

Driving Instructor Interventions during On-Road Tests of Functionally Impaired Drivers: Implications for Test Criteria

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Biography

Marilyn Di Stefano is an occupational therapist (OT), certified ergonomist and qualified OT Driver Assessor. She has worked in rehabilitation, occupational health and safety, ergonomics and functionally impaired driver assessment. Marilyn is a lecturer in these fields at La Trobe University, and at present she is completing her PhD research on assessment of the driving performance of functionally impaired drivers.

Abstract

Licensing authorities world-wide are facing the challenge of how best to assess the performance of drivers who are functionally impaired; of particular concern are those with cognitive decrements that have been associated with the elevated crash risk of older drivers. This study examines the types of driving errors associated with driving instructor interventions (DIIs) to maintain safety during tests conducted by specialist Occupational Therapists (OT) of drivers with diagnoses likely to be associated with cognitive impairment. DIIs have been found to be critical determinants of test outcome, so understanding the error patterns associated with them is an important pre-requisite to improving the validity and sensitivity of driver evaluation criteria in such tests.

OT reports to a licensing authority of all on-road assessments of drivers with possible cognitive impairment during a specified period were randomly sampled. A total of 256 report files were reviewed; average driver age was 60 years, 64% were male and the most common diagnoses were CVA, dementia and behavioural disorders. In most cases (86%) the tests had used a standardised route and procedure, rather than being 'local area' tests. The most frequently reported driving errors were associated with intersection negotiation, lane changing/diverging and position on the road, and at least one DII was recorded for 27% of the sample. Errors associated with DIIs were highly predictive of membership of the fail group – a relationship supported by other researchers. The error patterns displayed by this group are similar to those identified in groups of older drivers – a finding consistent with previous research.

Results will be presented in relation to international research and the authors' previous findings concerning driving errors reported during older driver "review tests" by a licensing authority. The potential role of DIIs in evaluating the performance of older and/or impaired drivers will be discussed.

1. BACKGROUND

As the proportion of older drivers increases, we confront the growing challenge of how best to preserve both road safety, and the independence and community mobility of older members of our ageing population (McKnight, 2000). Within many driver licensing jurisdictions the medical review and assessment process plays a key role in addressing this need (Janke & Eberhard, 1998). In Victoria, all drivers referred to the licensing authority (VicRoads) are required to undergo a medical assessment. The driver's doctor provides medical history information, checks compliance with required medical standards, and completes the official VicRoads medical report form. Based on this, and any other relevant

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reports, the authority commonly requires the driver to undertake one or other of two assessments: a licence “review” test, or an assessment delivered by a specialist Occupational Therapist (OT) (VicRoads, 1998).

The role of OTs in the assessment of older drivers and others with specific impairments is widely acknowledged (Australian Society for Geriatric Medicine, 2002; Darzins & Hull, 1999; Eberhard, 1996; Messinger Rapport & Rader, 2000), but its status within driver licensing systems varies between jurisdictions. In Victoria, OTs are identified as being qualified to undertake specialist driver assessment within road safety legislation (Road Safety Act 1986, Section 27 and Road Safety Procedures Regulations, 1988). On-road testing is a key component of driver assessment, whether conducted by staff of licensing authorities or by specialist OTs, because current methods of off-road assessment, in isolation, are an inadequate means of testing some aspects of driving ability (British Psychological Society, 2001; Withaar, Brouwer, & Van Zomeren, 2000). Further, on-road tests offer higher face validity, which is an important consideration for older drivers in particular, who typically feel very threatened when their status as a licensed driver is under review (Fildes, 1997; Korteling & Kaptein, 1996).

It is important to ensure that the performance of older drivers and others with possible impairments is assessed equitably, with due regard both to the road safety risk they may present and to their mobility needs. To achieve this, the characteristics of the driving tests used to assess them must differ in some respects from those of entry-level licence tests. All tests should validly and reliably identify drivers whose performance presents an unacceptable risk. However, entry-level licence tests must be able to identify drivers with an *inadequate level of skill development*, whereas tests of older or functionally impaired drivers must be able to identify those drivers whose *type and severity of functional impairment* should preclude them from holding a licence.

