Title: Teen Drivers Distracted by Handheld Digital Devices: Assessing Program Efficacy and Student Knowledge, Attitudes, and Behaviors through a School-Based Intervention

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Introduction

Motor vehicle crashes are the leading cause of death and disability for adolescents 15-20 years old. These younger drivers are more likely than older drivers to be involved in a crash. In fact, today’s teen drivers, although “safer drivers than they were 10-years ago,” are involved in more crashes. Despite the disturbing reality of teen driving behavior, there are gaps in the literature relating to interventions designed to change teen driving behavior; more specifically driver distraction caused by the use of handheld electronic devices. 
devices, such as cell phones. As technophiles, teenagers are much more likely than older drivers to have handheld electronic devices and accept using them while driving. We also know that cell phone use is increasing nationally among drivers of all ages. Preliminary research using driving simulators has shown that driving performance, driving maintenance, attention, response times, and safe driving decision-making are significantly affected when talking on a cell phone.\textsuperscript{2,5} Select studies have shown that teens tend to make more “judgment errors...than older drivers.” With consideration, we can infer that cell phone use would increase this error factor, due to attention required to operate such devices.\textsuperscript{3}

A national survey found that teens recognized using a handheld device as the second high-risk situation that “made a lot of difference” in driving safety (ranked just after “driver has been drinking alcohol”).\textsuperscript{2} Two studies of cell phone billing data found a four-fold increase in the risk of a property-damage-only crash and the risk of an injury crash associated with phone use.\textsuperscript{6} Laws preventing cell phone use have been implemented in 13 states and the District of Columbia, but no research has been completed to indicate the efficacy of such laws in preventing injury and death.\textsuperscript{7,8} One such law presents the graduated driver’s license (GDL) system. While the GDL system is used nationally, the Insurance Institute for Highway Safety (IIHS) has rated only 28 states as “good” and has yet to rate a state “optimal.” Studies have shown that GDL “reduces teenage driver crashes and fatalities.” A general increase in driver education and experience would likely reduce teen cell phone use while driving.\textsuperscript{3} Recent research indicates that increased driver awareness of the adverse consequences of distracted driving, enforcement of existing laws, and new legislation in states without laws prohibiting the use of handheld electronic devices by teen drivers are needed to reduce injuries and deaths.\textsuperscript{9}

Through this prospective study, investigators answered the question, “What are 16-20 year olds knowledge, attitudes, and behaviors regarding their use of handheld digital devices while driving?” For the purposes of this study, handheld digital devices included cell phones, personal digital assistants, text messaging devices, pagers, laptop computers, MP3 players, and handheld gaming systems. The knowledge gained from this project will guide the development of targeted behavioral interventions to reduce morbidity and mortality associated with the use of handheld digital devices among teens while driving.
Our specific aims are to determine 16-20 year olds:

- knowledge, attitudes, and behaviors on the use of handheld digital devices while driving
- willingness to accept risky driving behaviors associated with using handheld digital devices
- level of understanding of state laws on using handheld digital devices while driving
- willingness to eliminate using handheld digital devices while driving
- efficacy of in-school intervention on this topic

THEORETICAL FRAMEWORK

The theoretical framework that guided this study is the Health Belief Model. The Health Belief model is one of most widely used theories in health education and health promotion. The overall goal of the Health Belief Model is to develop implement an intervention that decreases risk through the espousal and consistent practice of the healthy behavior, along with measures to evaluate and measure response and compliance. The fundamental nature of this model is that a person’s beliefs or perceptions about a disease and their ability to alter the occurrence of that disease will influence their health behaviors. The application of the theory includes the constructs of perceived seriousness and perceived susceptibility to the disease, and the perceived benefits and perceived barriers to health behaviors recommended. It involves multiple cues to action which will prime the person to change, self-efficacy (belief in one’s abilities), and modifying factors that affect the success of the change in behavior. The focus of applying the Health Belief Model is to provide interventions that increase public awareness of the seriousness and susceptibility of a public health problem as well as develop interventions that will decrease the incidence of targeted challenges to public health.

