Older Adult Keynote Address:
From diagnosis to rehabilitation:
trying to develop care pathways in neuropsychology

Professor Glyn Humphreys, University of Oxford
(Convened by Dr Rebecca Poz)
New developments in cognitive screening

Glyn Humphreys

(glyn.humphreys@psy.ox.ac.uk)
- Write down 3 important cognitive problems after stroke

- What things are important to detect?
## OCS Impairment incidences

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>Tasks</th>
<th>Impaired (%)</th>
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Why is this important?

There is evidence that **neuropsychological factors** are **more important determinants of functional outcomes** after stroke than physical disability.

Post stroke cognitive problems are predictive of depression
Studies have typically used either:

- Quick but general (non-specific) measures of cognitive function:
  - MMSE (Lawrence et al., 2001)
  - Clock drawing (Friedman, 1991)
- Time consuming measures of single cognitive functions:
  - Language (PALPA)
  - Neglect (BIT, Balloons)
  - Executive functions (BADS, TEA)
  - Memory (Rivermead, Doors and People)
- Short screens are easy to deliver but relatively uninformative

- More detailed tests give more information but often impractical
Some attempts to find a half-way house:

- MOCA (Montreal Cognitive Assessment)
- ACE-III (Addenbrooke’s Cognitive Examination)
MONTREAL COGNITIVE ASSESSMENT (MOCA)
Version 7.1 Original Version

VISUOSPATIAL / EXECUTIVE

Copy cube

Draw CLOCK (Ten past eleven) (3 points)

END

Begin

NAME:
Education:
Sex:
Date of birth:
DATE:

POINTS

NAMING

Contour
Numbers
Hands

MEMORY
Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

FACE VELVET CHURCH DAISY RED

1st trial

2nd trial

No points
**ATTENTION**
Read list of digits (1 digit/sec.). Subject has to repeat them in the forward order [ ] 2 1 8 5 4
Subject has to repeat them in the backward order [ ] 7 4 2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65
4 or 5 correct subtractions: 3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt

**LANGUAGE**
Repeat: I only know that John is the one to help today. [ ]
The cat always hid under the couch when dogs were in the room. [ ]

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words)

**ABSTRACTION**
Similarity between e.g. banana - orange = fruit [ ] train - bicycle [ ] watch - ruler

**DELAYED RECALL**
Has to recall words with no cue

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</table>

Points for uncued recall only

Optional
Category cue
Multiple choice cue

**ORIENTATION**
[ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City

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www.mocatest.org

Normal ≥ 26 / 30
Total

Add 1 point if ≤ 12 yr edu
- Write down 2 things that are good about the MOCA as applied to stroke
- Write down 2 things that are not so good
These tests were developed to assess dementia.

They are language-laden, not designed for stroke patients (with high prevalence of aphasia, neglect). There is no assessment of neglect, limb praxis or everyday action.
MOCA is almost
totally
LANGUAGE
dependent

Also affected by
neglect
The test provides an overall score. What does this **mean**?

Tests not designed to **separate** cognitive processes (executive function, verbal memory, language processing).

How does the score feed in to rehabilitation?
- Need for a screen that is ‘broad but shallow’
- That covers a range of cognitive ‘domains’ AND that can be delivered efficiently, incl. at the bedside (time efficient test design)
- That is aphasia and neglect friendly – to maximise inclusion
- Test family – cognitive screens covering 5 ‘domains’ of cognition
  - attention and executive function
  - language
  - memory
  - numerical skills
  - praxis (action)

- BCoS full - delivered within 1 hour, at sub-acute stages of the incident - gives relatively detailed breakdown of cognitive function and provides pointers to rehabilitation

- BCoS 2 allows an in-depth assessment of the 5 cognitive domains

- OCS – delivered in 15/20 mins aimed at giving a brief snapshot, targeted at stroke

- OCS-d – delivered in 15/20 mins for dementia
Test philosophy:

- use short high frequency words
- use vertical layouts and multi-modal presentations
- design tests to incorporate several measures (to maximise time efficiency)
- use tests that are sensitive (will detect a problem if one is present) and indicate general domain deficits (e.g., problem in naming, but not exact problem)
- The measures provide a cognitive profile for an individual patient
- Web-based data entry to generate a normed profile
- Plus a visual snapshot of the patient’s profile for entry into case notes and use in case management
Stroke sensitive

Aphasia Friendly

Neglect Friendly
STROKE SENSITIVE APRAXIA
### STROKE SENSITIVE APRAXIA

<table>
<thead>
<tr>
<th>Hand sequences:</th>
<th>Finger positions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st presentation</td>
<td>1st presentation</td>
</tr>
<tr>
<td>2nd presentation</td>
<td>2nd presentation</td>
</tr>
<tr>
<td>□</td>
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- 1st presentation
- 2nd presentation
- □
- □
- /3
Aphasia friendly
Instruction Comprehension / semantics
<table>
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<tr>
<th>Question</th>
<th>Options</th>
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<tr>
<td>Which picture did you see before?</td>
<td>Beaver</td>
</tr>
<tr>
<td></td>
<td>Carrot</td>
</tr>
<tr>
<td></td>
<td>Broccoli</td>
</tr>
<tr>
<td>What did you cross out?</td>
<td>Heart</td>
</tr>
<tr>
<td></td>
<td>Star</td>
</tr>
<tr>
<td></td>
<td>Plus</td>
</tr>
<tr>
<td></td>
<td>Smiley</td>
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Tests measure multiple factors
Reading / writing (not in MOCA)

Have any of the islands got a quay, thought the colonel sitting on his yacht.

