Distracted Driving:
Understanding its Affects and
Advocating for Safe Driving

By: Sohan Shah and Snehi Shah
Incarnate Word Academy & Padua Franciscan HS SADD Chapters
Good Morning!
Welcome & Thank You

• Elizabeth Vermette (National SADD), Teresa Carper (Ohio SADD), and Joel Feldman (EndDD)
• Special thanks to:
  – Incarnate Word Academy (Advisor: C Rossman)
  – Padua Franciscan High School (Advisor: K Shuman)
  – Our Dad for his mentorship

➢ Who drives?
➢ Name some common distractions while driving
➢ Short pre-test
Let’s Understand Distracted Driving!
Objectives

• Learn about distracted driving (DD)
• Discuss the science behind the negative effects of DD on biometrics, safety, and performance
• Can feedback with eye-tracking help change driving behavior?
• The road ahead: initiatives we can use to help educate and change behavior in our communities
• Conclusion
Introduction - 1

- A Distracted Driving Story – Bob G., 12th grade

6 OUT OF 10 teen crashes involve driver distraction.

The most common forms of distraction leading to a teen driver crash include:

15% Interacting with one or more passengers
12% Using a cellphone
10% Looking at something in the vehicle
9% Looking at something outside the vehicle
8% Singing/dancing to music
6% Grooming
6% Reaching for an object

For teen driving tips, visit TeenDriving.AAA.com
Types of Distractions (3)

- **Mild (Manual):** Snacking, sipping coffee

- **Moderate (Visual):** Changing radio station/vol, talking on cell phone, grooming

- **Major (Cognitive/Mental):** Texting and doing analytical, memory, and concentration tasks
Introduction - 2

• **Some statistics on DD:**
  – 2013: >3,000 deaths; >400,000 injuries
  – 2015: >8000 accidents caused by DD and MT
  – 2016: USDT states >1.6 million accidents were caused by cell phone use
  – NHSTA states US loses >$200 million on DD accidents every year
2016-2017 Science Fair

• **Problem Statement:**
  – Do Distractions Affect Driver Safety, Performance, and Biometrics? If so, how?

• **Hypothesis:**
  – Distracted drivers will have more accidents, higher pulse and blood pressure, and lower concentration. The greater the degree of distraction, the faster they will drive and the more accident they will have.

• **Purpose:**
  – Understand DD
  – See how we can save *lives* and *money*
Equipment

- Car simulator (City Car driver v1.5.1)
- Wheel and pedal (Thrustmaster Racing Wheel)
- Radio, BP cuff
- Home made memory cards
City car driver v1.5.1

Clear Conditions

Adverse Conditions
Scientific Method

- Consent & Train subjects (exclusions)
- **Baseline** testing (Clear conditions) - Control
  - # lane swerves and # accidents
  - Time to finish course
  - Pulse, BP, concentration/memory score
  - Behavioral observations
- Distractions testing (Clear conditions)
  - Mild (eating, drinking)
  - Moderate (radio + phone conversation)
  - Major (texting, memory + conc)
- Distractions testing (Adverse conditions) - optional
Studying Memory/Concentration (during *major* distraction testing)
# Results - Subject Summary

<table>
<thead>
<tr>
<th>Group Type</th>
<th>Age Range</th>
<th>Mean Age</th>
<th>Subjects (#)</th>
<th>Gender</th>
<th>Subject (#)</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A: teens (beginner drivers)</td>
<td>15-29</td>
<td>16.5</td>
<td>4</td>
<td>F:M</td>
<td>3</td>
<td>F:M</td>
</tr>
<tr>
<td>Group B: middle aged (experienced drivers)</td>
<td>30-59</td>
<td>48.5</td>
<td>4</td>
<td>F:M</td>
<td>2</td>
<td>F:M</td>
</tr>
<tr>
<td>Group C: elderly (seasoned drivers)</td>
<td>60+</td>
<td>73.5</td>
<td>2</td>
<td>F:M</td>
<td>0</td>
<td>F:M</td>
</tr>
</tbody>
</table>

