Examining Visual Processing Speed Reaction Time as a Predictor of Driving Fitness

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PURPOSE: As a complex IADL, driving is essential for social participation and needs to be addressed by occupational therapy practitioners. Visual processing speed (VPS) is a critical component of driving ability, and advanced age as well as medical conditions can cause deficits in this area, increasing driving risk. Assessments of VPS are limited because of the complexity of cognitive processes; however, VPS can be isolated as a discrete ability when using some tools such as the Vision Coach. Recent studies using the Vision Coach (VC) have established normative data for VPS. Specifically, data establishing normal age differences between young and old. In addition, evidence shows no differences between gender, position (sitting vs.standing), and height. Building on this work, we seek to determine if 1) there is a statistically significant difference in VPS between healthy controls and the medically-at-risk (MAR), and 2) if the VC demonstrates adequate sensitivity and specificity to predict driving fitness outcomes.

DESIGN: Cross-sectional quasi-experimental and receiver operating characteristic (ROC) curve.

METHOD: Participants are healthy adults (n = 280, Median age = 64, range 21-87 yrs.) recruited through convenience sampling. The MAR adults' (n = 70, Median age = 65, range 17-89 yrs.) data were collected as part of a comprehensive driving evaluation to determine fitness to drive with outcomes of fail, pass, or pass with restrictions. Diagnoses in the MAR group included an array of cognitive impairment and neurological, orthopedic, and complex medical conditions. VC's 'Full Field 60' task gives VPS times in seconds for each participant. After one practice trial, three trials were averaged for the outcome score. Data collection is ongoing to establish sensitivity and specificity with ROC curve analysis.

RESULTS: An independent t-test ($t = -10.62$, $df = 348$, $p < .001$) showed a significant difference between the controls (Mean = 55.05, SD = 11.52) and MAR (Mean = 73.0, SD = 19.52). More importantly, a Welch ANOVA demonstrated significant difference between the three driving outcomes ($F(2,338) = 95.98$, $p < .001$) with Tukey post hoc analysis showing ($p < .001$) between all outcomes; pass (Mean = 54.60, SD = 10.92); restrictions (Mean = 71.61, SD = 11.46) and fail (Mean = 83.12, SD = 21.97). Additional data will allow analysis between the different medical conditions.

CONCLUSION: MAR drivers had significantly higher VPS times, indicating at least some medical conditions are likely to impair VPS. More importantly, the VC was able to differentiate between all three driving outcomes (fail, pass, pass with restrictions). This suggests that VPS is a significant factor to screen/evaluate for driving fitness. With more data collected across all ages, the ROC curve analysis will establish cutoff points for the VC. Further analysis will be done on specific conditions to determine which conditions are primarily affected. Impact: VPS is a critical component of fitness to drive and can be easily tested with the Vision Coach. As such, general OT practitioners can quickly determine whether further assessment for driving evaluation is needed. In addition, VC is flexible as an intervention tool that can be graded for difficulty. As occupational therapy is the 'go-to' profession for driving, this research contributes to highlighting occupational therapy's distinct value.

References

Hotta, R., Makizako, H., Doi, T., Tsutsumimoto, K., Nakakubo, S., Makino, K., & Shimada, H. (2018). Cognitive function and unsafe driving acts during an on-road test among community-dwelling older adults with cognitive impairments. *Geriatrics & gerontology international, 18*(6), 847–852, https://doi.org/10.1111/ggi.13260

Miller, M. (2017). Vision Coach: Effects of standing versus sitting on visual reaction times [Unpublished master's thesis]. East Carolina University.

Penna, V., Dickerson, A.E., & Wu, Q. (under review). Visual reaction time differences between medically-at-risk adult drivers and healthy controls.

Register, J. (2016). Effects of gender and age on reaction time during Vision CoachTM task [Unpublished master's thesis]. East Carolina University.