

Impact case study (REF3b)

Institution:	University of Birmingham
Unit of Assessment:	Psychology, Psychiatry and Neuroscience
Title of case study: 4: University of Birmingham Cognitive Screen for early identification of cognitive care pathways following stroke and other brain Injuries	
1. Summary of the impact (indicative maximum 100 words)	
<p>Stroke is the leading cause of disability in Europe. There are around 1.2 million stroke survivors in the UK. More than half have been left with disabilities that affect their daily life. The annual cost of stroke to the UK economy was £8.9 billion. Clinical response to stroke has often focused on resulting physical disabilities, but cognitive disability can be an equally substantial source of difficulty for patients and their carers. Sensitive and reliable assessment of cognitive disability following stroke is essential for identifying these needs in patients, and early assessment is a major benefit because problems soon after stroke are a strong prognostic indicator of future problems, and appropriate rehabilitation is most effective when started early. Founded on longstanding expertise in neuropsychological studies, the University of Birmingham group has developed a comprehensive stroke-specific screening tool (the BCoS), which enables early and efficient detection of cognitive impairment after a stroke for a wider range of patients than is possible with existing methods. Through this development and its associated training programme, the BCoS is changing the way stroke survivors are assessed in the UK and internationally and it is influencing practice in other areas, such as traumatic brain injury.</p>	
2. Underpinning research (indicative maximum 500 words)	
<p>The underpinning research was carried out from 1999 to 2011 at the University of Birmingham by a team of researchers under the leadership of Prof. Glyn Humphreys (UoB 1989-2011), and management of Dr Wai-Ling Bickerton (research fellow, UoB from 2002 onwards), who continues the Birmingham arm of this work. The group is internationally recognised for its pure-basic research on the effects of stroke on many aspects of cognitive function, as well as clinical assessment and rehabilitation. The Birmingham Cognitive Screen (BCoS)[1] was developed by the team to bring such knowledge together in a comprehensive clinical screen designed for use by health practitioners.</p> <p>The research and clinical experience of the team lead to a number of principles being incorporated into the BCoS. It was designed be efficient in detecting more diverse areas of cognitive deficits than existing tests, covering five domains (attention and executive function, language, memory, number processing, action planning and control)[2-6]. The tests were designed to avoid unnecessary language and spatial attention demands found in other cognitive assessments, enabling early and inclusive assessment of stroke survivors. And they were designed to be quick enough to administer that they could be used in normal clinical practice. The efforts make possible the earliest and most comprehensive and inclusive cognitive assessment for survivors of stroke. As a result, the research and clinical team can target rehabilitation more effectively.</p> <p>In 2006, the Stroke Association funded a 5-year research trial with BCoS to identify cognitive deficit profiles early on after a stroke and their ability to predict later function. Subsequently this was developed into a multi-centred Stroke Research Network portfolio study. The research implemented the BCoS assessment for over 900 stroke survivors from 14 hospital units in the West Midlands region. The tool was published by Psychology Press in April 2012[6].</p> <p>This program of work is continuing through further multi-centre projects. BCoS-Lite: A current trial on developing and validating a shorter version of the BCoS (BCoS-lite) for the more acute (within 6 weeks) assessment, the project also involves trialling of an associated rehabilitation intervention to</p>	

improve cognitive and everyday functioning as indicated by the BCoS assessment (funded by the National Institute of Health Research). BCoS-Care: A Stroke Association funded 3-year's project to develop and evaluate care pathway embedding BCoS assessment process in stroke teams. FACE-TIA: A national controlled cohort study of functional, cognitive and emotional outcomes after Transient Ischemic Attack, led by Prof Cath Sackley, University of Birmingham. CogWatch: a 3.6M euro FP7-ICT collaborative project to exploit intelligent tools and objects, portable and wearable devices as well as ambient systems to provide personalised cognitive rehabilitation at home for stroke patients with signs of apraxia and action disorganisation syndrome, coordinated by Prof Alan Wing, University of Birmingham. www.cogwatch.eu

3. References to the research (indicative maximum of six references)

1. Humphreys, G.W., Bickerton, W-L., Samson, D., & Riddoch, M.J. (2012) BCoS Cognitive Screen, Psychology Press: London.
2. Bickerton W-L., Samson D, Williamson J, Humphreys, G.W. (2011) Separating forms of neglect using the Apples Test: Validation and functional prediction in chronic and acute stroke. *Neuropsychology*, 25: 567-580. DOI 10.1037/a0023501
3. Bickerton W-L, Riddoch MJ, Samson D, Balani AB, Mistry B, Humphreys GW (2012) Systematic assessment of apraxia and functional predictions from the Birmingham Cognitive Screen (BCoS). *Journal of Neurology, Neurosurgery and Psychiatry*, 83(5):513-21. doi: 10.1136/jnnp-2011-300968
4. Chechlacz M, Terry A, Rotshtein P, Bickerton W-L, & Humphreys GW (2012). Common and distinct neural mechanisms of visual and tactile extinction: A large scale VBM study in sub-acute stroke. *Seeing and Perceiving*, 25(s1), 17–17. DOI: 10.1163/187847612X646398
5. Humphreys, G.W., Forde, E.M.E., Steer, E., Samson, D. & Connolly, C. (2006). Executive functions in name retrieval: Evidence from neuropsychology. In A.S. Meyer, L.R. Wheeldon & A. Krott, *Automaticity and Control in Language Processing* (pp. 143-159). Hove: Psychology Press.
6. Demeyere N, Lestou V & Humphreys GW (2010) Neuropsychological evidence for a dissociation in counting and subitization. *Neurocase*, 16:219-237 <http://www.tandfonline.com/doi/pdf/10.1080/13554790903405719>

