Cognitive Impairment and Driving:

Evidence-based Decisions Using the DriveABLE™ Assessment

Presentation for GPCME 2012

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What Driving Means

Driving provides mobility.

But, driving is more than mobility.

Being able to drive has become a symbol of competence.

Driving is so important that people mistakenly think of this privilege as a ‘right’.
Loss of Insight – an issue for many
Change of Focus:
Older Drivers
vs.
Medically At-Risk Drivers
Medical Not Age...

“DIDN’T he see where he was going?” An elderly driver lost control of this Peugeot and ploughed into a Jewellers — next to a Specsavers store. THE SUN – UK 24th May 2012
"It is thought the motorist was trying to park when he hit the accelerator instead of the brakes."
Cognitive Impairment is of Special Importance to Driving
Medical Conditions Alter Crash Risk

Increased At-Fault Crash Risk: Selected Medical Conditions

Increased At-Fault Crash Risk: Selected Medical Conditions

Medical Conditions that can Result in Cognitive Impairment

- **Cardiovascular disease** (e.g., acute MI, congestive heart failure, cardiac arrhythmia)
- **Metabolic disease** (e.g., diabetes Type 1 and Type 2, hypothyroidism)
- **Cerebrovascular disease** (e.g., stroke, arteriosclerosis)
- **Renal disease** (chronic renal failure)
- **Neurological disease** (e.g., epilepsy, Parkinson’s Disease, Multiple Sclerosis, tumor, narcolepsy, sleep apnea)
- **Dementia** (e.g., Alzheimer disease, multi-infarct dementia, frontal temporal dementia, Pick’s Disease)
- **Respiratory disease** (e.g., chronic obstructive pulmonary disease, respiratory failure)
- **Traumatic brain injury**
- **Psychiatric illness** (e.g., schizophrenia, depression)
- **Medications** (e.g., anti-depressants, other medications having prominent central nervous system effects)

*From B. Dobbs (2002) NHTSA report*
Driving Errors Recorded During a Driving Evaluation

- Drivers identified by a physician as cognitively impaired
- Patients were licensed and currently driving
  (In someone’s neighborhood)
- Physician concerned about driving safety
- Referred to DriveABLE for a driving evaluation
- Videos recorded during the evaluation
Driver with Dx of Alzheimer’s Disease

Lane change needed for upcoming right-turn

Evaluator takes control to avoid crash
Driver with Dx of probable Alzheimer’s Disease

Fails to observe pedestrian, evaluator takes control to avoid hitting pedestrian
Driver Dx with CVA

Left-turn requested

Evaluator takes control to avoid driving onto sidewalk
Driver Dx with Probable Alzheimer’s Disease

Drifts left out of lane, evaluator avoids head-on crash
Same driver

Drifts left, evaluator takes control to avoid crash
Driver with history of TIAs

Left-turn requested

Wrong-way on the freeway, evaluator takes control
Driving & Dementia

Medical health and well-being is the responsibility of the driver and the health care system

• Medical health includes all aspects of diagnosis, treatment, and rehabilitation
• Medical health is not the responsibility of the licensing authority
• NZTA will intervene, when advised by a concerned GP, by sending a letter advising the patient to have a Medical Driving Assessment or cease driving.

• Accidents when Driving with Dementia - Its not If not but When……..

http://youtu.be/J0d3tijf9-8
Best Practice for Screening
Medically At Risk Drivers
M.A.R.D Protocol
Medically At-Risk Driver Protocol

S.I.M.A.R.D.
Screen for Identifying Medically At-Risk Drivers

D.C.A.T.
DriveABLE Cognitive Assessment Tool

D.O.R.E.
DriveABLE On-Road Evaluation
Consultation - Listening

Does this person have a history of any medical conditions which could effect cognition? Family concerned about her driving?
## Referral Guide

Chronic medical conditions associated with cognitive impairment

<table>
<thead>
<tr>
<th>Stroke (CVA)</th>
<th>Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alzheimer’s Disease</td>
<td>Head Injury</td>
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<tr>
<td>Cognitive Impairment</td>
<td>Respiratory Disease</td>
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<tr>
<td>Cardiovascular Disease</td>
<td>Renal Disease</td>
</tr>
<tr>
<td>Parkinson’s Disease</td>
<td>Multiple Sclerosis</td>
</tr>
<tr>
<td>Medications with CNS Effects</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Psychiatric Illness</td>
<td>Polypharmacy</td>
</tr>
</tbody>
</table>
DriveABLE

