Learning Objectives

1. To examine roles and responsibilities of health professionals, drivers and driver licensing authorities
2. To understand the occupational therapy driver assessment procedure
3. To improve knowledge of neurological conditions and driving capacity
4. To present PhD studies and results on Return to Driving after Traumatic Brain Injury
Fitness to drive

What do we mean?

The aim of determining fitness to drive is to achieve a balance between minimising any driving-related road safety risks for the individual and the community posed by the driver's permanent or long-term injury or illness, and maintaining the driver's lifestyle and employment-related mobility independence.

Ref: Austroads - Assessing Fitness to Drive for commercial and private vehicle drivers, 2012

Summary of Roles and Responsibilities

OF THE DRIVER LICENSING AUTHORITY – DLA

To make all decisions regarding the licensing of drivers. The DLA will consider reports provided by health professionals, police and members of the public, as well as crash involvement and conviction histories.

To educate the driving public of their responsibility to report any long-term or permanent injury or illness to the driver licensing authority if the condition may affect their ability to drive safely.
Roles and Responsibilities - OF THE DRIVER

• To report to the driver licensing authority any long-term or permanent injury or illness that may affect their ability to drive safely.

Drivers should be aware that there may be long-term financial, insurance and legal consequences where there is failure to report an impairment to their driver licensing authority.

• To respond truthfully to questions from the health professional regarding their health status and the likely impact on their driving ability.

• To adhere to prescribed medical treatment.

To comply with requirements of a conditional licence as appropriate, including periodic medical reviews.
Roles and Responsibilities – Of the health professional

• To assess the person’s medical fitness to drive based on the relevant published medical standards.

• Health professionals have a duty of care to advise the person regarding:
  
  • the impact of their medical condition or disability on their ability to drive and recommend restrictions, need for assessment and ongoing monitoring as required
  
  • their responsibility to report their condition to the driver licensing authority if their long-term or permanent injury or illness may affect their ability to drive safely.

  Health professionals are advised to note in the medical record the nature of the advice given.
Reporting to driver licencing authority

The health professional has an ethical obligation, and potentially a legal one, to give clear advice to the patient in cases where an illness or injury may affect safe driving ability and should consider reporting directly to the driver licensing authority in situations where the patient is either:

- unable to appreciate the impact of their condition
  or
- unable to take notice of the health professional’s recommendations due to cognitive impairment
  or
- continues driving despite appropriate advice and is likely to endanger the public

VicRoads will request that they obtain a satisfactory medical report. If they don’t comply, licence is suspended.
Assessment of fitness to drive

Clinical assessment - key considerations

Doctor’s Role

Medical assessment

- Medication – up to doctor to advise
- Co-morbid conditions such as diabetes, psychiatric conditions, sleep apnoea, cardiovascular disease, substance misuse
- May require specialist advice eg psychiatrist, endocrinologist, neurologist
Assessment of fitness to drive

Clinical assessment - key considerations

Eye Specialists Role

To assess – Acuity with one or both eyes 6/12

- Diplopia
- Hemianopia
- Visual fields – preferred assessment is Esterman binocular field test
- Eye diseases such as cataracts, glaucoma, macular degeneration
Normal Ageing

Older drivers can be affected by:

• Deteriorating eyesight and hearing (eg visual fields and acuity)
• Reduced range of movement, physical strength and flexibility
• The onset of age-related diseases such as arthritis and neurological conditions such as dementia, stroke, Parkinsons.
• Changes in thinking and perceiving of events (e.g. reaction time slows)
• More likely to be taking medications (possible side effects can affect driving capacity)

Therefore should all older driver’s be assessed?
Assessment of Older Drivers

Each state has their own Driver Licensing Authority with its own guidelines:

No age based testing in Victoria or NT

- QLD & ACT - Over 75 annual doctor’s clearance
- WA - Over 80 require a med cert, over 85 annual licence tests
- NSW - Over 75 require a med cert, over 85 licence tests every 2 years
- SA – From 70 must pass a medical and eyesight test each year. Practical assessments over 85 licences other than cars
- Tas – Practical tests for over 85 have been scrapped – stats don’t support that these drivers are a significant risk.
Case studies

Age itself is not a good predictor of ability to drive: Functional ability rather than chronological age should be the criterion used in assessing the fitness to drive of older people.

For example:

1. 80 year old drove to Sorrento from Melbourne, caught ferry to Queenscliff, drove Great Ocean Road to Apollo Bay, stayed a week, drove back via Geelong, mostly unfamiliar areas, including high speed driving, busy traffic areas and winding hilly roads.