METHODS AND MATERIALS

This research represents a prospective, qualitative survey study. After receiving permission from the Institutional Review Board, we piloted our research and intervention for a group of twelve 10th to 12th grade high schools students at a Southeastern Michigan public high school. We augmented baseline and impact evaluations with process evaluation to determine if procedural changes were needed. After the pilot intervention, we conducted a focus group with the youth to refine the survey and intervention. The results of the focus group increased investigators’ abilities to respond to the specific aims of this study.
**Focus Group Procedures**

The focus group was comprised only of students with their driver’s licenses. Students were recruited to participate through their teachers. They were invited to attend the focus group on a set time and date, and investigators identified an appropriately skilled and experienced moderator to facilitate. After the informed consent process, subjects engaged with the moderator and each other for approximately 90-minutes. Subjects orally reviewed an informed assent form with the facilitator and had adequate time for questions and discussion prior to the start of the focus group. Demographic data points were collected for all focus group subjects. The discussion was audio-recorded, and notes were taken. Immediately following the focus group, handwritten notes were summarized and the tapes were carefully transcribed by researchers. The transcription tapes were coded by relevant themes, and the results were used to modify the presentation and survey.

**Participants**

We determined a sample of at least 1,300 students (ages 16-20) from six high schools in geographically disparate communities of Northwest Ohio and Southeast Michigan would yield statistically significant results. All students in the targeted age group were recruited to participate. Because we encountered significant difficulty engaging with two of the schools we identified before we launched this project, we sought other school partners through which to implement the study. We confirmed Bedford High School (Michigan) as the pilot site with St. John’s Jesuit High School (Ohio), St. Francis High School (Ohio), Perrysburg High School (Ohio), Eastwood High School (Ohio), Ottawa Hills High School (Ohio), and Mason High School (Michigan) participating as intervention sites.

**Intervention Procedures**

Our intervention-presentation is based on the recommendations from the Keeping Young Drivers Safe Web program and website, a collaboration between The Children’s Hospital of Philadelphia, the University of Pennsylvania, and State Farm Insurance Companies. This academic-industry alliance also created the [Partners for Child Passenger Safety study](#), the world's largest study of children in crashes. These institutions have joined together to reduce death and injury from young driver-related crashes through scientific research and outreach. Investigators on the project encourage other institutions to replicate and expand upon their research. Our
intervention uses solely Keeping Young Driver Safe resources as they were developed using evidence-based research.

Our pediatric nurse case manager/injury prevention coordinator implemented our in-school intervention-presentation. The intervention augments formal driver’s education courses, includes interactive learning activities, and incorporates pre- and post-survey testing onsite; we also conducted retention testing of the same students four months after the intervention. The surveys included an informational cover letter to each student informing them about the research and seeking their assent to participate. All surveys were identical and assessed demographics, motor vehicle crash history, use of electronic devices, driving behaviors, knowledge about driving safety, and attitudes about risky driving behaviors.

**Instrument**

Students in the intervention schools engaged with our pediatric trauma nurse case manager/injury prevention coordinator in classroom or school-wide presentations. Schools distributed opt-out permission slips to all parents in our partner high schools. We asked students to read an informed assent form before they complete the initial pre-test; they gave their permission to participate in the study by completing the pre-test. For all students, we collected demographics and information on their knowledge, attitudes, and behaviors related to teen driving and distractions.

**Data Analysis**

Descriptive statistics were to describe the sample. Chi-square, Spearman correlation coefficients, and factor analyses were or are being used to adjust for different baseline characteristics of the sample. Analyses were performed with SAS® version 9.2 software.

**ANALYSIS OF FINDINGS**

**Focus Group Results**

The focus group identified a number of intervention and survey components they perceived as positive, appropriate, and influential. For the presentation, they were most greatly impacted by the real pictures from motor vehicle crashes; group demonstrations; scary statistics; examples of consequences of behaviors; presentation format, location, and timing. For the survey, they liked that the format was clear, appropriate, self-explanatory, common sense, helpful, the right length, engaging. They also enjoyed doing the
The focus group identified the following items to change before implementing the presentation and survey on a broader scale. They suggested we mix up the activities (moving between videos, static slides, demonstrations, pictures, etc.) and use more pictures of actual crash scenes and wounds. They preferred more real-life stores and personal examples. They also asked for more information about drunk driving (because they perceived it to be a significant problem at their school), and they ask for rewards in the form of candy for correct responses to questions posed during the presentation. For the survey, they recommended rephrasing one question and expanding the post-test to gauge how youth feel after watching the presentation and their level of satisfaction with the project.

