Visual-Manual Driver Distraction Guidelines for In-Vehicle Electronic devices pertaining to original equipment in-vehicle electronic devices (78 Fed. Reg. 24,817, 2013). Although voluntary, the Guidelines encourage automobile manufactures to design in-vehicle devices so that potentially distracting tasks are limited while driving. This chapter only addresses behavioral strategies. It does not include environmental, vehicular, and engineering countermeasures because State Highway Safety Offices do not have authority or responsibility in these areas.

Driver drowsiness is a critical issue for commercial drivers. The Federal Motor Carrier Safety Administration regulates drowsiness in commercial drivers through Hours of Service regulations, driver logs and inspections (see for example FMCSA, 2008). FMCSA has an extensive drowsy driver research program focused on commercial drivers (FMCSA, 2005). Additionally, NHTSA recently published a Drowsy Driving Research and Program Plan that describes multiple projects related to quantifying the problem, building public awareness and education, policy development, high-risk populations, vehicle technology, and infrastructure (NHTSA 2016). NHTSA has also developed a prototype Drowsy Driver Warning System that appears promising in reducing drowsiness among drivers of heavy vehicles (Blanco et al., 2009; see also Brown et al., 2014). As with the environmental and vehicular countermeasures mentioned above, commercial driver countermeasures are not discussed in this guide because they do not fall under SHSO jurisdiction.

Resources

The agencies and organizations listed below can provide more information on distracted and drowsy driving and links to numerous other resources.

- U.S. Department of Transportation website on distracted driving: www.distraction.gov
- National Highway Traffic Safety Administration:
  - Research and Evaluation – one.nhtsa.gov/Driving-Safety/Research-&-Evaluation
  - Distracted Driving – www.nhtsa.gov/risky-driving/distracted-driving
  - Drowsy Driving – www.nhtsa.gov/risky-driving/drowsy-driving; one.nhtsa.gov/Driving-Safety/Drowsy-Driving
  - Behavioral Safety Research Reports – ntlsearch.bts.gov/repository/ntlc/nhtsa/index.shtm
- Governors Highway Safety Association: www.ghsa.org
- National Safety Council: www.nsc.org/learn/NSC-Initiatives/Pages/distracted-driving.aspx
- National Conference of State Legislatures: www.ncsl.org/research/transportation/spotlight-distracted-driving

- National Sleep Foundation: www.sleepfoundation.org
- Insurance Institute for Highway Safety: www.iihs.org
- AAA Foundation for Traffic Safety: www.aaafoundation.org
- Network of Employers for Traffic Safety: trafficsafety.org

For overviews of distracted driving prevalence, risks, legislation, research, and recommended strategies, see:

- NHTSA's Understanding the Effects of Distracted Driving and Developing Strategies to Reduce Resulting Deaths and Injuries: A Report to Congress – DOT HS 812 053 (Vegega, Jones, & Monk, 2013).
- NHTSA's Driver Distraction: A Review of the Current State-of-Knowledge – DOT HS 810 787 (Ranney, 2008).
- Overview of the National Highway Traffic Safety Administration's Driver Distraction Program – DOT HS 811 299 (NHTSA, 2010).
- GHSA's Distracted Driving: What Research Shows and What States Can Do (GHSA, 2011).
- World Health Organization's Mobile Phone Use: A Growing Problem of Driver Distraction (WHO/NHTSA, 2011).
- NHTSA's Blueprint for Ending Distracted Driving – DOT HS 811 629 (NHTSA, 2012).

For overviews on drowsy driving, see:

- GHSA's Wake Up Call! Understanding Drowsy Driving and What States Can Do (GHSA, 2016c).
- NHTSA Drowsy Driving Research and Program Plan – DOT HS 812 252 (NHTSA, 2016a).
- NHTSA's Asleep at the Wheel: A Nation of Drowsy Drivers Forum (NHTSA, 2016b).

Key terms

- GDL: Graduated driver licensing, a three-phase system for beginning drivers consisting of a learner's permit, a provisional license, and a full license. A learner's permit allows driving only while supervised by a fully licensed driver. A provisional license allows unsupervised driving under certain restrictions.
- NCSDR: National Center for Sleep Disorders Research
- NSF: National Sleep Foundation.

Distracted and Drowsy Driving Countermeasures

Countermeasures to reduce distracted and drowsy driving are listed in the table below. The table is intended to provide a rough estimate of each countermeasure's effectiveness, use, cost, and time required for implementation. Effectiveness is shown using a five-star rating system:

- Countermeasures that receive ★★★★ or ★★★★★ have been determined to be effective.
- Countermeasures that receive ★★★ are considered promising, and likely to be effective.
- Countermeasures that receive ☆ or ☆☆ have NOT been determined to be effective, either because there has been limited or no high quality evidence (☆) or because effectiveness is still undetermined based on the evidence that is available (☆☆).