2. 90 year old with a mild Traumatic brain injury TBI (PTA <24, GCS – 13)
   - OT on-road driver assessment – failed, overwhelmed, slow reaction times, lack of recent driving practice, determined to drive.
   - 6 driving lessons in local area
   - Reassessed by OT: Restricted licence to drive in local area – 5km from home
Assessment of fitness to drive

Always ensure the client has been medically cleared to drive and that their vision is satisfactory

Clinical assessment – key considerations:

• Motor Function – joint range, strength & coordination – may require practical assessment

• Cognitive - attention, concentration, presence of hallucinations and delusions, insight, judgement, memory, problem-solving skills, thought processing and visuospatial skills – neuropsychology and practical assessment

• Behavioural – anger management, impulsivity – more difficult to assess
Types of assessment

- Much research into identifying tests that predict fitness to drive – measured against on road performance
- Neuropsychology tests – useful for identifying potential areas of difficulty and need for practical assessment
- Driving simulators have benefits for driver retraining but not reliable in assessing fitness to drive

Practical assessment remains the ‘gold standard’

In Australia – Driver assessments conducted by OTs who have completed additional training and in Victoria are registered with VicRoads.

Main barrier is the cost and availability in rural areas
Occupational Therapy  Driver Assessment

Off road assessment (initial interview)

- Vision
- Medications
- Medical History
- Physical assessment
- Brake reaction timer
- Previous driving experience
- Insight, expectations & driving needs
- Road law knowledge
- Cognitive screen
Occupational Therapy Driver Assessment

On road assessment - 45 – 60 minutes duration

• Conducted in a dual control vehicle

• Set route – initial practice/familiarisation drive
  - then standard route includes manouvres to comply with 1998 Victorian OT driver assessor competency standards

• Local assessments – conditional licence

• Feedback provided to client
Occupational Therapy Driver Assessment

On road assessment

Driver Instructor gives directions & maintains vehicle safety

OT records non critical and fail errors and provides recommendations to DLA

OT documents driver performance based on:
- Observation
- Signaling
- Gap Selection including following distance
- Lane Position
- Road Rules
- Response to hazards
- Vehicle control – steering and pedal use
- Speed control
Driving Assessment Outcomes

Outcome usually determined by number of ‘fail errors’ requiring driving instructor intervention but recommendations may be influenced by history of crashes/infringements, medical and neuropsychology information.

Recommendations to DLA include:

- Return to driving
- Lessons then Re Assessment
- Suspension/Cancellation

Conditional/Restricted Licence

- area restriction
- automatic vehicle
- time of day restriction
- passenger restriction
- use of adaptive equipment
Driving and neurological conditions

Is the condition:
Progressive – Dementia, Parkinson’s Disease, MS
Likely to Improve – Stroke, Traumatic brain injury

What is the level of insight/self awareness?
Dementia - Effects on driving

Dementia associated with a moderately high risk of crashes

- Initially present with navigation difficulties – forgetting routes and getting lost in familiar areas
- Concentration difficulties: failing to see or respond to ‘stop’ signs
- Judgement: misjudging distance between cars and misjudging speed of other cars
- Confusion with choices: eg choosing between accelerator or brake pedals in stressful situations
Dementia - Questions for Caregivers

- Getting disoriented or lost while driving in familiar areas – can they read a road map?
- Forgetting the purpose of the trip
- Any motor vehicle crashes/ near misses
- Losing the car in a familiar carpark
- Unexplained scrapes /dents on car
- Driving through stop/give way signs
- Slow to make decisions at intersections
Dementia - Questions for Caregivers

- Can they tell left from right
- Difficulty staying in a lane
- Any changes in patient’s driving behaviour – more aggressive or angry
- Has the patient been pulled over by the police or had any speeding tickets
- Do other people toot their horn more
- Failure to see vehicles, pedestrians or cyclists
- Difficulty parking or driving into a carport
Failure to comply with advice

May continue to drive without valid licence due to denial, memory, or lack of insight

Strategies to discuss with caregivers

- Remove keys
- OT community mobility assessment to investigate alternative transport and support
- Notify the DLA

Seek support/refer family to dementia support groups
Dementia references /resources

• Alzheimers Association – alzheimers.org.au
• National Dementia Helpline 1800100500
• National Dementia Behaviour Management Service – Victoria 1800 699 799
• VicRoads publications – Dementia and Driving
• The Older Adult Driver with Cognitive Impairment
  Carr, DB, Ott BR, JAMA, April 28 2010 vol 16
• Predicting Road Test Performance in Drivers with Dementia
  Carr et al JAGS 59:2112-2117, 2011
Progressive conditions – Parkinson’s Disease

Neurodegenerative disorder that affects as many as 1–2% of people aged 60 years and older. Incidence is expected to increase dramatically in the coming decades with ageing population.