For this reason, it is important for performance criteria to discriminate between driving habits which for the driver population in question do not represent a significant increase in risk, from those aspects of driving performance which are valid and reliable indicators of unacceptable risk. This is necessary because older, more experienced drivers usually have a range of long-established driving habits of a kind that most driving instructors would see as ‘bad’ and deserving of penalty in a test. Such habits typically include rolling over stop lines at intersections, minor speed violations and some observational deficiencies. According to the assessment criteria routinely used in entry-level licence testing, such habits would be penalised and could result in test failure. However, there is some evidence that within an older or impaired driver population, the presence of such habits does *not* identify those who are at greatest risk (Carr, et al. 1992; Dobbs, 1998; Hunt et al. 1997; Staplin et al. 1998).

Dobbs and associates (1998) concluded that “hazardous errors” were the single best discriminator of cognitively impaired older drivers from control group drivers. These were defined as errors where “the driving evaluator had to take control of the vehicle or the traffic had to adjust to accommodate the error” (p. 367). The older, impaired drivers also made more errors in vehicle positioning, and were more often overcautious. Janke and Eberhard (1998), and Janke (2001) reported that the errors which best discriminated older and impaired drivers referred to a licensing agency from controls were “critical errors” (striking an object, disobeying a traffic sign or driving at inappropriate speed) and the subset of these called “hazardous errors” (dangerous manoeuvres and DIIs). Hunt and colleagues (1997) found that among drivers with dementia, DIIs were more frequent among those who failed the test. DIIs were defined here as occasions when “the driver required assistance from the driving instructor (i.e. controlling the steering wheel, applying the dual brake, or both)”.

In Australia, Fox and colleagues (1997) studied 19 drivers with probable Alzheimer’s Disease. DIIs were associated with the total driving score (percentage of correct actions calculated across all performance categories), although not with test outcome (pass/fail). In another more recent Australian study, Lovell and Russell (2003) analysed the performance of 20 drivers with dementia who were tested on a standard route following standard OT test

procedures (Schneider, 1998). Drivers failing the test were more likely to require DIs entailing use of vehicle controls, repeated instructions or verbal prompts.

Finally, Di Stefano and Macdonald (in press) analysed driver errors recorded by specialist licence testing officers (LTOs) in a sample of 533 VicRoads ‘review tests’. Test outcomes were based on a global judgement of driver performance and were strongly linked to whether or not there had been any LTO interventions (equivalent to DIs). Evidence for the concurrent validity of the global judgements (and by association, the occurrence of LTO interventions) was provided by additional analyses based on details of the far more numerous errors that were unrelated to DIs. These errors – unweighted in any way – were used to calculate an overall driving performance score, and this score was found to explain a very high proportion of variance in test outcome. Given that DIs are inherently a valid indicator of unsafe driver behaviour –since unsafe behaviour is precisely the criterion for their occurrence – this finding supported use of a performance score, based on unweighted driver errors observed throughout the test, as a valid basis for evaluating test performance of this population – that is, older drivers with no significant impairment related to medical conditions. The types of driver error included in this score were related to the following performance categories: intersection negotiation, lane changing, position and speed, low speed manoeuvring, safety margin and car control.

The present paper reports some findings from analyses of a large sample of OT test reports submitted to VicRoads, using the same strategy as in the above study. The sample was selected to focus particularly on drivers with known or suspected cognitive impairments, since they have been associated with an elevated crash risk, particularly in older drivers (Lundberg et al.1998; Stutts, Stewart, & Martell,1998).

2. ANALYSES OF DRIVER ERRORS FROM OT TEST REPORTS TO VICROADS

Data were extracted from a random sample of OT test reports in VicRoads files. The sample comprised 256 cases, representing one sixth of all reports for a six month period for drivers with medically diagnosed conditions that are typically associated with some cognitive impairment. Within the sample, 27% failed the test and 46% passed with conditions. Mean driver age was 61 years (SD = 22, range 19 – 101 years); 66% were male. The majority had been referred for testing by another OT or a rehabilitation team (43%), or by a medical practitioner external to the licensing authority (41%). One or more specific diagnoses were recorded as the apparent reason for the referral in 95% of cases (n = 244). The most commonly reported medical conditions relating directly to the referral were cerebrovascular accidents (CVA’s), dementia and behavioural disorders. Almost all tests were undertaken on standard (as opposed to local area) routes.