States, communities and other organizations are encouraged to use ★★★, and especially ★★★★ or ★★★★★, countermeasures. They should use caution in selecting ☆ or ☆☆ countermeasures, since conclusive evidence is not available to demonstrate the effectiveness of these countermeasures. If they decide to use a new or emerging countermeasure that has not yet been studied sufficiently to demonstrate that the countermeasure is effective, they are encouraged to have the countermeasure evaluated in connection with its use.

Further details about the symbols and terms used are included after the table. Effectiveness, cost, and time to implement can vary substantially from State to State and community to community. Costs for many countermeasures are difficult to measure, so the summary terms are very approximate.

Each countermeasure to reduce distracted and drowsy driving is discussed individually in this chapter. Full descriptions are included for ★★★, ★★★★ and ★★★★★ countermeasures. Brief descriptions are included for ☆ and ☆☆ countermeasures. Further details about the ☆ and ☆☆ countermeasures are included in Appendix A4 to this report.

1. Laws and Enforcement

Countermeasure	Effectiveness	Cost	Use	Time
1.1 GDL Requirements for Beginning Drivers	★★★★★†	$	High	Medium
1.2 Cell Phone and Text Messaging Laws	☆☆	$	Medium	Short
1.3 High-Visibility Cell Phone/Text Messaging Enforcement	★★★★	$$$	Low	Medium
1.4 General Drowsiness and Distraction Laws	☆	Varies	High††	Short

† Effectiveness demonstrated for nighttime and passenger restrictions
†† Included under reckless driving; use of explicit drowsiness and distraction laws is low

2. Communications and Outreach

Countermeasure	Effectiveness	Cost	Use	Time
2.1 Communications and Outreach on Drowsy Driving	☆	$$	Unknown	Medium
2.2 Communications and Outreach on Distracted Driving	☆	$$	High	Medium

3. Other Countermeasures

Countermeasure	Effectiveness	Cost	Use	Time
3.1 Employer Programs	☆☆	$	Unknown	Short
3.2 Education Regarding Medical Conditions and Medications	☆	Variable	Unknown	Medium

Effectiveness:

★★★★★ - Demonstrated to be effective by several high-quality evaluations with consistent results

★★★★ - Demonstrated to be effective in certain situations

★★★ - Likely to be effective based on balance of evidence from high-quality evaluations or other sources

☆☆ - Effectiveness still undetermined; different methods of implementing this countermeasure produce different results

☆☆ - Limited or no high-quality evaluation evidence

Effectiveness is measured by reductions in crashes or injuries unless noted otherwise. See individual countermeasure descriptions for information on effectiveness size and how effectiveness is measured.

Cost to implement:

$$$: requires extensive new facilities, staff, equipment, or publicity, or makes heavy demands on current resources
$$: requires some additional staff time, equipment, facilities, and/or publicity
$: can be implemented with current staff, perhaps with training; limited costs for equipment or facilities

These estimates do not include the costs of enacting legislation or establishing policies.

Use:

High: more than two-thirds of the States, or a substantial majority of communities
Medium: between one-third and two-thirds of States or communities
Low: fewer than one-third of the States or communities

Unknown: data not available

Time to implement:

Long: more than 1 year
Medium: more than 3 months but less than 1 year
Short: 3 months or less

These estimates do not include the time required to enact legislation or establish policies.

1. Laws and Enforcement

1.1 Graduated Driver Licensing Requirements for Beginning Drivers

Effectiveness: ★★★★★†	Cost: $	Use: High	Time: Medium

† Effectiveness demonstrated for nighttime and passenger restrictions

Studies suggest teenagers and adults are similar in terms of how often they engage in potentially distracting activities while driving (Foss & Goodwin, 2014; Klauer et al., 2014). However, as mentioned in the introduction, teens are at higher risk for a crash when engaged in distracting activities compared to adults (Klauer et al., 2014). Teens are less experienced at the task of driving, so driving requires more of their attention than is the case for experienced drivers (Lansdown, 2002). Moreover, key areas of the brain are still developing during adolescence, making it difficult for teens to manage potential distractions (Keating, 2007). A number of studies also suggest that drivers 16 to 24 are somewhat more likely than other age groups to drive while drowsy (AAA Foundation, 2012; Royal, 2003; Wheaton et al., 2014).