S.I.M.A.R.D.
Screen for Identifying Medically At-Risk Drivers

D.C.A.T.
DriveABLE Cognitive Assessment Tool

D.O.R.E.
DriveABLE On-Road Evaluation
S.I.M.A.R.D ~ Screen For Identifying Medically At Risk Drivers

- 5 minute pen & paper screening test
- Quickly identifies need for further evaluation
- Validated against driving performance
- High levels of sensitivity & specificity

To request this tool email anne.molloy@inspire.net.nz or amolloy@driveable.co.nz
### Word List (Immediate Recall)

> "I will now slowly read you a list of 10 words. When I have finished, please repeat as many of these words as possible. The order does not matter."

<p>| | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Apple</td>
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<td>Ticket</td>
<td>Tree</td>
<td>Chair</td>
<td>House</td>
<td>Ship</td>
</tr>
</tbody>
</table>

"Thank you. Now I will read you the same words again. Again, please repeat as many of these words as possible when I have finished."

<p>| | | | | | | | | | |</p>
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</tr>
</tbody>
</table>

### Number Conversion

For this task, turn the page over and say: "As you can see from this example, we can write the number 5 as the word 'five'. This task is like writing out a cheque. Please write the numbers in words."

- 209 = ___
- 4059 = ___

### Supermarket Task

> "Please name as many things as possible that you can buy in a supermarket. You have one minute to do this. Are you ready? ... Please begin."

### Repeat of the Word List (Delayed Recall)

> "At the beginning of this test I read you 10 words. Tell me as many of those words as you can please."

### Scoring Guide

- > 70: High passing probability
- 31-70: Referral for a DriveABLE assessment recommended
- ≤ 30: Low passing probability

### Total Score

(Sum of calculated weighted scores) (Max 130)
DriveABLE

- S.I.M.A.R.D.
  - Screen for Identifying Medically At-Risk Drivers

D.C.A.T.
DriveABLE Cognitive Assessment

- D.O.R.E.
  - DriveABLE On-Road Evaluation
D.C.A.T. DriveABLE Cognitive Assessment Tool

- In-office, computer based, driving specific assessment
- Standardised & evidence based
- Allows for arms length decision making
- High sensitivity & specificity: 95% predictive of on-road performance
- Results are aged normalised & compared to healthy drivers
- Three tiered outcome

“Screening tests are too blunt to be used for licensing purposes on a simple pass / fail basis. A three-level outcome has greater potential to provide more precise validity measures by statistically isolating those who are most difficult to categorise”. (Langford 2008)
Cognitive Assessment Report

Performance Outcome:

Age-normed performance was commensurate with a decline in driving ability.

Summary of Findings:

In-Office Competence Assessment:

Mr. Driver was given sufficient individualized practice on each task to enable a valid assessment and appeared cooperative and effortful during testing.

Assessment Outcome Measures (in Standard Scores)

<table>
<thead>
<tr>
<th></th>
<th>Well Below</th>
<th>Below</th>
<th>Average</th>
<th>Above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Speed/Control</td>
<td>-5.2</td>
<td></td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Span of Attentional Field</td>
<td>*-5.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatial Judgment and Decision Making</td>
<td>*-1.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of Attentional Shifting</td>
<td>*-3.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Executive Function</td>
<td>*-2.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification of Driving Situations</td>
<td>*-10.7</td>
<td></td>
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</tbody>
</table>

Overall Performance: 99% predicted probability of road test failure.

Mr. Driver’s overall performance outcome indicates cognitive abilities have declined and driving performance may be compromised.
DriveABLE

S.I.M.A.R.D.
Screen for Identifying Medically At-Risk Drivers

D.C.A.T.
DriveABLE Cognitive Assessment Tool

D.O.R.E.
DriveABLE On-Road Evaluation
DriveABLE On-Road Evaluation

- Evidence based alternative for evaluating medically at-risk drivers
- Defined driving errors indicating competence declines
- Road course design to reveal competence errors
- Auto Dual-control car used for safety & standardisation
- Use of external criterion with known relationship to driving performance
- Allows unprecedented degree of standardization
### Recommendation:

Driving cessation is strongly recommended.

