

Hazard Perception and Younger Drivers: The Role of Cognitive Function

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Abstract

Hazard perception is a complex cognitive process that is consistently linked to crash involvement. While research has focused on older populations for which cognitive declines are associated with poorer hazard perception, this study is the first to investigate the cognitive correlates of hazard perception in younger drivers. Ninety-eight undergraduates completed a hazard perception test and battery of cognitive tests. Cognitive function was positively related to hazard perception accuracy and response times; with inhibitory control, visuo-spatial skills, executive functioning and overall cognitive status important predictors of hazard perception. Future research could lead to training programs aimed at improving hazard perception in younger drivers.

Background, Method, Results and Conclusions

Background: Driving is a cognitively complex and dangerous task; with drivers under 25 years of age having the highest crash risk (Transport for NSW, 2017). Hazard perception, or the ability to anticipate potentially dangerous traffic situations, is a driving skill most consistently linked with crash risk (Horswill & McKenna, 2004). Governments recognise the importance of hazard perception to young drivers such that hazard perception testing has become part of licensing laws in Australia (Australian Government, 2018). Research has shown that hazard perception ability improves in young drivers who are undergoing brain maturation at the same time as they gain on-road experience (Borowsky, Shinar, & Oron-Gilad, 2010; Foy, Runham, & Chapman, 2016). Conversely, hazard perception deteriorates in drivers aged over 65 years who are experiencing age-related cognitive decline (Horswill et al., 2009). This suggests cognitive function may play a role in hazard perception ability. However studies have largely focused on older drivers and assessing fitness to drive (Aksan, Anderson, Dawson, Uc, & Rizzo, 2015). A recent study into younger drivers found specific cognitive domains were related to driver errors, including executive functioning, attention, visuo-spatial skills, memory, inhibition, psychomotor skills and overall mental status (Ledger, Bennett, Chekaluk, & Batchelor, 2019). This study is the first to investigate the neuropsychological correlates of hazard perception in younger drivers.

Method: Ninety-eight undergraduates, aged 18-48 years ($M = 22.90$, $SD = 6.59$, 68.5% female) with a minimum of a provisional drivers licence were recruited. Participants completed a newly created computer-based hazard perception test (HPT) that involved watching live video clips of potentially hazardous traffic events displayed from the driver's perspective. The HPT measured accuracy and captured response times when anticipating the hazard and/or when action was required to avoid a crash, such as braking. The battery of cognitive tests included Rey-Osterrieth Complex Figure, Grooved Peg Board, Trail Making Test, Visual Object and Space Battery, Mini-Mental Status Exam and Stop-signal task.

Results: Cognitive function was positively related to hazard perception accuracy, and a multiple regression was found to be significant, $F(10,87) = 2.44$, $p = .013$, $R^2 = .219$, accounting for 21.9% of variance. A backwards elimination resulted in a significant parsimonious model, $F(3,94) = 7.35$, $p < .001$ that included inhibitory control, mental status and visuo-spatial skills. The model for hazard anticipation response times was not significant, $F(10,87) = 1.56$, $p = .132$, $R^2 = .152$. A backwards elimination resulted in a significant model, $F(3,94) = 3.87$, $p = .012$, and included

inhibitory control, mental status and executive function. The multiple regression predicting hazard action response times was not significant, $F(10,87) = 0.81$, $p = .623$, $R^2 = .085$ with a backwards elimination resulting in no predictors remaining in the model.

Conclusion: The present study showed specific cognitive domains including inhibitory control, overall mental status, executive functioning and visuo-spatial skills were related to hazard perception accuracy and anticipation response times in younger drivers. Future research could extend findings to enhance training programs to improve driving skills in younger drivers.

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