Several elements of graduated driver licensing (GDL) reduce the likelihood of drowsiness and distractions for newly licensed drivers. For example, nighttime driving is typically restricted under GDL. Driving at night is associated with higher fatal crash risk than during the day for teen drivers (McCartt & Teoh, 2015), and also may pose greater risks of drowsy driving. In addition, GDL systems usually include a passenger restriction. Passengers, especially teenage passengers, are a major source of distraction for young, beginning drivers (Foss & Goodwin, 2014). Cell phones can also distract drivers (see Appendix A4, Section 1.2), so they are often restricted under GDL. The NCHRP guide for reducing crashes involving young drivers describes the key provisions of GDL laws (Goodwin, Foss, Sohn, & Mayhew, 2007). The Insurance Institute for Highway Safety (IIHS, 2015) and the Governors Highway Safety Association (GHSA, 2016a) summarize State GDL laws. These summaries are updated monthly. See Chapter 6, Sections 1.1 and Appendix A6, Section 1.7, for a complete discussion of GDL for beginning young drivers.

Use: As of November 2016 all 50 States and the District of Columbia had some GDL components in place. The laws in 49 States and the District of Columbia do not allow driving during certain nighttime hours. Laws in 46 States and the District of Columbia limit the number of passengers allowed with a driver with a provisional license (GHSA, 2016a; IIHS, 2015). Thirty-Seven States and the District of Columbia prohibit the use of cell phones, both hand-held and hands-free, by drivers with learner's permits or provisional licenses or by drivers under 18 (IIHS, 2016).

Effectiveness: Several studies document that nighttime and passenger GDL restrictions reduce teenage driver crashes and injuries (Hedlund & Compton, 2005; Goodwin, Foss, Sohn, & Mayhew, 2007; Williams, 2007); however, an evaluation of a GDL cell phone restriction suggests cell phone restrictions may have little effect on teenage drivers' cell phone use (Foss, Goodwin, McCartt, & Hellinga, 2009; Goodwin, O'Brien, & Foss, 2012). This finding is consistent with McCartt, Kidd, & Teoh (2014) who determined that cell phone laws in general have little effect on teenagers' use of cell phones while driving.

One factor that may undermine the effectiveness of GDL restrictions on cell phone use in teen drivers is the perception that the risk of penalty from not complying with the law is low. In particular, a study of GDL violations in Washington State and North Carolina found low overall enforcement of the GDL requirement laws, particularly the cell phone use requirement in both States (AAA Foundation, 2014). The authors cite that one possible explanation for low enforcement of cell phone requirements is that it may be difficult for officers to discern whether a particular cell phone activity is a banned task or one that is allowed. The most frequently charged violation was violation of passenger restrictions. In an analysis of naturalistic driving data, the most frequently seen driving behavior leading up to a teen crash was attending to passengers (Carney, McGeHee, Harland, Weiss, & Raby, 2015). AAA Foundation (2014) also found that a high proportion of citations were dismissed by the courts, which "may very well be detrimental to the overall effectiveness of GDL programs."

Costs: Publicity for GDL restriction changes can be delivered directly by the Department of Motor Vehicles to young drivers as they apply for their learner's permits and provisional licenses, so costs can be minimal. Information about GDL restrictions can also be provided through driver education courses.

Time to implement: GDL nighttime, passenger, or cell phone restriction changes require several months to implement for drivers receiving a provisional license. They then will take one or two years before all provisionally licensed drivers are subject to the new restrictions.

1.2 Cell Phone and Text Messaging Laws

Effectiveness: ☆☆	Cost: $	Use: Medium	Time: Short

This countermeasure involves legislation to curtail distracted driving or driver cell phone use. It has been implemented at both the State and local level throughout the country. Bans on texting are more common than bans on hand-held cell phone use. Fourteen States and the District of Columbia have laws banning hand-held cell phones while driving, but at present no State restricts *hands-free* phone use for all drivers (GHSA, 2016b; IIHS, 2016). Forty-Six States have banned text messaging for all drivers (GHSA, 2016b; IIHS, 2016).

Effectiveness Concerns: *The effectiveness of laws banning cell phone use has been examined in several research studies. The results across types of phone use are inconsistent. Specifically, research examining prohibitions on hands-free phone use and texting have yielded mixed results in terms of reductions in phone use while driving and reduced crashes. There is some evidence that banning hand-held cellphone use leads to long-term reductions in this behavior; however, it is unknown if drivers are simply switching to hands-free use. At this time, there is insufficient consensus across research findings to determine that this countermeasure is effective.*

Further information about the known research, potential effectiveness, costs, use, and time to implement is available in Appendix A4, Section 1.2.