A progressive multisystem disease – involves CNS & PNS

- motor changes – bradykinesia, rigidity, postural instability, tremor and slowness
- Cognitive changes – executive function, memory, visuo-spatial
- Sleep disturbance – sleepiness and fatigue
Parkinson’s disease - medication

- Medication can lead to psychosis, insomnia and behavioural disturbances such as apathy, compulsive behaviours and impulsivity – will require close monitoring of medication to determine impact of driving.

- When assessing response to treatment, should consider the response over the whole cycle. Eg with motor fluctuations can’t assess on basis of best ‘on’ response.
Parkinsons disease - guidelines

Affects driving in advanced stages

Not fit to drive if:

1. Significant impairment of movement
2. Significant impairment of reaction time
3. Onset of dementia – neuropsychology assessment useful in monitoring for dementia
Transient ischaemic attacks - guidelines

Can be single or followed by stroke

Advised not to drive for 2 weeks

- May impair driving if they occur while driving, but very uncommon cause of crashes.
- 15% risk of another TIA within 3 months and half of that risk is in first week
Stroke

- Leading cause of disability in Australia
- Around 60,000 people per year
- Mean age of stroke in Australia is 72.5 years
- Only 19 – 54% return to driving

Advised not to drive for at least 4 weeks due to risk of recurrent stroke and effects of fatigue and cognitive impairment then seek medical advice – at Epworth recommend 3 months

No evidence that stroke drivers are more likely to be involved in accident following assessment and many modify their driving behaviour
Stroke - guidelines

Not fit to drive if significant impairment in:

- Visuospatial perception
- Insight
- Judgement
- Attention and concentration
- Reaction time
- Memory
- Sensation, Muscle power, Coordination

On road assessment is best predictor for return to driving after stroke
Stroke – questions for caregivers

Drives too fast or too slow for road conditions or posted speeds
Needs help or instructions from passengers
Doesn’t observe signs or signals
Makes slow or poor distance decisions
Gets easily frustrated or confused
Often gets lost, even in familiar areas
Has accidents or near misses
Drifts across lane markings, close to parked cars

Epworth Richmond
Stroke Recommendations

• May require practical driving assessment or neuropsychology assessment, particularly with lack of insight
• Physical impairment can often be addressed by vehicle modifications
• Improvements occur with time, so important to offer reassessment after initial fail
• Can also benefit from driver retraining
Progressive conditions – Multiple sclerosis

• Multiple sclerosis is an inflammatory demyelinating disease of the central nervous system – common in younger patients

• Despite anti-inflammatory or immunosuppressive therapy, 50% of patients with MS progressively deteriorate after a 10-15-year relapsing/remitting disease course - Driving risk will increase

• Difficult to assess as deficits may be temporary or permanent, therefore it is hard to assess the point when driving becomes unsafe

• The accident rate for drivers with MS is estimated to be three times higher than that of similarly aged healthy individuals
Multiple Sclerosis - guidelines

• Not fit to drive if significant impairment in:
  • Visuospatial perception
  • Judgement
  • Attention and concentration
  • Reaction time
  • Memory
  • Sensation Muscle power Coordination

• Insight - Awareness is a key predictor of fitness to drive as many choose not to drive during acute exacerbations and can monitor effects of fatigue, heat, dizziness
  - Unaware of deficits associated with higher risk of crashes
Multiple Sclerosis - Assessment

Multi disciplinary approach

- Vision – acuity, visual field changes, reduced ability to cope with glare and to see contrasts – eye specialist
- Motor – coordination, sensation (unable to feel pedals) reduced strength – doctor and practical assessment - Car adaptions
- Cognitive changes - Neuropsychology assessment may be useful to identify need for practical assessment and provide monitoring of changes. Provide emotional support
- Medication - can also affect skills for driving – requires doctor’s assessment
- Will require regular medical monitoring of condition
Seizures and epilepsy

Seizure free period depends on:

- Type of seizure
- Circumstances of seizure
- Private or commercial licence

Requires medical advice – refer to guidelines
Intra cranial surgery - guidelines

Non driving periods may be varied by neurosurgeon
Usually 3 – 6 months Depends on type of surgery
May require neuropsychology assessment if cognitive concerns and practical driving assessment
Traumatic Brain Injury
Driving performance can be affected by