**Demographic Profile**

At baseline, there were 1,420 16-20 year old youth from Northwest Ohio and Southeast Michigan schools involved in the study. Of those 329 (23%) were in the 9th grade, 494 (35%) were in the 10th grade, 316 (22%) were in the 11th grade, and 281 (20%) were in the 12th grade. Those numbers decreased to 1,115 students at impact (distributed similar to the baseline) and 1,058 students at the final survey (different from baseline – 26% 9th grade, 35% 10th grade, 32% 11th grade, and 7% 12th grade). Of those students, 37% (529) had their driver’s licenses at baseline, 36% (399) at impact, and 43% (459) at the final survey. Of those who drove, only a portion drove on their own (beyond “learning to drive”): 34% (473) at baseline, 35% at impact, and 45% at the final survey. The majority of students who completed all three sets of surveys were male (80% at baseline, 73% at impact, and 91% at final). Racially, students were 77% Caucasian, 9% African American, 4% Hispanic/Latino, 1% American Indian, 3% Asian American, and 6% Other/Multiracial.

**Knowledge Assessment**

*FACT: Sixteen year olds are three times more likely to die in a car crash than other drivers.* A small percentage of participants through all three surveys (baseline – 1,404; impact – 1,117; final – 1,041) believed sixteen year olds drivers were just as likely as any other drivers (baseline – 5% [76]; impact – 7% [77]; final – 6% [65]). At “three times more likely,” the baseline was 20% (285), the impact was 57% (637), and the final was 28% (290). Forty-nine percent (688) at baseline, 24% (265) at impact, and 39% (408) at final believed that sixteen year olds are five times more likely to die in a car crash than other drivers. The
twelve-fold odds varied among the three surveys: 25% (355, baseline), 12% (138, impact), and 27% (278, final).

**FACT:** The most common factor in fatal teen crashes is driver error. Among the factors contributing to fatal teen crashes are alcohol, driver error, poor vehicle maintenance [or an older vehicle], and poorly maintained roadways. At baseline, the survey of 1401 showed that 544 (39%) thought alcohol was the most common factor; compared to the impact (1110 students) and final (1036 students) of 22% (239) and 34% (353), respectively. Driver error as the most common factor attributed to 57% (794) of the baseline, 72% (802) of the impact, and 62% (644) of the final. Only 1% (18) of the baseline, 2% (25) of the impact, and 1% (11) of the final considered poor vehicle maintenance or driving an older vehicle the most common factor in fatal teen crashes. Similarly, poorly maintained roads received 3% (45) at baseline, 4% (44) at impact, and 3% (28) at final.

**FACT:** When teen occupants are killed in car crashes, they most often are not wearing seat belts. In car crashes, it is sometimes not what the teen driver and occupants are doing, but what they are not doing that leads to fatalities. Of the three surveys (baseline – 1398; impact – 1116; final – 1036), the least amount (2% [32] at baseline; 4% [45] at impact; 3% [32] at final) believed that the leading issue was a driver without a license. The majority of the participants believed “not wearing seat belts” contributed to death in car crashes involving teens: 75% (1055) at baseline, 81% (900) at impact, and 79% (820) at final. 16% (218) of the baseline, 8% (93) of the impact, and 12% (121) of the final believed not obeying traffic signs was most often the cause of death. “Not listening to music” attributed for 7% (93) of the baseline, 7% (78) of the impact, and 6% (63) of the final.

**FACT:** Driving after being awake for 18 hours is similar to driving while legally drunk. When asked what condition is most similar to driving legally drunk, at baseline, 169 (12%) said “driving at night,” 914 (65%) said “driving after being awake for 18 hours,” 115 (8%) said “driving while drinking coffee or soda,” and 203 (14%) said “driving while listening to music.” At impact, these numbers changed along with the decreased number (1,117) of survey-takers: night driving – 110 (10%); driving while tired – 912 (82%); driving while drinking coffee or soda – 5%); driving while listening to music – (4%). During the final survey of 1048 students, 111 (11%) responded “driving at night,” 826 (79%) responded “driving after being awake for 18 hours,” 39 (4%) responded “driving while drinking coffee or soda,” and 72 (7%) responded “driving
while listening to music.” As shown, a majority of students considered “driving after being awake for 18 hours” to be most similar to driving while legally drunk.