1.3 High-Visibility Cell Phone and Text Messaging Enforcement

Effectiveness: ★★★★	Cost: $$$	Use: Low	Time: Medium

Numerous studies demonstrate that high-visibility enforcement (HVE) can be effective in curbing alcohol-impaired driving and increasing seat belt use among drivers (see Chapter 1, Section 2.1 and Chapter 2, Section 2.1). Recently, NHTSA has examined whether the HVE model could be effective in reducing hand-held cell phone use and texting among drivers.

Similar to sobriety checkpoints, the objective is to deter cell phone use by increasing the perceived risk of a ticket. The HVE model combines dedicated law enforcement with paid and earned media supporting the enforcement activity. Enforcement officers actively seek out cell phone users through special roving patrols or through a variety of enforcement techniques such as the spotter technique where a stationary officer will radio ahead to another officer when a driver using a cell phone is detected. Officers report that higher vantage points, SUVs, and unmarked vehicles are strategies useful in identifying violators (Chaudhary, Casanova-Powell, Cosgrove, Reagan, & Williams, 2014). Both earned and paid media are critical to ensure the general public is aware of the enforcement activity, and to increase the perception that being caught is likely.

NHTSA conducted a high-visibility enforcement demonstration project aimed at reducing cell phone use among drivers. The message of the program was: “Phone in one hand. Ticket in the other.” Pilot programs were tested in Hartford, Connecticut, and Syracuse, New York, from April 2010 to April 2011. Law enforcement officers conducted four waves of enforcement during the course of the year. Approximately 100 to 200 citations were issued per 10,000 population during each enforcement wave. Paid media (TV, radio, and online advertisements and billboards) and earned media (e.g., press events and news releases) supported the enforcement activity. For more details about the program, see Chaudhary et al. (2014).

To examine the effectiveness of high-visibility enforcement in larger jurisdictions, NHTSA proceeded to implement an HVE campaign in Delaware and in nine California counties in the Sacramento area. Three waves of enforcement were conducted from November 2012 to June 2013. Paid and earned media were similar to that in Hartford and Syracuse. See Schick, Vegega, and Chaudhary (2014) and Chaudhary, Connolly, Tison, Solomon, & Elliott (2015) for more information.

Observations from the previous demonstration projects in Hartford/Syracuse and California/Delaware indicated that relatively few citations were issued for texting while driving. Moreover, feedback from law enforcement officers suggested that enforcing laws prohibiting texting while driving was difficult. In 2012 NHTSA undertook a third demonstration program to determine the enforceability of texting laws and to test methods for enforcing these laws. Law enforcement agencies in Connecticut and Massachusetts participated in the program. Four waves of enforcement were conducted in each State over 2013 and 2014. The evaluation suggested that having a strong set of distracted driving laws helps with enforcement of texting laws (See Retting, Sprattler, Rothenberg, & Sexton, 2017).

Use: To date, only a handful of States have implemented high-visibility enforcement programs to address talking and texting among drivers.

Effectiveness: Results from the NHTSA HVE program suggest hand-held cell phone use among drivers dropped 57% in Hartford and 32% in Syracuse (Chaudhary et al., 2014). The percentage of drivers observed manipulating a phone (e.g., texting or dialing) also declined. Public awareness of distracted driving was already high before the program, but surveys suggest awareness of the program and enforcement activity increased in both Hartford and Syracuse. Surveys also showed most motorists supported the enforcement activity. In California and Delaware, similar reductions in cell phone use were observed following the campaign, although decreases were also noted in comparison communities (Schick et al., 2014). Although these results are encouraging, the effect of HVE campaigns on crashes is not certain. An analysis of crash data from before and after the enforcement period found no effects of HVE on the incidence of distraction-related crashes (Chaudhary et al., 2015). Note that the evidence for effectiveness is based on community and smaller statewide programs that targeted hand-held cell phone use. There is no evidence available that HVE programs targeting texting will be as effective.

Costs: High-visibility enforcement campaigns are expensive. They require time from law enforcement officers to conduct the enforcement. In addition, time is needed from State highway safety office and media staff and often from consultants to develop, produce, and distribute advertising, educational materials, and other communications tools. In the NHTSA demonstration program, both Connecticut and New York received $200,000 to implement and evaluate the program, and each State contributed an additional $100,000 to the Federal funds. Paid media costs for the program in the two States were over $500,000.

Time to implement: A high-visibility enforcement program requires 4 to 6 months to plan and implement.