Physical Issues – Vision, Co-ordination
Behaviour – Short temper, Impulsive
Cognitive issues

• Fatigue
• Difficulty maintaining and dividing attention
• Slower speed of thinking
• Impaired planning and problem solving
• Poor memory
• Visuo –spatial difficulties
• Reduced self awareness
Traumatic Brain Injury - guidelines for fitness to drive (2012)

- A head injury will only affect driver licensing if it results in chronic impairments or seizures.
- Minor head injuries involving LOC < 1 minute do not usually result in long term impairment.
- Any person who has had a traumatic injury causing LOC should not drive for a minimum of 24 hours.
- People who are initially unfit may eventually resume driving.
- A person is not fit to hold an unconditional licence if the head injury has resulted in significant visual, physical or cognitive impairment.
BACKGROUND TO PhD

• When can I return to driving? – a simple question

• Difficult to answer due to: Lack of guidelines, uniform assessment and rehabilitation procedures, range of sensory, cognitive, physical, emotional and behavioural impairments after TBI and knowledge of post-assessment driver safety and behaviour.

• Summary of observations based on over 25 years of clinical experience and at least 3000 on-road assessments!

• Embarked on PhD journey due to lack of evidence to support clinical observations about who and when to refer for assessment, benefits of driver rehabilitation and longer term safety.

• The objective of the study is to contribute to current knowledge about resuming driving after TBI, to assist in clinical decision-making and optimize the driver assessment and rehabilitation process for individuals with TBI.
STUDY RATIONALE

• The inability to return to driving following a traumatic brain injury (TBI) can have a devastating impact on quality of life for an individual and their carers (Liddle et al., 2011, Fleming et al., Kreutzer et al., 2009)

• Driving cessation affects participation in work, social, leisure and daily life activities and is associated with loss of identity and roles (Liddle et al., 2012, Liddle et al., 2011)

• So it is important that rehabilitation includes assessment of driving and provides interventions for those who fail the initial assessment
AIMS OF PHD STUDY

• To document the patient characteristics and outcomes of an occupational therapy driver assessment and rehabilitation program.

• To examine pre-injury and injury-related factors and their association with the outcome of the initial on-road driver assessment.

• To describe the range of goals, processes, outcomes, and resources associated with providing on-road driver rehabilitation, in a group of drivers with TBI who failed an initial OT driver assessment.

• To examine self-reported pre- and post-injury driver safety and patterns of driving behaviour amongst individuals with a TBI, who had completed an OT driver assessment and rehabilitation program.
AIMS OF PHD STUDY

• To compare the characteristics and subsequent self-reported driver behaviour of those drivers who returned to driving after one on-road assessment with those who received on-road driver rehabilitation prior to subsequent assessments.

Subsidiary aims included:

• To describe the practical application of the driver assessment and rehabilitation process and use of restricted licensing as interventions for grading return to driving after TBI.
**PHD STRUCTURE**

- **Study 1** – *Predictors of On-Road Driver Performance following Traumatic Brain Injury* – Published in Archives of Physical Medicine and Rehabilitation

- **Study 2** - *Driver Rehabilitation Lessons and Restricted Licensing: Interventions for Resuming Driving after Traumatic Brain Injury’* -submitted to Disability and Rehabilitation in Nov 2015

- **Study 3**– *On the road again after traumatic brain injury: Driver safety and behavior following on-road assessment* - Published in Disability and Rehabilitation
STUDY 1 - PREDICTORS OF ON-ROAD DRIVER PERFORMANCE FOLLOWING TRAUMATIC BRAIN INJURY

- **Objective**: To examine the assessment outcomes and factors associated with passing an occupational therapy (OT) on-road driver assessment, after traumatic brain injury (TBI).

- **Design**: Retrospective analysis of the outcomes of on-road driver assessments over an eight year period.

- **Participants**: A consecutive sample of 207 individuals with mild to severe TBI, (Mean PTA 23 days) who completed an on-road driver assessment and were assessed at least 3 months post injury at Epworth Rehabilitation.

