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The relationship of neuropsychological functioning to driving competence in older persons with early cognitive decline

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Abstract

The study focused on the role of traditional and computer-administered visual attention and executive measures in the prediction of driving competence in older individuals with early-stage cognitive decline. A group of 23 patients with questionable dementia by Clinical Dementia Rating (CDR = 0.5) was evaluated with a group of 23 age-matched controls. For the patient group, correlational analyses revealed that road-test performance was significantly related to a number of executive and visual attention measures but not to other neuropsychological measures. For the control group, road-test performance was only significantly related to age. A hierarchical regression procedure was utilized to further explore the contribution of specific executive and visual attention measures and 46% of the variance in road-test performance was attributable to these measures for the patient group. A discriminant function analysis utilizing executive and visual attention measures for the entire group of participants classified those who passed and failed the road test with 80% accuracy. Neuropsychological executive and visual attention measures may play a useful role in determining competence to drive in older individuals with early-stage cognitive decline.

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1. Background

Elderly drivers are at higher risk than all other age groups for motor vehicle accidents (MVA) on a per-mile basis (Graca, 1986; Klein, 1992; Vernon, 1995), and elderly individuals with moderate to severe dementia are at even greater risk (Rabins et al., 1997). What is unclear is the extent to which driving ability is compromised in individuals with early-stage cognitive decline, and whether neuropsychological assessment can assist in the determination of driving competency in these individuals. Specifically, the relationship between cognitive factors and driving competence has not been adequately explored to date.

Brief mental status examinations, often insensitive to early changes in dementia (Whelihan, Leshner, Kleban, & Granick, 1984), have yielded variable results. Some researchers have found that impaired elderly drivers scored lower on the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) than non-impaired drivers (Carr, Jackson, & Alguire, 1990; Fitten et al., 1995; Fox, Bowden, Bashford, & Smith, 1997); whereas others have not found such a relationship between global measures of cognitive status and driving ability (Foley, Wallace, & Eberhard, 1995; Odenheimer et al., 1994; Trobe, Waller, Cook-Flannagan, Teshima, & Bieliauskas, 1996).

The few studies investigating the relationship between driving ability and neuropsychological measures have also yielded inconsistent results. In their study of on-road driving performance in 25 older adults, Hunt, Morris, Edwards, and Wilson (1993) found that several neuropsychological measures [Wechsler Memory Scale-R Logical Memory, Benton Visual Retention Test (BVRT), Boston Naming Test, Trails A, Wechsler Adult Intelligence Scale-R Digit Symbol] were significantly related to driving performance, but Verbal Fluency was not. However, Rebok, Keyl, Bylsma, Blaustein, and Tune (1994), using driving simulation, found that Verbal Fluency was correlated with driving performance. Furthermore, Fox, Bowden, and Smith (1997) did not find a relationship between neuropsychological measures (Visual Form Discrimination Test, Judgment of Line Orientation Test, Trails A and B, BVRT, and WAIS-R subtests) and results of an on-road driving evaluation.

More consistent findings have been reported with computer-administered visual attention tests. Ball and Roenker (1998) and Ball and Owsley (1993) developed the Useful Field of View (UFOV), a test now available commercially that shows promise as a predictor of driving ability. Using logistic regression models, Sims, Owsley, Allman, Ball, & Smoot (1998) found that a 40% reduction in useful field of view (the visual area available in a single glance, without head or eye movements) was associated with increased crash involvement. In addition, Owsley et al. (1991, 1994) reported that statistical models incorporating the UFOV and the Dementia Rating Scale (Mattis, 1976) have been useful in predicting accident frequency in samples of older drivers.

Duchek, Hunt, Ball, Buckles, and Morris (1998) studied healthy elderly and elderly with very mild or mild DAT using three computerized tasks (Visual Search, Visual Monitoring, UFOV) as predictors of on-road driving ability. While the study incorporated a number of neuropsychological tests, there was none beyond a mental control measure from the Wechsler Memory Scale that could be considered an executive measure. The authors found that error rate and reaction time on the Visual Search task were the best predictors of driving performance. It is interesting to note that while UFOV performance was significantly correlated with on-road

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