1.4 General Driver Drowsiness and Distraction Laws

Effectiveness: ☆	Cost: Varies	Use: High†	Time: Short

† Included under reckless driving; use of explicit drowsiness and distraction laws is low

This countermeasure involves laws that specifically target the issue of drowsy and/or distracted drivers. With regard to drowsy driving, this type of law would permit drivers to be prosecuted for vehicular homicide if they have not slept in 24 hours and they cause a crash in which someone is killed. With regard to distracted driving, this type of law would permit drivers who are involved in a crash or who commit an infraction to be cited for distracted driving if a police officer believes distraction to be the underlying cause. Distraction is defined as an activity not necessary to the operation of the vehicle that impairs, or could impair, the ability to drive safely (GHSA, 2011).

Effectiveness Concerns: *Laws that specifically target drowsy and/or distracted drivers are not widely used, and this countermeasure has not been systematically examined. There is insufficient evaluation data available to conclude that the countermeasure is effective.*

Further information about the known research, potential effectiveness, costs, use, and time to implement is available in Appendix A4, Section 1.4.

2. Communications and Outreach

2.1 Communications and Outreach on Drowsy Driving

Effectiveness: ☆	Cost: $$	Use: Unknown	Time: Medium

This countermeasure involves drowsy driving communications and outreach campaigns directed to the general public (Stutts, Knipling, Pfefer, Neuman, Slack, & Hardy, 2005, Strategy C1; NSF, 2004). Campaign goals usually include:

- raising awareness of the dangers of drowsy driving;
- motivating drivers to take action to reduce drowsy driving; and
- providing information on what drivers can do, either before they start out on a trip or if they become drowsy while driving.

These campaigns can be conducted by States and national organizations such as the National Sleep Foundation.

Effectiveness Concerns: *This countermeasure has not been systematically examined. There is insufficient evaluation data available to conclude that the countermeasure is effective.*

Further information about the known research, potential effectiveness, costs, use, and time to implement is available in Appendix A4, Section 2.1.

2.2 Communications and Outreach on Distracted Driving

Effectiveness: ☆	Cost: $$	Use: High	Time: Medium

This countermeasure involves distracted driving communications and outreach campaigns directed to the general public. Since distracted driving is a particular concern among teenage drivers (Foss & Goodwin, 2014; NHTSA, 2012), distracted driving campaigns may specifically target teen drivers. Some campaigns carry a general "pay attention" message, while others are directed at specific behaviors such as cell phone use.

Effectiveness Concerns: *Based on NCHRP research, there are no studies of any campaign's effects on driver knowledge, attitudes, or behavior (Stutts, Knipling, Pfefer, Neuman, Slack, & Hardy, 2005, Strategies C1 and D2).*

Further information about the known research, potential effectiveness, costs, use, and time to implement is available in Appendix A4, Section 2.2.

3. Other Countermeasures

3.1 Employer Programs

Effectiveness: ☆☆	Cost: $	Use: Unknown	Time: Short

This countermeasure involves employer-based programs targeting workers that are at higher risk of drowsy-driving crashes. These groups include shift workers who work long or irregular hours or who work at night, including many law enforcement officers (Stutts, Knipling, Pfefer, Neuman, Slack, & Hardy, 2005, Strategy D6). Another at-risk group for drowsy driving crashes is medical interns and emergency responders (such as EMS), who frequently work extended shifts of 24 hours or more. Education program for shift workers can include information on sleep habits in general and drowsy driving in particular. Employer programs can also include medical condition testing/education.

Effectiveness Concerns: *This countermeasure has not been systematically examined. There is insufficient evaluation data available to conclude that the countermeasure is effective.*

Further information about the known research, potential effectiveness, costs, use, and time to implement is available in Appendix A4, Section 3.1.

3.2 Education Regarding Medical Conditions and Medications

Effectiveness: ☆	Cost: Variable	Use: Unknown	Time: Medium

This countermeasure involves providing education about a number of chronic medical conditions and sleep disorders that may compromise sleep and lead to drowsy driving or falling asleep at the wheel. These conditions include insomnia, sleep apnea, and narcolepsy.

The principal countermeasures to address these conditions are:

1. Communications and outreach on sleep disorders to increase overall awareness of their symptoms, consequences, and treatment.
2. Efforts with driver licensing medical advisory boards to increase their awareness of these conditions as they review driver fitness for licensing.
3. Efforts with physicians to increase their awareness of these conditions and their potential effects on driving, to treatment for these conditions as appropriate, and to counsel their patients to take steps to reduce the risk of drowsy driving.