- **Method**: Divided into two groups
  - **Pass Group** - passes initial on-road assessment
  - **Rehabilitation Group** - required driver rehabilitation
STUDY 1 - PREDICTORS OF ON-ROAD DRIVER PERFORMANCE FOLLOWING TRAUMATIC BRAIN INJURY

• Results:
  
  • 66% of TBI drivers (n=137) passed the initial on-road driver assessment (*Pass* group – mean PTA 16 days)
  
  • 34% (n=70) required on-road driver rehabilitation and/or one or more on-road assessments (*Rehabilitation* Group – mean PTA 39 days)
  
  • After driver rehabilitation, only 3 of this group did not resume driving.
  
  • The *rehabilitation* group were more likely to be female, had significantly lower GCS scores, longer PTA duration, slower reaction times, and more physical injuries compared to the *pass* group.
**Study 1- Predictors of On-Road Driver Performance following Traumatic Brain Injury**

- **Conclusions:**
  - Post traumatic amnesia duration, proved to be a better predictor of driver assessment outcome than Glasgow coma scale score.
  - In combination, being male, shorter post traumatic amnesia duration, the presence of physical/visual impairment and slowed reaction times correctly classified 88% of the pass group and 71% of the rehabilitation group and could assist clinicians to determine referral criteria for OT driver assessment.
  - Whilst driving experience was not a significant predictor inexperienced and older drivers may be more likely to require assessment.
  - On-road driver rehabilitation, followed by on-road reassessments were associated with a high probability of return to driving after TBI.
What is Driver Rehabilitation?

• Driver rehabilitation aims to provide training to improve driving skills, change behaviour and develop compensatory strategies to assist the driver cope with impairments. (Di Stefano and McDonald, 2006)

• Most commonly reported OT driver rehabilitation interventions included:
  o off road education programs,
  o computer based driving simulator training,
  o cognitive retraining where specific skills, such as attention, speed of information processing, or perception are targeted (Unsworth and Baker, 2014)

Functional or contextual re-training of driving skills, such as on-road driving lessons, found to be more effective than cognitive based approach. (Devos et al., 2012)
**STUDY 2 - ON-ROAD DRIVING LESSONS**

In Australia, the accepted form of driver rehabilitation is on-road driving lessons, provided by driving instructors under OT direction (Unsworth and Baker, 2014)

- Lack of studies examining this functional approach to driver rehabilitation (Unsworth and Baker, 2014)

- Pass/fail rates of on-road assessment after TBI have been examined (Ross et al., 2015, Schultheis et al., 2002, Van Zomeren et al., 1987)

- Potential reasons for failing on-road driving assessment included:
  - confusion, impulsivity, slowness, distractibility, inattention and anxiety (Galski et al., 1992),
  - lack of recent driver experience or confidence (Di Stefano and McDonald, 2006)
  - being assessed too early. (Hopewell, 2002)

Lack of knowledge about the prevalence of these issues after TBI and the reasons why driver rehabilitation is recommended.
STUDY 2 - DRIVER REHABILITATION LESSONS AND RESTRICTED LICENSING: INTERVENTIONS FOR RESUMING DRIVING AFTER TRAUMATIC BRAIN INJURY

Aim

• To describe the process of driver rehabilitation for those patients with TBI who required driver rehabilitation after failing an initial OT driver assessment and to examine:
  o driver characteristics (age, gender, injury severity measured by PTA duration and GCS score, driving experience)
  o average number of driving lessons and reassessments and resources required to deliver the intervention
  o timing of driver assessment and return to independent driving
  o outcome of reassessments including prevalence of restricted licences
  o the goals of on-road driver rehabilitation
STUDY 2 - PARTICIPANTS

- From a consecutive sample of 340 participants with mild to severe TBI, who completed an OT driver assessment over a 12 year period, 94 (28%) participants received on-road driver rehabilitation lessons.

- Mainly MVA or work injuries, therefore cost of driver assessment and rehabilitation was funded.

- Exclusion criteria:
  - learner drivers

- Older drivers (aged 65 or over) were not excluded, as they form a significant proportion of TBI population and comprised 12.9% (n=44) of the total sample.
**STUDY 2 - METHODOLOGY**

On-road driver assessment procedure

Referred usually at least 3 months post injury after medical, eyesight clearances, neuropsychology Ax – standard practice at Epworth Rehabilitation.