DIs occurred on 235 occasions within 68 of the 256 tests. For these 68 tests, the mean number of DIs per test was 3.6 (range 1-12). There were no DIs in the pass group, since, based on test pass criteria, occurrence of a DI necessarily resulted in either failure or a conditional pass only. For tests in which the driver passed ‘with conditions’ there was one or more DI in only 8.5% of cases; in these cases, the pass was conditional on the driver undertaking some form of rehabilitation program and then undergoing re-assessment. For tests in which the driver failed, there was at least one DI in 85.3% of cases ($\chi^2 = 109.763$, $df = 1$, $p < .000$) as depicted in Table 1.

Table 1. Relationship between test outcome (pass/fail) and whether or not there was a DI intervention (DI) during the OT test.

	Pass	Pass with conditions	Fail	n
One or more DIs	-	10	58	68
No DIs	70	108	10	188
Total	70	118	68	256

Detailed information was also available about the driver errors, driving manoeuvres and driving contexts related to DIIs, as shown in Table 2. It can be seen that DIIs typically occurred during manoeuvres involving intersections (noted three times more frequently than other manoeuvres), maintaining correct position on the road, and during lane changing.

Table 2. The most frequent manoeuvres, errors and contexts associated with DI interventions, from the 68 tests in which DI interventions occurred. (NB. Information on same row does not refer to same set of events.)

Manoeuvres	Errors	Contexts
Intersections (109)	Failure to apply give way laws (53)	Intersections: general (51)
Position on road (35)	Vehicle position on road (52)	Straight stretch of road (43)
Lane changing (28)	Judgement (23)	Lane changing (28)
Inappropriate response to hazard (20)	Difficulty managing vehicle operational controls (23)	Intersections: turning right (27)
Progress (15)	Failure to apply other laws (22)	Behaviour affects other vehicles * (26)
Car control (14)	Failing to perform head checks (21)	Roundabouts (20)
Low speed manoeuvres (8)	Poor observations/mirror checks (10)	Unexpected hazard (10)

* another vehicle had to accommodate an error of the driver undergoing assessment

In contrast to the level of detail available about driver errors associated with DIIs, details about errors that were *not* associated with DIIs was inconsistent, primarily due to VicRoads reporting requirements. OTs were required to report details of driver errors only to the extent seen as necessary to substantiate the test outcome. In view of the key role evidently played by DIIs, details of other errors were very limited. Based on this limited information, the largest category of errors unrelated to DIIs were reported in association with intersection negotiation, followed by errors associated with lane changing, and vehicle position on the road. Poor vehicle position, use of signals and failing to perform over the shoulder checks represented the highest specific error frequencies.

3. DISCUSSION AND CONCLUSIONS

The results reported above are very similar to those previously reported for VicRoads LTO Review Tests of older drivers (Di Stefano and Macdonald, in press). Based on this, along with the research reviewed earlier, it is clear that DIIs and associated 'hazardous' driver errors play a significant role in determining test outcomes for older and cognitively impaired drivers, at least in the state of Victoria. Given the core requirement for such tests to identify drivers with an unacceptably high crash risk, how appropriate is this key role of DIIs as a criterion for automatic test failure? What independent evidence is there of the validity of DIIs as indicators of unsafe behaviour?

DIIs – or at least, those entailing intervention in car control – are typically provoked when the DI perceives the need to avoid a potentially dangerous situation. In terms of Gibson's "field of safe travel" (Gibson & Crooks, 1938), the DI perceives a potential conflict between the test vehicle's trajectory and associated 'field of safe travel', and the perceived field of another road user. This gives DIIs high face validity as a basis for test failure, or at least as grounds for a severe scoring penalty. Also, the kind of traffic situations in which DIIs typically occur are those where older driver accidents are most likely: for example, during intersection negotiation, or in the types of driving contexts that are typically avoided by older drivers (eg. complex or new situations) (Ball et al., 1998; Brouwer & Ponds, 1994; Daigneault, Joly, & Frigon, 2002; Preusser, Williams, Ferguson, Ulmer, & Weinstein, 1998; Ryan, Legge, & Rosman, 1998). These situations also represent occasions where a driver's cognitive limitations are most likely to increase their risk of encroaching upon another road users' projected travel path, which in a test situation may provoke a DII.