Effectiveness Concerns: *This countermeasure has not been systematically examined. There is insufficient evaluation data available to conclude that the countermeasure is effective.*

Further information about the known research, potential effectiveness, costs, use, and time to implement is available in Appendix A4, Section 3.2.

Distracted and Drowsy Driving References

78 Fed. Reg. 24,817 (proposed April 26, 2013). Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices.

AAA Foundation. (2010). *Asleep at the wheel: The prevalence and impact of drowsy driving*. Retrieved from www.aaafoundation.org/pdf/2010DrowsyDrivingReport.pdf

AAA Foundation. (2013). *Distracted driving and perceptions of hands-free technologies. Findings from the 2013 Traffic Safety Culture Index*. Retrieved from www.aaa-foundation.org/sites/default/files/2013%20TSCI%20Cognitive%20Distraction.pdf

AAA Foundation. (2014). *Violations and Enforcement of Graduated Driver Licensing Restrictions in North Carolina and Washington State*. Retrieved from www.aaafoundation.org/sites/default/files/WA%20and%20NC%20GDL%20Enforcement%20FTS%20FINAL%20FORMAT.pdf

AAA Foundation. (2016). *2015 traffic safety culture index.* Retrieved from www.aaafoundation.org/sites/default/files/2015_TSCI.pdf

Blanco, M., Bocanegra, J. L., Morgan, J. F., Fitch, G. M, Medina, A., Olson, R. L., . . . Zimmermann, R. P. (2009). *Assessment of a drowsy driver warning system for heavy-vehicle drivers: Final report* (Report No. DOT HS 811 117). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.dot.gov/DOT/NHTSA/-NRD/Multimedia/PDFs/Crash%20Avoidance/2009/811117.pdf

Brown, T., Lee, J., Schwarz, C., Fiorentino, D., & McDonald, A. (2014). Assessing the feasibility of vehicle-based sensors to detect drowsy driving. (Report No. DOT HS 811 886). Washington, DC: National Highway Traffic Safety Administration.

Carney, C., McGeHee, D., Harland, K., Weiss, M., & Raby, M. (2015). *Using naturalistic driving data to assess the prevalence of environmental factors and driver behaviors in teen driver crashes.* Retrieved from www.aaafoundation.org/sites/default/files/2015TeenCrashCausationReport.pdf

Chaudhary, N. K., Casanova-Powell, T. D., Cosgrove, L., Reagan, I., & Williams, A. (2014). *Evaluation of NHTSA distracted driving demonstration projects in Connecticut and New York* (Report No. DOT HS 81 635). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/staticfiles/nti/pdf/811635_Eval_NHTSA_Distracted_Driving_Demo_Proj_Comm_CT_and_NY.pdf

Chaudhary, N. K., Connolly, J., Tison, J., Solomon, M., & Elliott, K. (2015). *Evaluation of the NHTSA Distracted Driving High-Visibility Enforcement Demonstration Projects in California and Delaware* (No. DOT HS 812 108).

Dingus, T. A., Guo, F., Lee, S., Antin, J. F., Perez, M., Buchanan-King, M., & Hankey, J. (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data. *Proceedings of the National Academy of Sciences*, *113*(10), 2636-2641.

Donmez, B., Boyle, L. N, & Lee, J.D. (2007). Safety implications of providing real-time feedback to distracted drivers. *Accident Analysis and Prevention*, *39*, 581-590.

Federal Motor Carrier Safety Administration. (2005). *5-Year strategic plan, FY2005-FY2009*. Retrieved from www.fmcsa.dot.gov/facts-research/research- technology/report/rt-5year-strategicplan.htm

Federal Motor Carrier Safety Administration. (2008). *Hours-of-service regulations*. Retrieved from www.fmcsa.dot.gov/rules-regulations/topics/hos/hos-2005.htm

Foss, R. D., Goodwin, A. H. (2014). Distracted driver behaviors and distracting conditions among adolescent drivers: Findings from a naturalistic study. *Journal of Adolescent Health*, *54*, S50-S60.

Foss, R. D., Goodwin, A. H., McCartt, A. T., & Hellinga, L. A. (2009). Short-term effects of a teenage driver cell phone restriction. *Accident Analysis and Prevention*, *41*, 419-424.