All drivers completed same

- Off-road and on-road assessment
- Feedback provided to driver, with specific examples of errors, with recommendations for driver rehabilitation including number of and goals of driving lessons.
Study 2 - On-road Driver Rehabilitation

- Example of goals of driver rehabilitation:
- Fatigue observed during assessment, patient’s goal was to be able to drive 40 mins, to and from work: assisted to recognise fatigue and educated to take a rest break after 20 minutes (coffee break).
- Unable to plan and remember routes, poor observation of road signs. Goal of lessons was to trial GPS systems, training to use GPS and use of commentary as a compensatory strategy to improve road sign observation.
- OT reassessment after lessons. Feedback from driving instructor is taken into account.
- Pass with or without restrictions, further driver rehabilitation or fail.
STUDY 2 — DRIVER REHABILITATION RESULTS

- 72% (n=246) passed without needing driver rehabilitation
- 28% (n=94) failed and of these, 93% (n=87) resumed driving following driver rehabilitation
- Individuals required, on average, 7.0 driving lessons (14 driving instructor hours) and 2.5 on-road reassessments, (9.8 OT and 3.8 driving instructor hours).
- Although the maximum number of driving lessons provided was 35, ten or less driving lessons were provided in 85.1 % of cases. In 87.2 % of cases, twelve or less OT hours were required, for the reassessments
- 45% (n=42) resumed driving with an open/unconditional licence,
- 48% (n=45) with restricted licence (19 % - area restriction, 34 % – automatic, 17% – adaptive equipment)
- 7% (n=7) failed to meet licensing standards.
## Study 2 Results - Driver Characteristics

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<thead>
<tr>
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<th>Passed – no lessons</th>
<th>Driver rehab group</th>
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<tbody>
<tr>
<td></td>
<td>N=246 (72.4%)</td>
<td>N=94 (27.6%)</td>
</tr>
<tr>
<td>Age at injury (years)</td>
<td>38.65 15.52 17-82</td>
<td>39.50 18.88 18-91</td>
</tr>
<tr>
<td>GCS score</td>
<td>9.55 4.37 3-15</td>
<td>7.69 4.36 3-15</td>
</tr>
<tr>
<td>PTA duration –days</td>
<td>19.52 20.49 .1-140</td>
<td>37.60 28.89 .2-107</td>
</tr>
<tr>
<td>Years Licensed</td>
<td>19.57 15.07 .2-60</td>
<td>18.34 17.32 .3-61</td>
</tr>
<tr>
<td>Gender (Male)</td>
<td>82.9 204</td>
<td>67 63</td>
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</tbody>
</table>

*Note: SD = Standard Deviation, M = Mean, Range = Minimum - Maximum, p = p-value*
## RESULTS – TIMING OF OFF-ROAD & INDEPENDENT DRIVING

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<tr>
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<th>Driver rehab group</th>
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<tbody>
<tr>
<td>N</td>
<td>246</td>
<td>94</td>
</tr>
<tr>
<td>Months from injury to off-road assessment</td>
<td>7.62 7.79 1.54-</td>
<td>18.31 27.37 2.76-</td>
</tr>
<tr>
<td>Months from injury to independent driving</td>
<td>8.21 8.62 1.81-</td>
<td>26.03 36.14 3.84-</td>
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Goals of on-road driver rehabilitation

Goals of lessons were assigned into 5 categories defined by Di Stefano and MacDonald (2006)

1. 64% (n=60) to learn compensatory strategies for cognitive impairment - (reduced planning, concentration, poor navigation skills, distractibility, slower processing, fatigue)

2. 53% (n=50) to improve confidence/reduce anxiety

3. 57% (n=54) improve previously learned skills - remediating poor driving habits, updating road law knowledge, adapting to a new driving environment (eg. rural to urban, cultural differences) or practice for lack of recent driving experience.

4. 26% (n=24) learning compensatory strategies for physical impairment including 17% (n=16) who learnt to use adaptive equipment

5. 16% (n=15) learning to compensate for visual impairment (field loss or reduced binocular vision, following loss of vision in one eye)
STUDY 2 RESULTS

Number of goals recommended:

• Only one goal recorded for 23.4% (n=22) of drivers,
• 2 goals recorded for 42.6% (n=40) of drivers,
• 3 goals recorded for 28.7% (n=27)
• 4 goals recorded 5.3% (n=5)

Significant results:

• Those with greater injury severity were significantly more likely to require lessons to compensate for cognitive impairment than those requiring lessons for other reasons.
• Women were significantly more likely than men to require lessons to improve confidence.
CONCLUSIONS

• On-road driving lessons were an effective rehabilitation intervention for resuming driving after TBI.

• For patients who fail the initial driver assessment, a graded approach, offering on-road driver rehabilitation lessons to address individual goals and use of restricted licences can achieve successful return to driving following TBI.

• Not all individuals with severe TBI will require driver rehabilitation: 16% (n=55) of total sample (n=340), had sustained a very severe TBI (PTA duration > 28 days) but passed the initial on-road assessment without requiring driver rehabilitation.

