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Cognitive Functioning and Driving Simulator Performance in Middle-aged and Older Adults With HIV

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Nearly half of people living with HIV experience cognitive deficits that may impact instrumental activities of daily living. As the number of people aging with HIV increases, concerns mount that disease-related cognitive deficits may be compounded by age-related deficits, which may further compromise everyday functions such as driving. In this cross-sectional pilot study, during a 2.5-hour visit, 26 middle-aged and older adults (40 + years) were administered demographic, health, psychosocial, and driving habits questionnaires; cognitive assessments; and driving simulator tests. Although CD4+ T lymphocyte count and viral load were unrelated to driving performance, older age was related to poorer driving. Furthermore, poorer visual speed of processing performance (i.e., useful field of view) was related to poorer driving performance (e.g., average gross reaction time). Mixed findings were observed between driving performance and cognitive function on self-reported driving habits of participants. Implications for these findings on nursing practice and research are posited.

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By 2015, nearly half of people living with HIV in the United States will be 50 years of age or older (Kirk & Goetz, 2009). Aging of the HIV population is a testament to the ability of combination antiretroviral therapy (cART) to reduce mortality and improve quality of life. Yet, even with improved health, concerns remain that people aging with HIV are at risk for microbial translocation, systemic and chronic inflammation, immune senescence, vascular comorbidities, and oxidative stress, all of which may account for the elevated cognitive deficits found in middle-aged and older adults with HIV compared to their uninfected counterparts (Vance, Fazeli, Moneyham, Keltner, & Raper, 2013).

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HIV and Cognition

Many studies have shown that individuals with HIV, especially as they age, exhibit lower cognitive performance than uninfected individuals in the domains of speed of processing, psychomotor speed, executive functioning, and learning and memory (Lojek & Bornstein, 2005; Valcour, Paul, Neuhaus, & Shikuma, 2011; Vance, Fazeli, & Gakumo, 2013). The cognitive deficits in HIV reflect a dysfunction of the frontal-subcortical brain circuitry (Lojek & Bornstein, 2005). Although cART has dramatically improved life expectancy and reduced the incidence of HIV-associated dementia, more subtle forms of HIV-associated neurocognitive disorders persist as individuals continue to age with HIV (Vance, Fazeli, Moneyham et al., 2013). In fact, approximately 50% of people with HIV experience some form of cognitive deficit; the more subtle form (asymptomatic neurocognitive impairment) is the most common (Heaton et al., 2010).

Although it is promising that severe forms of cognitive deficits in HIV are less prevalent today, there remains a growing concern that even subtle cognitive deficits in the aforementioned domains will adversely affect instrumental activities of daily living (IADL) tasks such as driving (Marcotte et al., 2004). In fact, with the potential synergistic effect of aging and HIV on cognitive functioning (Vance, Fazeli, & Gakumo, 2013), examining driving abilities in people aging with HIV is particularly relevant, as the ability to drive safely has significant quality-of-life and public health implications. Driving is perhaps one of the most cognitively complex everyday activities, involving the ability to successfully negotiate one's environment on the road by making quick decisions and attending and reacting to various stimuli. Given that in HIV the most pronounced and prevalent cognitive deficits are found in measures of speed of processing, and these functions directly underlie the ability to drive safely, this area requires further examination, especially given that 29% of adults with HIV have indicated a decreased driving ability (Marcotte, Heaton, Reicks, Gonzalez, & Grant, 2000).

HIV and Driving

While examining driving in HIV is a relatively new research area, Marcotte and colleagues have conducted several seminal studies on this topic. One study examined HIV-associated cognitive deficits and performance on a personal computer (PC)-based driving simulator, as well as specific cognitive predictors of simulator performance in adults with HIV ($N = 68$; $M_{age} = 37.0$ years; Marcotte et al., 1999). They found that participants with cognitive deficits were more likely to fail the driving simulator protocol than cognitively "normal" participants, particularly with regard to number of simulator accidents. Further, they found that poor executive functions, attention, speed of processing, complex perceptual/motor, and simple motor abilities were the most consistent predictors of poor performance on the simulations. Self-reported crash history was not related to simulator performance, which may speak to the poor predictive validity of self-report crash data, and/or the ecological validity of the driving simulation (Marcotte et al., 1999). A later study by Marcotte et al. (2004) examined individuals with ($N = 40$; $M_{age} = 41.3$ years) and without ($N = 20$; $M_{age} = 42.5$ years) HIV on driving simulations, on-road driving, Useful Field of View (UFOV; Visual Awareness Research Group, Inc., Punta Gorda, FL, USA) performance (a computerized test of visual speed and attention), and overall cognitive performance. Comparisons between three groups (the HIV-infected individuals with cognitive deficits, the HIV-infected cognitively normal group, and the uninfected group) revealed that the HIV-infected group with cognitive deficits had worse performance on all driving outcomes and UFOV than the HIV-infected cognitively normal group and the uninfected group, who performed similarly. Cognitive performance and the driving simulations were independent predictors of on-road driving performance, explaining 48% of the variance, suggesting the unique predictive value of both indices. Another study by Marcotte et al. (2006) assessed HIV-infected ($N = 42$; $M_{age} = 42.0$ years) and uninfected ($N = 21$; $M_{age} = 42.5$ years) individuals on cognitive measures and found that those with HIV performed significantly worse than the uninfected group on the UFOV test. Further, poor UFOV performance was related to higher

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