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Research Award Brief

Neurophysiological Biomarkers of Hazard Perception Among Novice and Experienced Teenage Drivers (2017-2019)

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Research Question: Are there neurophysiological differences (i.e., differences in skin conductance, heart rate, neural activity) between inexperienced and experienced teenage drivers as they experience driving hazards?

Interdisciplinary Approach: We will use behavioral, psychophysiological, and neuroimaging techniques to explore neurophysiological markers of hazard detection in experienced versus inexperienced teenage drivers.

Potential Implications of Research: Results from this line of research may identify biomarkers of driver crash risk, which could subsequently inform training needs and on-road practice needs to increase learning of hazard perception in novice drivers before they begin driving independently.

Motor vehicle crashes are the leading cause of death among U.S. teenagers. In particular, the fatal crash rate for younger drivers (i.e., 16-19 years-old) is nearly three times that of more experienced drivers (i.e., ages 20 and over). Not surprisingly, there is a rapid decline in crash risk that occurs as drivers become more experienced. Specifically, there is a rapid decline in crash risk that occurs following the first year of independent driving. One skill that develops over this first year of driving experience that helps reduce crash rates is hazard detection. Hazards are abundant when driving including pedestrians, other cars on the road, debris, and animals. The ability to pick up on cues in the environment and respond to these cues immediately is critical in hazard detection when driving.

Research has shown that biological cues in response to hazard detection differ between experienced and inexperienced drivers. That is, when hazards are present, the body's nervous system responds in order to help an individual react quickly to the hazard. Changes in skin conductance and heart rate (both measures of autonomic system activity) have been shown in response to hazard detection. Interestingly, prior research has shown that experienced drivers have greater autonomic activity likely due to their body's ability to detect and anticipate hazards in the environment (Figure 1), compared to inexperienced drivers. In addition to physiological changes, driving requires the engagement of many brain regions involved in cognitive processes such as selective attention, visuomotor integration, and decision-making. However, to date few studies have examined the neural correlates of hazard detection while driving and none have compared neural activity to hazard detection in inexperienced versus experienced drivers.

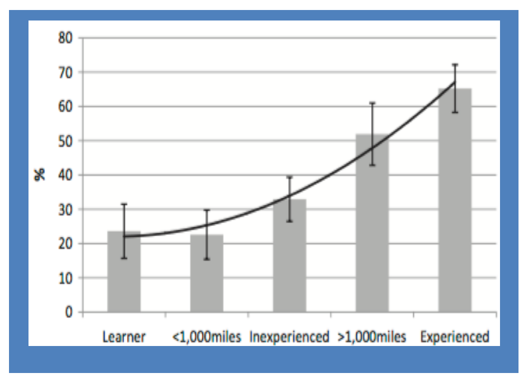

Figure 1. Skin conductance response in anticipation of hazard between inexperienced and experienced drivers.

The goal of this research is to identify neurophysiological correlates of hazard vs. non-hazard detection in inexperienced and experienced drivers. We will do this by showing participants several videos that include hazards and several videos that contain no hazards in random order. While they are watching these videos we will collect physiological (i.e., skin conductance and heart rate) data as well as neural activity data (i.e., fMRI data). Results from this study could help inform the development of a system of driver assessment and training based on neurophysiological biomarker data.

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