**FACT:** A driver who talks on a cell phone is four times more likely to be involved in a serious crash, and this risk does not decrease if the driver uses a hands-free cell. A question was posed regarding cell phone use with and without a hands-free option: using a hands-free cell phone reduces the risk of a serious crash. The majority of students, at both baseline (1,310 students) and impact (786 students), believed this statement as “true,” (baseline – 64% [841]; impact – 36% [469]) with the remaining considering it “false” (baseline – 61% [483]; impact – 39% [303]). While the baseline and impact results were fairly consistent, the final survey showed a near split-audience: of 1,046 survey participants, 538 (51%) believed the statement was “true,” and 508 (49%) believed it was “false.” The difference in results is due to the misconception that hands-free cell phone use reduces your risk of an accident.

**FACT:** Speeding is a factor in 40% of all teen driver fatalities. Speeding is thought to contribute to a significant percentage of teen driver fatalities. At baseline, in a survey of 1,396 students, 65 (5%) said “one percent,” 135 (10%) said “five percent,” 635 (45%) said “twenty percent,” and 561 (40%) said “forty percent” (the correct response). The impact survey (1112 students) showed a minor change with 70 (6%) responding “one percent,” 168 (15%) responding “five percent,” 417 (38%) saying “twenty percent,” and 457 (41%) saying “forty percent.” Of the 1,041 students surveyed at final, 60 (6%) said “one percent,” 196 (19%) said “five percent,” 458 (44%) said “twenty percent,” and 327 (31%) said “forty percent.”

**FACT:** Motor vehicle crashes are the number one cause of death among teens in the United States. The majority of participants rightly selected motor vehicle crashes as the number one cause of death among teens in the United States (50% [680] at baseline; 64% [662] at impact; 53% [554] at final). The results show a cascading effect from top to bottom, indicating a high concern of death among teen drivers. 26% (350) at baseline, 16% (171) at impact, and 30% (312) at final believe motor vehicle crashes to be the number two reason for these fatalities. Of the surveys, the belief that it is the number four cause is marginal: 17% (231 at baseline, 15% (157) at impact, and 11% (119) at final. The least amount of participants (7% [97] at baseline; 5% [47] at impact; 6% [58] at final) thought of motor vehicles as the number six cause of death among teens in the United States.
Key Findings

1. The age of the participants was slightly younger for the final survey. Only 7% were in the 12th grade, compared to 20% and 18% from the baseline and impact surveys, respectively (p < .001).

2. There was a significant change in self-reported influence of peers on driving habits over time, but no change due to parents influence over time (p=0.022 and p=0.5 respectively).

3. Students expressed less confidence with their knowledge and skills at impact and retention surveys when compared to the baseline results (85% Agree or Strongly Agree at Impact, 89% Agree or Strongly Agree at Retention compared to 94% who Agree or Strongly Agree at Baseline, p <.001.).

4. Students were less likely to agree with the statement "I believe road rage plays a role in distracting young people while driving" at Impact and Retention compared to baseline responses (p = 0.008).

5. There was no change in the percent of students who reported talking on the cell phone was "no big deal;" however, at impact 29% of the students felt talking on the cell phone should be illegal, compared to 15% at baseline and 20% at impact (p < .001).

6. Students were more likely to report driving within the speed limit at impact and retention then at baseline (51% and 56% compared to 45%, respectively, p = 0.004).

7. Students reported driving at night more often during the baseline survey compared to the impact and retention surveys (81% compared to 77% and 72%, respectively, p = 0.022).

8. Students were more likely to drive with both hands on the wheel at impact then at baseline or retention (p = 0.003).

9. There was no significant change in the frequency of self-reported texting while driving over time (p = 0.16).

10. Students reported more frequent use of a laptop or gaming device while driving over time (p < .001).

11. There was a significant difference in the proportion of students who drove to school or work over time (p = 0.019), and the number of hours driven each week (p = 0.004) among cohorts.

The results presented in this report are preliminary. Within the next month, we intend to submit our final results in a manuscript to the Journal of Community Health. We will send a final copy of the paper to the ODPS EMS Division once it is published.
REFERENCES