**Subject population by Group Type**

- A: 15-29 years: 40%
- B: 30-59 years: 40%
- C: 60+ years: 20%

**Population By Gender**

- Male: 60%
- Female: 40%
Results: Qualitative (behavior)  
Group A (Teens)  

- As distractions got more cognitive or worse:  
  - Frustrated  
  - Irritable & aggressive  
  - Hysterical  
- Mis-operated turn signals and missed traffic lights  
- Honked horn and yelled at other drivers  
- Dropped food  
- Dropped phone and tried to pick it up  
- Consistently looked away from screen towards phone  
  (fun fact: at 65 mph, that’s like going the length of a football field in under 3 seconds!)
Results: Qualitative (behavior)
Group B (Middle-Aged)

- As distractions got more cognitive or worse:
  - Frustrated
  - Irritable & aggressive
- Got confused and complained about how hard the test was
- Misoperated turn signals, missed traffic lights
- Consistently looked away from screen towards phone
Examples of Qualitative Data
• Group A (teens): middle but bad in adv conditions (little exp?), $$$$
• Group B (middle-age): most lane drifts/acc, (overconfidence), $$$$$$
• Group C (60+): slowest but safest (fewest swerves/accidents), $
Quantitative Results - Performance

70% of drivers tended to drive SLOWER with greater distraction.

Explanation?: Brain cannot multi-task well and so it prioritizes one activity over another (e.g. taking foot off gas pedal when texting).
Quantitative Results - Biometrics

Pulse: increased by 10% with D
BP: Variable with little correlation with degree of D

All groups did **poorly**!
Group A: 52% (Ana: 3.3   Mem: 3)
Group B: 57% (Ana: 3.5   Mem: 3.5)
Group C: 38% (Ana: 2.5   Mem: 2)
Examples of texting errors

• In addition to slowing down while multi-tasking, the quality of texting was *poor* and full of *errors*
Examples of violations/accidents

- Lane Drifts
- Lane Drifts
- Merging Accident
- Right of way accident
- Pedestrian Accident
- Overall car damage
## Types and costs of traffic violations

<table>
<thead>
<tr>
<th>Event</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess of the speed limit more than by 5 miles per hour</td>
<td>$234</td>
</tr>
<tr>
<td>You haven't yielded to a pedestrian</td>
<td>$194</td>
</tr>
<tr>
<td>Hindrance to the vehicle moving in the same direction</td>
<td>$276</td>
</tr>
<tr>
<td>Excess of the speed limit more than by 5 miles per hour</td>
<td>$234</td>
</tr>
<tr>
<td>You've had an accident</td>
<td>$194</td>
</tr>
<tr>
<td>Right turn signal not used when changing the lanes</td>
<td>$194</td>
</tr>
<tr>
<td>You've had an accident</td>
<td>$194</td>
</tr>
<tr>
<td>Excess of the speed limit more than by 5 miles per hour</td>
<td>$234</td>
</tr>
<tr>
<td>You've had an accident</td>
<td>$194</td>
</tr>
<tr>
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<td>$194</td>
</tr>
<tr>
<td>Excess of the speed limit more than by 5 miles per hour</td>
<td>$234</td>
</tr>
<tr>
<td>You've had an accident</td>
<td>$194</td>
</tr>
<tr>
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<td>$194</td>
</tr>
<tr>
<td>Excess of the speed limit more than by 5 miles per hour</td>
<td>$234</td>
</tr>
<tr>
<td>You've had an accident</td>
<td>$194</td>
</tr>
<tr>
<td>Crossing a solid line of the marking</td>
<td>$194</td>
</tr>
<tr>
<td>Right turn signal not used when entering the roundabout</td>
<td>$194</td>
</tr>
<tr>
<td>Rolling off the road without turning on the right signal</td>
<td>$194</td>
</tr>
<tr>
<td>Driving into the traffic lane without turning the left turn signal</td>
<td>$194</td>
</tr>
<tr>
<td>Right turn signal not used when changing the lanes</td>
<td>$194</td>
</tr>
<tr>
<td>Left turn signal not used when changing the lanes</td>
<td>$194</td>
</tr>
<tr>
<td>Right turn signal not used when changing the lanes</td>
<td>$194</td>
</tr>
<tr>
<td>Violation of stopping rules.</td>
<td>$2000</td>
</tr>
</tbody>
</table>
Discussion