Governor's Highway Safety Association. (2011). *Distracted driving: What research shows and what states can do*. Retrieved from www.ghsa.org/html/files/pubs/sfdist11.pdf

GHSA. (2016a). *Graduated Driver Licensing (GDL) laws.* Retrieved from www.ghsa.org/html/stateinfo/laws/license_laws.html

GHSA. (2016b). *Distracted Driving Laws.* Retrieved from www.ghsa.org/html/stateinfo/laws/cellphone_laws.html

GHSA. (2016c). *Wake Up Call! Understanding Drowsy Driving and What States Can Do.* Retrieved from www.ghsa.org/resources/wake-call-understanding-drowsy-driving-and-what-states-can-do

Goodwin, A., Foss, R., Sohn, J., & Mayhew, D. (2007). Guidance for implementation of the AASHTO Strategic Highway Safety Plan, Volume 19: *A guide for reducing collisions involving young drivers*. Washington, DC: Transportation Research Board. Retrieved from http://download.nap.edu/cart/download.cgi?record_id=14103

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. *Accident Analysis & Prevention, 48,* 363-367.

Hedlund, J., & Compton, R. (2005). Graduated driver licensing research in 2004 and 2005. *Journal of Safety Research*, *36*, 109-119.

Horrey, W. J., Lesch, M. F., & Garabet, A. (2008). Assessing the awareness of performance decrements in distracted drivers. *Accident Analysis and Prevention*, *40*, 675-682.

Insurance Institute for Highway Safety. (2012a). *U.S. licensing systems for young drivers: Laws as of July 2010*. Retrieved from www.iihs.org/laws/graduatedLicenseIntro.aspx

IIHS. (2012). They're working: Insurance collision claims data show which new technologies are preventing crashes. *Status Report*, *47*. Retrieved from www.iihs.org/iihs/sr/statusreport/article/47/5/1

IIHS. (2014a). *Teenagers: State laws*. Retrieved from www.iihs.org/iihs/topics/laws/graduatedlicenseintro?topicName=teenagers

IIHS. (2014b). *Distracted driving: State laws*. Retrieved from www.iihs.org/iihs/topics/laws/cellphonelaws?topicName=distracted-driving

IIHS. (2014c). Technology that pays attention to the road when drivers don't. *Status Report, 49*(8). Retrieved from www.iihs.org/externaldata/srdata/docs/sr4908.pdf

IIHS. (2015). *Teenagers*. Retrieved from www.iihs.org/iihs/topics/laws/graduatedlicenseintro?topicName=teenagers

IIHS. (2016). *Distracted driving*. Retrieved from www.iihs.org/iihs/topics/laws/cellphonelaws?topicName=distracted-driving

Keating, D. P. (2007). Understanding adolescent development: Implications for driving safety. *Journal of Safety Research*, *38*, 147-157.

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). Retrieved from: http://vtechworks.lib.vt.edu/bitstream/handle/10919/55090/DriverInattention.pdf?sequence=1

Klauer, S. G., Guo, F., Simons-Morton, B. G., Ouimet, M. C., Lee, S. E., & Dingus, T. A. (2014). Distracted driving and risk of road crashes among novice and experienced drivers. *The New England Journal of Medicine*, *370*, 54-59.

Lansdown, T.C. (2002). Individual differences during driver secondary task performance: Verbal protocol and visual allocation findings. *Accident Analysis and Prevention¸ 34*, 655-662.

May, J. F., & Baldwin, C. L. (2009). Driver fatigue: The importance of identifying causal factors of fatigue when considering detection and countermeasure technologies. *Transportation Research Part F*, *12*, 218-224.

McCartt, A. T., Kidd, D. G., & Teoh, E. R. (2014). Driver cellphone and texting bans in the United States: evidence of effectiveness. *Annals of Advances in Automotive Medicine, 58*, 99.

McCartt, A. T., & Teoh, E. R. (2015). Tracking progress in teenage driver crash risk in the United States since the advent of graduated driver licensing programs. *Journal of Safety Research*, 53, 1–9

National Center for Statistics and Analysis. (2016). *Traffic Safety Facts, Research Note: Distracted Driving 2014*. (Report No. DOT HS 812 260). Washington, DC: National Highway Traffic Safety Administration. Retrieved from http://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812260

NHTSA. (2010). *Overview of the National Highway Traffic Safety Administration's driver distraction program* (Report No. DOT HS 811 299). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/staticfiles/nti/distracted_driving/pdf/811299.pdf

NHTSA. (2011). *Drowsy driving* (Report No. DOT HS 811 449). Washington, DC: National Highway Traffic Safety Administration. Retrieved from crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811449

NHTSA. (2012). *Blueprint for ending distracted driving* (Report No. DOT HS 811 629). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.distraction.gov/downloads/pdfs/blueprint-for-ending-distracted-driving.pdf

NHTSA. (2016a). *NHTSA Drowsy Driving Research and Program Plan* (Report No. DOT HS 812 252). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/staticfiles/nti/pdf/DrowsyDriving_StrategicPlan_030316.pdf

NHTSA. (2016b). *Asleep at the Wheel: A Nation of Drowsy Drivers.* Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/nhtsa/symposiums/november2015/index.html

National Sleep Foundation. (2004). *Drive Alert – Arrive Alive national campaign.* Washington, DC: Author.