Additional evidence of the validity of DIIs for assessing older and cognitively impaired drivers

is provided by the evidence reviewed earlier concerning the significant association between DIIIs and overall error rates based on evaluation of driver performance throughout the test (Di Stefano and Macdonald, in press; Fox, Bowden, Bashford, & Smith, 1997). The former authors found that for older drivers without major impairments, test outcome was best predicted by sets of errors associated with driving manoeuvres associated with intersection negotiation, lane changing, and with vehicle position on the road. Evidence from the present data set of cognitively impaired drivers was consistent with these findings, although much less information was available about such these 'non DII' errors.

In view of this evidence, what relative weight should be placed on DIIIs versus an overall performance score in determining driving test outcome for older and impaired drivers? Should a formal scoring system be used, or would it be adequate simply to pass or fail drivers on the basis of whether or not they provoke a DII? This would not be satisfactory in the case of entry-level testing of very inexperienced drivers, because the nature of their skill deficiencies is likely to be reflected in a range of specific performance errors rather than in gross errors requiring DIIIs. With highly experienced drivers, however, it might be considered because their car control skills are more highly automatised and it is their deficiencies in information processing speed and response capacity that increase their rate of hazardous errors and associated DIIIs, as discussed earlier.

However, there are problems in relying too heavily on DIIIs alone, particularly in relation to test reliability. The DI's decision concerning whether or not to intervene must reflect a wide range of behavioural and contextual factors which, by their nature, cannot all be clearly specified in advance. Decision reliability is therefore highly dependent on how well each DI is trained and 'calibrated' in relation to the types of situations and level of perceived risk which should justify such interventions. The issue of how DIs perceive driver errors has been raised more generally in relation to the different criteria that arguably should apply to entry-level versus experienced older drivers and more generally to the effect of DI experience and training on test reliability (Dobbs et al., 1998; Janke and Eberhard, 1998). It is evident that to achieve adequate reliability, test procedures and scoring criteria need to be more highly specified than seems feasible with DIIIs (Macdonald, 1987; Macdonald, Bowland, & Triggs, 1992; McKnight, 1989).

If errors in addition to those associated with DIIIs are to be scored, it is important that they are the types of error which best characterise drivers who, *within that subgroup of the driver population* (i.e. older, or cognitively impaired), have an unacceptably high crash risk – rather than errors which are common in the majority of drivers (Dobbs, Heller, & Schopflocker, 1998; Macdonald & Scott, 1993; Withaar et al., 2000). However, a blanket decision not to penalise errors which simply represent 'bad habits' would fail to consider important contextual factors. For example rolling through a stop sign might not have safety implications if there are no pedestrians crossing, but if the vehicle traverses the intended path of a pedestrian or another vehicle with a right of way, this error may be indicative of the driver's inability to take into account the contextual moderators which should limit such habitual behaviours (Di Stefano & Macdonald, in press). In fact, Dobbs (1998) noted the potential usefulness of such contextual information ... "the conditions of the driving errors may help to further refine the meaning of the errors for the purposes of developing an empirically based scoring scheme" (p.369).

Also, the influence of driving test content on driver training practice needs to be considered, particularly since many OT tests are implemented within the context of a rehabilitation process. In this context, specific information on the kinds of driving errors observed during a test provide essential input to decisions concerning training requirements and/or possible licence conditions. More generally, the process of scoring driver performance throughout the test is likely to enhance test validity (in that it ensures that adequate numbers of 'test items' are included), and for the purpose of providing feedback to the driver. For these reasons also, a formal method of scoring performance throughout the test is desirable (Fox, Bowden

& Smith;1998). A related need, discussion of which is beyond the scope of this paper, concerns the need to match test route characteristics to the nature of the test being undertaken. If an unconditional licence is a possible test outcome, then it is important that the test route should provide adequate exposure to a full range of 'error opportunities'.

In cases where only one tester is present in the car, a practical disadvantage of scoring throughout the test is the additional workload it imposes. In this case, potential risks to the occupational health and safety of the tester need to be weighted up against the need for the information, taking account of the 'riskiness' of the driver, the particular driving environment, and the specific means by which information is to be recorded, which can significantly affect the attentional demands of this task.

In conclusion, it is clear that there is a need for further work to develop methods for testing the driving performance of older and cognitively impaired drivers which satisfy both road safety and community mobility objectives. Key requirements include the need for more comprehensive information about the error patterns that may typify different subgroups of drivers, particularly as they may vary with both age and type of impairment. There is also an important need to investigate the reliability of DIs in different situations and with different types of driver, given the key role they are currently playing in determining test outcomes for older and cognitively impaired drivers.

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Keywords

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