• **What we know:** DD and MT costs lives and $

• **What we don’t know:** how DD affects gender and age

• Our intervention has to focus on what is the best way to educate each group to change behavior

• Summary for each age group
Discussion: Group A (Teens) Summary

• Little driving experience; fastest, adapted well, poor performance with adverse cond

• Qualitative data (observational/behavior):
  – Irritable, aggressive, shouted, and honked (more with greater distractions)
  – Performed worse at adverse conditions
  – Forgot to use turn signals and side mirrors
  – Ignored traffic lights and pedestrians (especially in city and while merging onto highway)
Group A (Teens) Summary

• Quantitative data:
  – Significantly more lane drifts and accidents esp with cognitive distractions
  – Subject dropped food & phone; had pedestrian accidents
  – Many times license revoked
  – Ave cost of repair + traffic violations = $7,215
  – Pulse increased and BP increased (means less heart rest)

• Analytical skill and memory score was only 52 percent with major distractions
Discussion: Group B (Middle-Aged)

Summary

• Had 15-45 years of driving experience

• Qualitative data (observations/behavior):
  – Irritable and nervous
  – Frustrated, overconfident
  – Forgot to use turn signals and side mirrors
  – Ignored traffic lights and pedestrians (especially in city and while merging onto highway)
Group B (Middle-Aged) Summary

- Quantitative data:
  - Highest number of lane swerves and accidents
  - Ave cost of repair + traffic violations = $13,333 (maybe slower reflexes than they realized)
  - Many times license revoked
  - Pulse increased and BP increased (means less heart rest)
  - Highest score on memory & concentration test
Conclusion of Experiment

• For drivers of multiple age groups and levels of experience, distractions and multi-tasking while driving overwhelmingly caused a NEGATIVE effect on safety, performance, and biometrics
The Road Ahead: (RED)

• **Research**
  – Work with scientists to understand cognitive distractions (Dr. Paul Atchley)

• **Educate**
  – Peer-to-peer talks at local and regional level
  – Start SADD chapter (SADD National meeting)
  – Create social media links, videos, live demos, etc.

• **Develop**
  – Work with car manufactures, insurance companies, and engineers to develop apps and devices (2018 Science Fair)
2017-2018 Science Fair

• Problem Statement:
  – Will the use of an eye-tracking method with feedback affect driver safety, performance, and behavior? And if so, how?

• Hypothesis:
  – If an eye-tracking method with feedback is used during DD and MT, then drivers will become more aware of distractions and change behavior to have fewer lane drifts, fewer accidents, and faster course completion.

• Purpose:
  – Build a device to detect distractions and to change behavior
Research, Develop

Dr. Paul Atchley  
Univ of Kansas

- Research on cognitive science
  - How can we change human behavior

Dr. Kuban  
Cleveland Clinic

- Science Fair 2017-2018
- Develop a device for feedback loop to change behavior of distracted drivers
Feedback Module
Methods

• Consent & Train subjects (exclusions)
• **Baseline testing** (WITH distractions, WITHOUT feedback) – Control
  – # lane swerves and # accidents
  – Time to finish course
  – Times looked away from the screen
  – Behavioral observations
• **Feedback testing** (WITH distractions, WITH feedback)
  – Sensory (Vibration)
  – Audio (High-pitch sound generator)
  – Visual (Lights)
Can an eye-tracking method with feedback affect distracted driver safety and performance?