### Summary of Findings:

#### On-Road Evaluation:

Mr. Driver appeared cooperative and effortful during testing. In the evaluation, simple, explicit directions for each driving maneuver are given. A dual-brake car is always used for safety reasons. The driving performance is compared against normal, healthy drivers who also drove a dual-brake car. Minor handling errors typical of drivers in an unfamiliar vehicle are not a part of the scoring. Only competence defining errors identified by the research are scored.

The weather and road conditions were good.

Traffic conditions were sufficiently challenging to reveal competence-defining errors.

#### Overall Performance:

The significant driving errors made by Mr. Driver are listed on the following page.

Mr. Driver’s driving errors were outside the range of normal healthy drivers and beyond reasonable road safety as defined through the research. The driving errors were of the type and severity demonstrated by the research to be characteristic of medically impaired drivers and are commensurate with driving ability having declined to an unsafe level. Continued driving may place Mr. Driver’s safety and the safety of others at high risk.

Driving cessation is strongly recommended.

The recommendation is based on criteria developed through the scientific comparison of medically impaired and normal, healthy drivers across a broad age range. Those criteria enable normal, healthy drivers of Mr. Driver’s age to receive a passing score.

The DriveABLE™ Road Evaluation has been demonstrated through research to be equally sensitive and fair for both urban and rural drivers.
During the DriveABLE™ Road Evaluation, Mr. Driver made the following significant driving errors. Only competence-defining driving errors defined by the research are listed.

1. Turned from improper lane
2. Turned into improper lane
3. Dangerous left turn creating a hazardous situation; other road users affected
4. Turned from improper lane creating hazardous situation; other road users affected
5. Dangerously changed lanes without adequate observation
6. Drove on wrong side of road for a significant distance; evaluator intervened
7. Straddled lanes on curve or straight roadway

The road evaluation was discontinued as it was unsafe to continue.
Overall performance measures:

- **Fail:** The number, kind, and/or severity of errors made during the on-road evaluation are outside the range of normal, healthy drivers as defined by the research. Errors listed are significant and often hazardous. Continued driving may be high risk and may result in injury to the individual or other road users.

- **Pass with errors toward upper end of normal:** The driving errors made during the on-road evaluation are toward the upper end, but did not exceed, the range for normal healthy drivers. The amount of acceptable risk taking into account the medical profile should be considered. Reassessment in six months time or sooner is strongly recommended if medical status or function changes.

- **Pass:** Performance on the road evaluation was within the range of normal healthy drivers as defined through the research. Driving cessation is not indicated. Reassessment is recommended if the driver’s medical status declines.
The Legal Position for the NZ GP
Reporting to Licensing Authority

- NZ Transport Authority (NZTA) – to be notified of any drivers deemed unsafe to drive, by the GP
- See www.brookersonline.co.nz section 18
- ‘Doctors and Optometrists to provide NZTA with Medical reports of persons unfit to drive.’
- Medical Driving Assessments are provided by specialised occupational therapists, not driving instructors or testers.
Legal obligations for the Medical Practitioner

In New Zealand medical practitioners have two main legal obligations relating to fitness to drive under transport legislation.

The NZ law requires:
• Medical practitioners to advise NZTA (via the Chief Medical Advisor) of any individual who poses a danger to public safety by continuing to drive when advised not to (section 128 of the Land Transport Act 1998 – see section 1.4). Ph: 0800 822 422 – medical section

• Medical practitioners to consider Medical Aspects of Book – “Medical Aspects of Fitness to Drive” is a helpful reference when conducting a medical examination to determine whether an individual is fit to drive. (Provided by NZTA free of charge.) Ph: 0800 822 422
The DriveABLE Assessment Battery
The DriveABLE Assessment Battery

This can be presented verbally or via a short demonstration video of the tasks.
Motor Speed and Control

Driving sometimes requires quick responses to avoid dangerous situations.