Papadelis, C., Chen, Z., Kourtidou-Papadeli, C., Bamidis, P. D., Chouvarda, I., Bekiaris, E., & Maglaveras, N. (2007). Monitoring sleepiness with on-board electrophysiological recordings for preventing sleep-deprived traffic accidents. *Clinical Neurophysiology*, *118*, 1906-1922.

Persaud, B., Lyon, C., Eccles, K., & Soika, J. (2016). Safety effectiveness of centerline plus shoulder rumble strips on two-lane rural roads. *Journal of transportation engineering*, *142*(5). Retrieved from http://dx.doi.org/10.1061/(ASCE)TE.1943-5436.0000821#sthash.g02qiq31.dpuf

Ranney, T. A. (2008). *Driver distraction: A review of the current state-of-knowledge* (Report No. DOT HS 810 787). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/2008/810787.pdf

Retting, R., Sprattler, K., Rothenberg, H., & Sexton, T. (2017). *Evaluating the enforceability of texting laws: Strategies tested in Connecticut and Massachusetts* (Report No. DOT HS 812 367). Washington, DC: National Highway Traffic Safety Administration.

Royal, D. (2003). *National survey of distracted and drowsy driving attitudes and behavior: 2002 volume I: Findings* (Report No. DOT HS 809 566). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.dot.gov/people/injury/drowsy_driving1/survey-distractive03/index.htm

Sahayadhas, A., Sundaraj, K., & Murugappan, M. (2012). Detecting driver drowsiness based on sensors: A review. *Sensors*, *12*, 16937-16953.

Schick, A., Vegega, M., & Chaudhary, N. (2014). *Distracted driving high-visibility enforcement demonstrations in California and Delaware* (Report No. DOT HS 811 993). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/staticfiles/nti/pdf/811993DistractedDrivingHighVisibilityEnforcement_CA-DE-TT.pdf

Schroeder, P., Meyers, M., & Kostyniuk, L. (2013). *National survey on distracted driving attitudes and behaviors – 2012* (Report No. DOT HS 811 729). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/staticfiles/nti/pdf/811729.pdf

Stutts, J., Knipling, R. R., Pfefer, R., Neuman, T. R., Slack, K. L., & Hardy, K. K. (2005). *A guide for addressing collisions involving distracted or fatigued drivers.* (Report 500, Vol.

14). Washington, DC: Transportation Research Board. Available at http://download.nap.edu/cart/download.cgi?record_id=23420

Tefft, B. C. (2014*). Prevalence of motor vehicle crashes involving drowsy drivers, United States, 1999-2013.* Retrieved from the AAA Foundation for Traffic Safety website: www.aaafoundation.org/sites/default/files/AAAFoundation-DrowsyDriving-Nov2014.pdf

Vegega, M., Jones, B., & Monk, C. (2013). *Understanding the effects of distracted driving and developing strategies to reduce resulting deaths and injuries: A report to Congress* (Report No. DOT HS 812 053). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www.nhtsa.gov/staticfiles/nti/pdf/UnderstandingEffectsDistractDriving.pdf

Wheaton, A. G., Chapman, D. P., Presley-Cantrell, L. R., Croft, J. B., & Roehler, D. R. (2013). Drowsy driving – 19 States and the District of Columbia, 2009-2010. *Centers for Disease Control Morbidity and Mortality Weekly Report*, *61*, Nos 51 & 52, 1033-1037. Retrieved from www.cdc.gov/mmwr/preview/mmwrhtml/mm6151a1.htm

Wheaton, A. G., Shults, R. A., Chapman, D. P., Ford, E. S., & Croft, J. B. (2014). Drowsy driving and risk behaviors-10 States and Puerto Rico, 2011-2012. *Morbidity and Mortality Weekly Report*, *63*, 557-562.

Williams, A. F. (2007). Contribution of the components of graduated licensing to crash reductions. *Journal of Safety Research, 38*, 177-184.

World Health Organization & NHTSA. (2011). *Mobile phone use: A growing problem of driver distraction*. Retrieved from www.who.int/violence_injury_prevention/publications/road_traffic/distracted_driving_en.pdf