• Although all of the sample had a TBI, only 64% required driver rehabilitation for cognitive goals therefore 36% required driver rehabilitation for other reasons.
STUDY 3 - DRIVER SAFETY AND BEHAVIOR FOLLOWING ON-ROAD ASSESSMENT

Previous studies found high numbers return to driving but most accurate measure of fitness to drive is the absence of crashes in the longer term, rather than passing on-road Ax.

Objective: To compare pre- and post-injury safety record and driver behavior in drivers with TBI who returned to driving after OT driver assessment and rehabilitation.

Hypothesis: It was hypothesized that:

1. Drivers who did not pass the initial driver assessment and required driver rehabilitation would have sustained a more severe TBI and would be more likely to have modified their driving behaviour.
2. Drivers would report more crashes or near-crashes, and would report more modifications to their driving behaviour relative to pre-injury.
**STUDY 3 - DRIVER SAFETY AND BEHAVIOR FOLLOWING ON-ROAD ASSESSMENT**

- **Participants**: 106 responded to a questionnaire (total sample of 207) Contacted at an average of 4.5 years post-assessment (range of 10 months to 8 years)

- **Method**: Questionnaire included pre and post injury driving frequency, distances driven, employment status, avoidance of driving at night, freeways, with passengers, busy traffic, unfamiliar places and ongoing issues affecting driving, number of crashes, speeding fines and difficulty with navigating.

- Crash rates and changes in driving behaviour were compared between pre and post injury and the pass group and those who required driver rehabilitation
STUDY 3 - DRIVER SAFETY AND BEHAVIOR FOLLOWING ON-ROAD ASSESSMENT

Results:

Hypothesis 1 was supported:

• Drivers who did not pass the initial driver assessment and required driver rehabilitation had sustained a more severe TBI:
  - Rehabilitation group (n=32) was significantly more severe than the Pass group (n=74) with mean PTA duration of 44 days than pass group 18 days
• and were more likely to have modified their driving behaviour
  - Rehabilitation group reported driving less frequently and less distances than the pass group (4 times more likely to be within 5km)
  - More likely to avoid driving with passengers, busy traffic, night and freeway driving than pass group
Study 3 - Driver Safety and Behavior Following On-Road Assessment

Results:

Hypothesis 2 – partially supported:

• **Drivers would report more crashes** relative to pre-injury was not supported
  
  - Drivers did not report more crashes -No significant differences were found between self reported pre- and post-injury crash rates, speeding fines, license suspensions or between the pass and rehabilitation groups.

• **Drivers would report more** near-crashes relative to pre-injury was supported
  
  - 20.0% reported more near-crashes. (15% pass and 28% rehab)

• **Would report more modifications to their driving behaviour**, was supported.
  
  - Significant differences found in changes to driving behaviour compared to pre-injury:
STUDY 3 - DRIVER SAFETY AND BEHAVIOR FOLLOWING ON-ROAD ASSESSMENT

Results – modifications to driving behaviour

- 36.8% of drivers reported limiting driving time
- 40.6% drove more slowly
- 41.5% reported greater difficulty with navigating—remembering and planning routes (50% rehab group, 37% pass group)
- Both groups more likely to avoid night driving and busy traffic post-injury.
- 2 people in rehab group not driving and 1 in pass group.
**STUDY 3 - DRIVER SAFETY AND BEHAVIOR FOLLOWING ON-ROAD ASSESSMENT**

**Results**

- 74% felt that injury related issues continued to affect driving; 
- Fatigue was the most frequently reported issue for both groups.  
- Concentration and memory were next most reported (pass group)  
- Slowness, followed by memory issues (Rehabilitation group)  
- 70.3% of pass group and 40.6% of rehabilitation group engaged in work or study post-injury (Pre-injury: 95%)  
- 25% of respondents considered their driving ability to be worse and 59% about the same as pre-injury  
- 92% felt driving program was helpful:  
  - ‘good to be given formal clearance to drive’  
  - ‘improved confidence’
LIMITATIONS & FUTURE RESEARCH

- Participants were referred on basis of potential to drive and may not be representative of wider TBI population.

- Lack of a comparison group who did not receive on-road driver rehabilitation – considered impractical, not ethical and unsafe.

- Reliance on self-reported crash rates and infringements in a cognitively impaired population may compromise accuracy – DLA records and significant other may improve accuracy.