**Number of Lane Swerves for each Subject**

<table>
<thead>
<tr>
<th>Subject Number</th>
<th>Baseline (Minor lane swerve)</th>
<th>Feedback (Minor lane swerve)</th>
<th>Baseline (Major lane swerve)</th>
<th>Feedback (Major lane swerve)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
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<tr>
<td>4</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
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<tr>
<td>5</td>
<td>9</td>
<td>10</td>
<td>11</td>
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<td>6</td>
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<td>12</td>
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<tr>
<td>7</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

**Time to Course Completion by Subject**

<table>
<thead>
<tr>
<th>Subject Number</th>
<th>Baseline</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2:24</td>
<td>2:24</td>
</tr>
<tr>
<td>2</td>
<td>4:48</td>
<td>4:48</td>
</tr>
<tr>
<td>3</td>
<td>7:12</td>
<td>7:12</td>
</tr>
<tr>
<td>4</td>
<td>9:36</td>
<td>9:36</td>
</tr>
<tr>
<td>5</td>
<td>12:00</td>
<td>12:00</td>
</tr>
<tr>
<td>6</td>
<td>14:24</td>
<td>14:24</td>
</tr>
<tr>
<td>7</td>
<td>16:48</td>
<td>16:48</td>
</tr>
</tbody>
</table>
Can an eye-tracking method with feedback affect distracted driver safety and performance?

Feedback Loops:
- Sensory
- Visual
- Auditory
SCIENCE FAIR – 2017-18

CAN AN EYE-TRACKING METHOD WITH FEEDBACK AFFECT DISTRACTED DRIVER SAFETY AND PERFORMANCE?

Percent of Subjects who Completed Course

- Slower with feedback
- Faster with feedback

Number of times looked away from screen

<table>
<thead>
<tr>
<th>Subject Number</th>
<th>Baseline</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>45</td>
<td>40</td>
</tr>
</tbody>
</table>
Discussion

• Hypothesis overwhelmingly supported
• Feedback did work (safety and performance)
• We have created a device to change behavior of distracted drivers and to detect distractions
• With this device we can change how drivers drive and decrease the amount of distracted driving in the world
Education (peer-to-peer)

Local Education

• Create social media platforms to reach out to a wider audience

• Reach out to different organizations about these problems
  – Westshore Young Leaders Network
  – CAPA
  – Ohio Highway State Patrol

SADD Education

• National level
  – SADD June 2017
  – Life Savers (2018)
Westshore Young Leaders Network Workshop
March 2017: n=94 teenagers
Pre Test survey vs. Post test survey

- **Results:** Peer-to-peer education to teens is very effective when educating on dangers of distracted driving
- Based on this we are able to do this workshop at the 2017 National SADD conference
• The results show that child-to-adult education is also very effective for DD
Why we started SADD at our schools?

- Teens deal with the problem by being self-advocates for themselves
- SADD empowers teens to be role models and leaders for other teens through peer to peer education
- This is a WIN-WIN solution to educate about DD and various other issues affecting teens
Incentives for children to engage in SADD

• **Altruism**: We learn, we teach, we grow
  – Service to ourselves and service to community

• **Leadership and networking opportunities**
  – Local, State, and National

• **Peer to peer education effectiveness**
  – Example: Westshore Young Leaders Network

• **Money**
  – Scholarships and Grants for us and our chapter

• **College applications**
Distracted driving has a significant negative effect on driver safety, performance, and biometrics (teen, adults, elderly)

- Accounts for > 1.6 m accidents/yr & >$200 m /yr lost
- Cognitive distractions are the worst
- Most people drive slower when distracted
- Elderly – slowest but safest group
Conclusion - 2

• We can help save lives and $$ by:
  – Understanding the different types of distractions
  – Educating ourselves of the negative effects of DD
  – Partnering with engineers, scientists, and insurance companies to develop tools to help save lives and money lost from DD
Questions and Post-test

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