Please write the following numbers: 708 15,200 400
• Measures executive functions using timed measures and baseline conditions to extract effects of slow motor speed and neglect
ATTENTION
Controlled / Executive

1. Connect circles – largest to smallest (max 30seconds) (practice first) /6
2. Connect triangles – largest to smallest (max 30seconds) (practice first) /6
3. Alternate triangles to circles – largest to smallest (time) (practice first) /13

Executive score = (circles + triangles) – mixed score

Final score reflects the relative cognitive load
Measurement of *relative* performance speed provides a highly sensitive measure of the *added* effect of cognitive load on processing speed.

Antoniades et al. (2014) – only executive task sensitive to difference between non-medicated early PD patients and controls.
INCLUSIVE

Neglect Friendly:
INCLUSIVE

Aphasia Friendly:
- All tests validated against other standard tests in the literature
- All tests with 100+ norms at different age and education levels
How does the OCS perform against the MOCA?

OCS vs. MOCA

data from 150 patients
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- LANGUAGE AND MEMORY: 12% of patients had sufficiently severe expressive aphasia to preclude testing on the MOCA. Only 2% of patients were unable to respond to the multiple choice questions in the OCS (receptive aphasia).

- OCS – more inclusive

- OCS less contaminated
74% failure

61% failure
MOCA Score /30

‘normal’

>26/30
OCS more sensitive to the cognitive problems after stroke
OCS less contaminated by co-occurring cognitive problems
OCS better able to provide rehabilitation-related information
Full BCoS
Attention
Controlled attention: auditory

Auditory attention test [words presented at uneven times on MP3 player, respond to goodbye, please, no but not to hello, yes and thanks across 3 trial blocks]

measures:

- selective attention/response inhibition
- sustained attention (across blocks)
- working memory (learning & recall of words)
Controlled attention: rule finding and switching
Gains measures of: **rule finding** (how many rules are found)
and **set shifting**
across dimensions (rows to colour)

**within** dimensions (colour 1 to colour 2)
Patient is given parts of a torch plus distractor objects – task is to assemble the torch and to show how to use it

Provides a measure of *perseveration* along with implementation of individual actions and action sequence
BCoS

- Data on ~950 patients within 3 months (& depression/anxiety, apathy, ADL)
- ~600 at follow-up (9 months)
- Analysed CT scans on ~600
- All tests validated against other standard tests designed to assess similar abilities, test-retest reliability
- All tests normed (100+ control)
- At least 1 impairment present in 79% of cases (50%+ of patients in some tests)

- No overall difference in impairment (e.g., number of failed tests) for right and left hemisphere cases
Profile by hemisphere

Different areas

**Left lesion group**
- Verbal memory– encoding
- Working memory
- Picture naming
- Writing
- Nonword reading
- Language based

**Right lesion group**
- Cancellation
- Left tactile extinction
- Left visual extinction
- Orientation- time and space
- Sentence construction
- Spatial, memory

Common areas

- Selective attention
- Rule finding and switching
- Sentence reading
- Gesture imitation
- Figure copy
## Functional correlates

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<th>Outcome measure at 9 months</th>
<th>NEADL²</th>
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<tr>
<td>N=362</td>
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<td>0.45</td>
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<td>2.34</td>
<td>0.98</td>
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- Role of co-occurring deficits?

- Predicting NEADL from Apple cancellation
  - apple alone (16% variance)
  - apple & WM (28% variance)
  - apple & Bham rule/executive function (30% variance)

Co-occurring deficits are important for predicting outcome
In sum, the BCoS provides a useful overview of cognitive abilities that predicts outcome.

- It is inclusive.
- It provides measures of attentional & executive deficits & their co-occurrence with other impairments.
- It can be scored remotely and used in clinical case management.
- It is also useful scientifically – e.g., extraction of incidental deficits, lesion analyses.
Tablet version

Considerable advantages
High sensitivity
Standardised administration
Automated scoring
Automated recording
Extra data for free
Patient with systematic performance
Patient with non-systematic performance
Systematicity captured in a simple nearest-neighbour scoring scheme
Correlates with scorers’ measures of systematicity
Correlates also with measures of executive function

R = .517
P = .002
N = 29
- Tea/coffee break!!!!

http://www.isis-innovation.com/outcomes/cns/ocs.html

http://www.cognitionmatters.org.uk/