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ADHD Teen Driver Evaluation and Training Tool Development

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1. BACKGROUND

1.1. Teen Driver Challenges

Motor vehicle crashes are the leading cause of death for young drivers age 15-20 in the U.S. The latest available data from the National Highway Traffic Safety Administration (NHTSA) (2011) indicates that 10.0% of all drivers involved in fatal crashes are between the ages of 15 and 20 whereas drivers in this age group make up a much smaller percentage of the total population of drivers. Within the age range so identified, research has shown that due to their limited experience, 16 and 17 year old drivers have a significantly higher crash rate than the safest driving cohorts. The most critical period is the first six months after a teenager obtains a driver's license. (McCartt, et al. 2003) Teens struggle with self-regulation as well as developmental and cognitive processing limitations. Teens with cognitive disabilities have additional challenges.

1.2. ADHD Specific Driver Challenges

Many teens have learning disabilities and other medical conditions that can affect their ability to learn and transfer skills. ADHD is reportedly present in 3-7% of school aged children with males being over represented in this group (Moller, et al., 2011; Barkely, et al., 2007). The primary challenges facing these teens are with regard to executive function and decision making. Other cognitive skills are affected by this neurological disorder and behavioral deficits can manifest themselves as outlined in the left panel of Figure 1. Not surprisingly, the behavioral deficits associated with ADHD have a specific impact on the skills critical to driving. Difficulties with these skills in turn lead to inflated crash statistics (right panel of Figure 1). For example, research suggests that ADHD teen drivers are seven times as likely to have been in two or more crashes and four times as likely to have been at fault for the crash in which they were involved (Edge Foundation accessed 2009).

ADHD Attributes	ADHD Driving Impacts
Cognitive impacts of ADHD: • Distractibility, lack of focused attention • Difficulty in organizing tasks or subject matter • Inability to filter out external stimulus or sensory inputs • Difficulty managing emotions or regulating impulsivity • Difficulty with accessing working memory or recall • Difficulty with or processing speed	Impacts on Driving task: • 8 X more likely to lose license • 4 X more likely by involved in a collision • 3 X more likely to sustain serious injury • 2 – 4 X more likely to receive a motor vehicle violation

Figure 1. *Overview of Applicable ADHD Driver Research*

Source: (Moller, et al., 2011; Barkley, et al., 1996, 2007; Cox, et al., 2004.)

1.2.1. Literature

Given the above behavior deficits, teens with ADHD are at a greater disadvantage when learning to drive. A case can be made that the teen ADHD crash statistics are inflated because driving instruction is not targeted towards their particular deficits. Driving is considered a multilevel task that involves skill competency on and across three levels: operational, tactical and strategic. At

the operational level, quick responses, attention, concentration, visual scanning, visual-motor integration and spatial perception are required. During the tactical level of a driving task, where executive function is particularly important, a person must learn to anticipate hazards, maintain attention, and mitigate hazards when they do occur. At the strategic level, decisions regarding trip planning, route choice or time of day of travel are required. Any neurological disorders or deficiencies that could affect these three core competencies could negatively impact the driving task (Barkely, et al., 1996 & 2007). ADHD teens struggle with some of these core competency skills required for a successful driving experience.

2. EXPERIMENT

This experiment measured; attention maintenance, hazard anticipation, hazard mitigation, & roadway scanning in different types of driving environments. The Experiment was conducted in two Phases. Three groups of ADHD and non-ADHD drivers are included, those 16-18, 22-30 and those 30-55 years old, a total of 6 groups. Within each of the three age cohorts, half of the drivers have a medical or educational diagnosis of ADHD and the other half has no prior history of an ADHD diagnosis. During Phase I, the participants were asked to drive through 4 drives, including 8 hazards. The results were then used to develop an integrated training program. During Phase II of the research, participants returned to the HPL Lab and were given a training module. Following the training (15-25 minutes) they were then asked to drive for 4 randomized drives with a total of 8 hazards totaling 15 minutes

The drives were developed and programmed to replicate differentiated driving conditions to engage the drivers at different levels of intensity using different levels of traffic density and roadway geometry. *Engaging or High Load (HL)* driving environments consist of: Curves; lane position and velocity require careful monitoring; To create levels of an engaging environment - the roadway geometry changes from tangent to curve and traffic is included.
Not Engaging or Low Load (LL) driving environments consist of: Tangent roadway; lane position and velocity do not require careful monitoring; To create a lower level of engagement, traffic will be removed.

The driving environment is intended to replicate Route 116 in Amherst, Massachusetts with a mix of residential and business in close proximity to the roadway. Vehicle and eye tracker measures were collected including participants' attention to the forward roadway and their speed, speed deviation, and lane position.

3. RESULTS

For each participant and for each drive, in both Phase I and Phase II, scanning patterns, hazard anticipation, attention maintenance, hazard mitigation and the effects of age on driving behavior were analyzed:

The results to date have proved very promising.