Tenth International Conference on Managing Fatigue: Abstract for Review

Occupational Demands on Fatigue and Driving Safety in Surgical Residents

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Problem

Surgical residents are fatigued during nearly half of their wake time and function post-shift at levels comparable to being intoxicated. Surgical residents may be at risk for drowsy driving, which contributes to 20 percent of fatal crashes. Fatigue has been shown to impact driving by negatively impacted attentional capabilities. Previous research has suggested driving performance is negatively affected post-shift in residents, but the role of fatigue brought on by occupational demands in driving performance has not been fully examined. The purpose of this study is to identify the effects of fatigue on driving performance in surgical residents post-shift.

Method

Forty-two surgical residents will be recruited to participate in a brief initial appointment where they will complete self-reported measures of driving history and behavior (Driver Behaviour Questionnaire), and sleep quality (Pittsburgh Sleep Quality Index). Participants will be given actigraphy watches to wear for 2 weeks to provide objective indicators of sleep, activity, and energy expenditure.

Participants will complete 3 additional appointments: 1) On an off day, 2) before beginning a shift, and 3) after completing a shift. At each appointment participants will complete self-reported measures of sleep propensity (Epworth Sleepiness Scale) and fatigue (Occupational Fatigue Exhaustion Recovery Scale). Participants will drive in a driving simulator at each appointment. The high-fidelity, fully immersive simulator is outfitted with a 2016 Honda Pilot featuring fully functional steering wheel, throttle, brake, turn signals, and dashboard. It is on a 1 degree-of-freedom motion base to provide pitch cues for acceleration and braking. Scenery is displayed on three 80’ LCD projection screens providing a 180° field of view (See Figure 1). Participants will drive in 3 scenarios (order

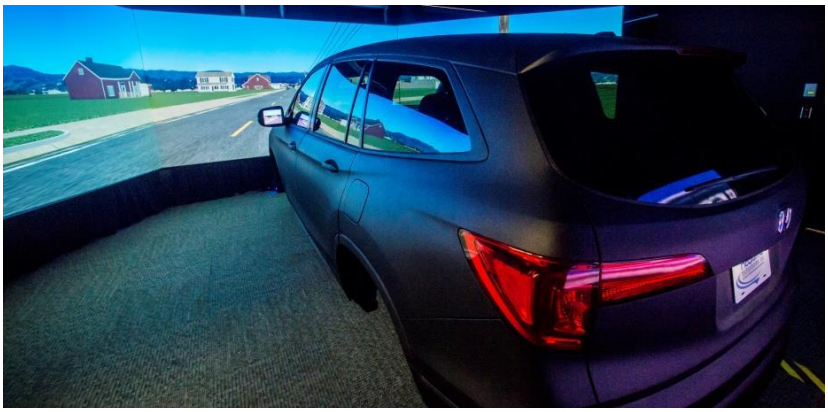

Figure 1. Driving Simulator

counterbalanced) approximately 15 miles in length with scenery similar to the local region and including urban, highway, and suburban roadway environments. The light levels will reflect the time-of-day at which the appointment is occurring. Weather and traffic will be held constant among the 3 scenarios. Driving outcomes will include lane positioning, collisions, speed and speed variability, headway time, and reaction time.

Results

Descriptive statistics will be conducted on all collected variables to assess for outliers and normality. Bivariate correlations will be run among continuously distributed variables, and correlations will also indicate agreement between self-reported measures of sleep and fatigue with objectively assessed measures of sleep and fatigue. Mixed effects regressions will be conducted for each driving performance outcome, using duty period (off shift, before shift, and after shift), sleep, and fatigue indicators as predictors of driving. As driving is measured 3 times, the intercept will be included as a random effect to allow variation over time. Driving variables presenting as count variables or overdispersed (variance ≥ mean) will be analyzed with mixed effects Poisson or negative binomial general estimating equations (GEE) where appropriate. Data collection is in progress.

Discussion

Data on the driving performance of surgical residents following a duty period, collected for the first time using a high-fidelity driving simulator and realistic simulated environment to measure specific components of driving performance will fill critical knowledge gaps. This research will yield objective measures of driving safety in an occupation prone to fatigue where research on safety is alarming lacking, yet critically important as errors during a shift or afterwards may be fatal. The findings have the potential to reduce motor vehicle collisions by shaping policy regarding sleep and fatigue in surgical residents. For example, if driving performance is negatively affected only at high levels of sleep or fatigue, specific policy or interventions may be developed to curb high levels of sleep and fatigue post-shift. This research is expected to influence duty hour policies to maximize patient safety, resident education, and resident health and safety to ultimately reduce crash rates.

Summary

Drowsy driving directly contributes to 100,000 police-reported crashes annually. Although previous research has shown that residents perform worse on a simple reaction time task post-shift, little work has examined specific decrements in driving performance following duty periods and considering occupational demands among surgical residents. Certain work-related factors such as sleepiness and fatigue are known to impact mental and physical performance, and may further exacerbate driving risks. The overall objective of this study is to examine the driving performance of 42 surgical residents before and after duty periods using a high-fidelity driving simulator. Both self-reported and objective measures of sleep and fatigue will be

collected at multiple time points. This research may reduce collisions by shaping policies regarding shift demands and regarding sleep and fatigue in surgical residents.