- Questionnaire response rate was 52% and may not have captured ‘at risk’ drivers or those not wishing to disclose a poor post assessment driving record.

- Changes in self-awareness from pre- to post- driver rehabilitation was not measured and warrants further investigation.

- Learner drivers with a TBI were excluded from the current study, but is an area that requires further research.
SUMMARY

• Overall most individuals with mild to moderate TBI (84% of pass group had PTA <28) resume driving with few issues supports previous research (Brouwer and Withaar 1997).

• Those with shorter PTA duration who have been comprehensively screened to ensure no physical/visual issues, average reaction times and relevant pre-injury driving experience and are at least 3 months post-injury may not require a practical driver assessment.

• Demonstrated that PTA duration is a better predictor of on-road assessment outcome than GCS score but can’t be used alone to determine need for driver assessment.

• Referral guidelines for driver assessment should ensure that injury severity, presence of physical/visual impairment, slower reaction times, anxiety/reduced confidence, previous/recent driving experience are considered.

• For those who fail the initial assessment, a graded approach using driving lessons, reassessments, and use of restricted licences can achieve successful return to driving following TBI.
SUMMARY

• The study demonstrated that a range of factors contribute to failing the initial assessment

• Fitness to drive is often based on the pass/fail outcome of the initial on-road assessment. With this approach 28% of participants in this study may have been excluded from driving, therefore driver rehabilitation, addressing individual goals should be offered to those who fail the initial on-road.

• When reporting pass/fail outcomes, future studies should specify whether driver rehabilitation was offered or results are based on an initial assessment.

• The study has achieved the aims and main objective which was to contribute to current knowledge about resuming driving after TBI, to assist in clinical decision-making and optimize the driver assessment and rehabilitation process for individuals with TBI
ACKNOWLEDGEMENTS

• Professor Jennie Ponsford
• Dr Marilyn Di Stefano
• Dr Judith Charlton
• Dr Gershon Spitz
• RACV - Sir Edmond Herring Scholarship
• Monash Epworth Rehabilitation Research Centre
  Meagan Carty
  PhD students
• Epworth Rehabilitation
  Anne Sutherland
  Lorraine Macmillan
Role of Driving Simulators in OT Driver Rehabilitation
Churchill Fellowship – 2016

To investigate how driving simulators are being used overseas to assess, and retrain older drivers and those with a disability, in order to develop guidelines for their use in Australia and establish training for OT driver assessors in their use.

4 main areas

• On road safety can be improved in older drivers following training sessions on a simulator.

• Simulator training can improve onroad performance following stroke, MS and brain injury and some visual conditions. Useful with anxiety.

• Train drivers with a physical disability to use vehicle modifications – for example, after spinal cord injury, stroke and amputation,

• Train learner drivers who have CP, TBI, Aspergers,, hearing impairment. Currently difficult to assess potential to drive due to complexity of driving a real car.
Churchill Fellowship

Types of simulators used in OT driver Rehab and their suppliers:
StiSim, Doron 400 RA, DriveSafety, Virage Simulation

Attend American OT conference in Chicago
Visit hospitals - talk to clinicians, observe how they are used with a variety of medical conditions, funded, staff training how driver licensing authorities are informed about licence recommendations.

Eca Faros – France

Attend Mobility Road show in UK
Benefits of driving simulators

Provide low stress and safe option for:

• Teaching physically disabled to use vehicle modifications before on-road lessons (e.g., hand controls) following hemiplegia, amputee etc.

• Trial ability to drive a manual car

• De-sensitisation for patients with anxiety or PTSD

• Complexity can be graded for learner drivers with TBI, learning or physical disability, or autism.

• Testing reaction times, ability to learn and benefit from practice
Driving Simulators for OT Screening, Assessment, and Intervention

• Due to potential driving simulator adaptation sickness unfamiliarity and anxiety with technology, and a lack of standardization and validation of outcome, driving simulators should not be the sole determinant of fitness to drive for older adults.

• Occupational therapists using driving simulation need to seek and obtain the appropriate education and training to use this tool effectively, appropriately, and with the knowledge to minimize simulator sickness. (Classen and Brooks 2014)
Churchill Fellowship

Outcomes of trip

• Contribute to medical fitness to drive and OT driver assessor guidelines.

• Consult with driver licensing authorities regarding policy issues for the use of driving simulators in driver rehabilitation.

• Prepare a document outlining the different types, features, costs of simulators.

• Train OTs to use simulators with different client groups.

• Long term vision would be to try to develop centres throughout Australia where drivers with a disability could access driving simulators at low cost.