This task measures the time to respond to an event that occurs in an unpredictable location. Shifting of attention, response speed, and accurate movements all are involved in good performance.

The patient responds by touching a shape shown on the screen as quickly as possible after it appears.

Measures:
- Reaction time
- Movement time
- Accuracy
Span of Attentional Field

Driving requires attending to the road ahead, responding to events in the periphery.

The second task examines how well the client can notice things that happen off to one side or another while attention is focused straight ahead.

This task engages the patient’s attention straight ahead and measures the ability to respond to visual events that occur in other places.

Measures:

- Accuracy of response to centrally presented word
- Accuracy in identifying peripheral target location
Spatial Judgment and Decision Making

The third task looks at judgement and decision making abilities that are important for making safe right turns or crossing a stream of traffic.

Turns, merges, and crossing a stream of traffic are driving manoeuvres associated with high crash rates.

Complex task requiring speed, gap, acceleration judgments

Measures:
- Time to response
- Accuracy
- Type of hits (‘crashes’)
Speed of Attentional Shifting

Driving requires shifts of attention

The fourth task looks at how quickly the client can shift attention from one thing to another.

Measures:

Time to respond when attention is
• correctly focused
• inappropriately focused
• left unfocused

Disengagement of attention
Executive Function

Driving requires
frequent shifting of mental abilities
up-dating information in memory

The fifth task looks at how well the patient can hold a couple of things in memory while responding to other things.
The task is a Working Memory task emphasizing ‘executive’ control
Measure:
Accuracy on lag tasks
Identification of Driving Situations

Drivers need to identify potential hazards and evasive actions for safe driving.

The last task is a set of short videos of real driving scenes.

The client is asked to make decisions about the driving situation.

The task provides information about the person’s interpretation of driving situations in the context of the speed of traffic flow.

Measure:

Best Outcome selection
External Validation

Accepted in Canadian and US jurisdictions

Evaluation procedure used exclusively by DMV in one jurisdiction, under consideration in 3 more.
Used as science-based criterion for national and international research

Selected by Ontario Neurotrauma Foundation as only Best Practice Driving Evaluation
Identified in American Medical Association’s Physician’s Guidelines as science-based driving evaluation
Also now introduced in Australia and New Zealand
“Both the DriveABLE™ In-Office and DriveABLE™ Road Tests have been developed following a rigorous scientific process based on identifying and measuring key factors which discriminate between impaired and non-impaired drivers. Further, the DriveABLE™ In-Office Test has been shown to be strongly predictive of performance on the DriveABLE™ Road Test, enabling it to perform the valuable function of substituting for an actual on-road test...”

Research Validated Appropriateness for Wide Range of Cognitively Impairing Medical Conditions
# Primary diagnoses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Diagnosis Given</td>
<td>5</td>
<td>.3</td>
<td>.3</td>
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<tr>
<td>Cognitive impairment/memory problems</td>
<td>508</td>
<td>32.6</td>
<td>33.0</td>
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<tr>
<td>Alzheimers</td>
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<td>Vascular dementia</td>
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<td>Frontal temporal dementia</td>
<td>22</td>
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<tr>
<td>Mixed dementia</td>
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<td>.8</td>
<td>46.8</td>
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<td>174</td>
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<td>MI</td>
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<td>Movement Disorders</td>
<td>56</td>
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<td>Visual problem</td>
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<tr>
<td>Total</td>
<td>1556</td>
<td>100.0</td>
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</tr>
</tbody>
</table>
P/F for Dementia and CI vs. Other Diagnoses

N=1556
SUMMARY:

Look for the ‘Red Flags’ then

• 1. Screen – SIMARD MD

• 2. Refer for an OT Medical Driving Assessment – DriveABLE is accepted as Best Practice Internationally.

• 3. If there are concerns regarding patient compliance - inform NZTA
DriveABLE NZ
Auckland Medical Driving Assessments

Anne Molloy OT Consultancy
Referrals welcome from anywhere in NZ

Medical & Cognitive Driving Assessment

- Referrals or Contact details: Anne Molloy NZROT
- Ph: 09 846 0046    Fax: 09 8460048
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