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# **DRIVING REASSESSMENT FOLLOWING NEUROLOGICAL DAMAGE: AN INTEGRATED APPROACH**

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the requirements for the degree of  
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*Dedicated to the memory of  
Grandad, with love.*

## ABSTRACT

The impetus for the present study was a lack of guidelines for evaluating neuropsychologically-impaired drivers, and the need for relevant exploratory research within a New Zealand context. The overall aim was to provide an integrated approach describing the driving performance and behaviour of neuropsychologically-impaired drivers. The researcher anticipated that social and neuropsychological factors could be identified which were related to various measures of practical driving ability, including current New Zealand driving test measures.

The present study involved a quasi-experimental analysis of four subject groups, each comprising ten subjects. Neuropsychologically-impaired subjects comprised two groups: (i) neuropsychologically-impaired presenters who were seeking driving reassessment; and (ii) neuropsychologically-impaired drivers who were driving again following a successful assessment outcome. The other two subject groups comprised: (i) control drivers who were similar for age, gender, and number of years driving experience to the neuropsychologically-impaired presenters, and (ii) professional drivers who provided a criterion for a high standard of driving.

All subjects underwent extensive neuropsychological and driver testing, as well as supplying background sociodemographic and driving-related questionnaire data. Seven neuropsychological tests (Mini Mental State Examination, Benton Visual Retention Test - Revised, Standardised Money Road Map Test, Southern California Figure Ground Test, Stroop Colour Word Test, Trail Making A and B Test, and reaction time) were included on the basis of several criteria. Practical driving measures included the New Road Test, which is the standard test for driver licensing in New Zealand, and the Advanced Driver Assessment, which is used in circumstances where an independent driving evaluation is required. These practical driving measures were complemented by an informal global driver instructor rating, as well as subject's own comparative driver self-ratings.

Questionnaire data gave some practical insight into the effects of neurological damage. Notably, all neuropsychologically-impaired subjects reported some reduction in driving frequency and a change in driving patterns. Post-injury driver self-report ratings for the two neuropsychologically-impaired groups indicated some important perceived differences relating to stages in return to driving. Both the neuropsychologically-impaired groups performed less well on the neuropsychological and practical driving

test measures. Across the neuropsychological tests, slowed response time and a difficulty with complex tasks were characteristic of many neuropsychologically-impaired subject's test performance. In particular, mean scores for the Mini Mental State Examination (Total Score), the Standardised Road Map Test of Direction Sense, and two of the reaction time conditions were significantly lower for neuropsychologically-impaired groups. For the practical driving test measures, type of driving errors made by the neuropsychologically-impaired subjects differed qualitatively from control and professional drivers. However, these differences were not necessarily reflected in overall driving test scores.

Multiple linear regression analyses were performed on composite groups of neuropsychologically-impaired versus neuropsychologically-intact subjects. Of the neuropsychological tests, the Standardised Road Map Test of Direction Sense, and some of the reaction time measures were related to both the practical driving tests. Interestingly, reaction time measures suggested an important differential relationship between neuropsychologically-impaired and neuropsychologically-intact subjects. Here, faster reaction times were associated with fewer driving errors in neuropsychologically-intact subjects. By contrast, slower reaction time for the combined neuropsychologically-impaired subjects was associated with better driving performance.

The present results demonstrated the importance of an integrated approach toward understanding the complexity of the driving process. An important theme to emerge from both qualitative and quantitative data was a relationship between subjects' perceived neurological deficit and the utilisation of compensatory driving strategies. Thus, the questionnaire data, and the driver self-rating scales suggested that the neuropsychologically-impaired subjects had some insight into their neurological deficit. Furthermore, the inverse relationship between some of the reaction time data and practical driving test outcome suggested the neuropsychologically-impaired subjects were compensating their driving, either by driving slower or by allowing a greater margin for error. The integrated approach also provided some insight into the process of return to driving through subject's reports of change, and comparison of retrospective and current driver self-ratings. Here, inclusion of the two neuropsychologically-impaired groups was an important feature of the research design, enabling further insight into different stages of this process.

Overall, the present study provided an entry point for further research, and has practical and safety implications for the reassessment of drivers following neurological damage.

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