Research and knowledge transfer grant funding

2012-2014 Birmingham Guangzhou Brain and Cognition Centre (UK Lead applicant: G.W. Humphreys, Co-applicants: WL Bickerton, MJ Riddoch) £200,000

2011-2014 Stroke Association Research Project Grant (Lead applicant: GW Humphreys, Co-applicants: WL Bickerton, S Jowett, MJ Riddoch, A Williams) £200,000

2011-2012 NIHR Programme Development Grant (Lead applicant: GW Humphreys, co-applicants: WL Bickerton et al.) £100,000

2009-2011 FSF and CLRN funding £100,000

2006-2011 Research Fellowship funded by the Stroke Association Programme Grant (Lead applicant: GW Humphreys, Co-applicants: MJ Riddoch, D Samson) £250,000

4. Details of the impact (indicative maximum 750 words)

Broader coverage, greater sensitivity and improved ease of use.

The BCoS was developed as a stroke-specific cognitive screen that can be used soon after stroke. It is more comprehensive in its range of assessment than those used in current clinical practice, it is able to assess a wider range of patients, who would otherwise be untestable because of their difficulties with language and attention, and it does not require a clinical neuropsychologist (a highly specialised expert) for its administration.

“The BCoS provides a comprehensive screen, which looks at all areas of cognitive function. This has meant that we now only do one routine screen instead of a number of smaller ones that cover smaller areas of cognitive function. The Screen is as aphasic and neglect friendly as possible, an issue which many of the other assessments routinely used with stroke patients don't adequately address.” [1].

Previous cognitive assessments for stroke suffered from two types of problem. Stroke-specific

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assessments tend to be lengthy to administer and narrowly focussed on one particular difficulty, such as language. Such assessments are typically used for detailed assessment once an area of difficulty has already been identified. In contrast, primary screening for the presence of a wide range of cognitive difficulties requires a test that can be administered more quickly and covers more potential difficulties. Prior to the BCoS these general assessments of stroke patients were often conducted using measures primarily designed for use with other disorders, such as dementia (e.g. MMSE, MoCA, and ACE-R). This is critically limiting, because strokes may lead to difficulties not observed in dementia, such as apraxia or spatial neglect. Moreover, dementia assessments often make moderate demands on attention and language. Impairments to attention and language are common after stroke, meaning that stroke patients cannot be appropriately tested with these assessments, and consequently their other difficulties may go unnoticed. To illustrate the improvements made possible by BCoS, in the BCoS trial, 62% of the patients had language deficits and 58% of the participants demonstrated spatial neglect. These patients would struggle to take part in the conventional cognitive screen tasks where reliable responses depend upon patients' language and visual attention abilities. Because of its aphasia- and neglect-friendly assessments, BCoS enabled 45% and 61% of the above patients to complete all 22 of the BCoS tasks, giving a full cognitive profile for large numbers of patients who would otherwise not be tested.

The BCoS is both broader and more detailed than the above general screens, which is clinically important for analyses of deficits and treatment. Importantly, it is also more time-efficient than the expensive and lengthy single domain stroke-specific test batteries (e.g. WMS, PALPA) and more informative than any single one of these, due to its multiple-domain coverage. This enables a larger proportion of patients to be assessed and directed for further, more detailed, investigation and ultimately rehabilitation. Critically, whereas such tasks require administration by a specialist neuropsychologist, the BCoS can be administered by clinical ward staff after a short training course, allowing it to be adopted much more widely into clinical practice. The clinical benefits of this research have been recognised by the National Stroke Research Network [e.g. 2]; patients [e.g. 3] and health professionals [e.g. 4].

Training, and uptake of the BCoS screen by clinical and research community in the UK

The initial testing of the BCoS screen involved recruitment of stroke hospitals in the West Midlands area, and their associated services in acute, rehabilitation and community care. The project team trained over 100 health professionals and researchers throughout this region, which serves 125,452 stroke survivors, and sees 11,600 new incidences every year. Nine hundred stroke survivors were screened in the initial 2011 study, and since then all therapists involved in the research sites have continued to use BCoS as their screening tool. Since the launch of the BCoS in Nov 2011, the team have conducted 7 training days for a further 120 health professionals and academics from UK and abroad. Though these events the team has trained and equipped 62 clinical specialist psychologists and occupational therapists from UK and abroad (Ireland, Greece to Australia). On-going research projects (see section 2) are leading to the recruitment of further hospitals and associated services in Thames, Bristol and Yorkshire regions.

The development of this work and the launch of the BCoS has attracted widespread interest from practitioners. For example, the research team was invited to give a presentation to the NHS Stroke Improvement Programme national event 10th Nov 2011 "Improving the provision of psychological care after stroke; making a difference in your service" on "Cognitive screening and developing the cognitive care pathway". The research team are working to meet the new needs for training arising from this interest.

In June 2012, the Anglia region Stroke and Heart Network (covers 93,385 stroke survivors, 9,700 incidences occur every year) supported 8 stroke specialists to attend BCoS training, and during 2013 the BCoS team has trained 33 staff from the Hertfordshire regional stroke care network, for their adoption of BCoS across their care pathway. Other stroke services within and outside of UK are equipped with the assessment tool and techniques through purchase of the screen (84 copies sold worldwide, typically one screen is shared within a team of professionals) and attending the training through Cognition Matters (see below).

The BCoS has been very positively received by practitioners:

"The true strength of this assessment is that staff can see that the investment of the time to carry it out allows for clearer communication with the patient and the team and improves treatment"

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planning. Using the same assessment tool across our pathway means that staff has improved communication about patients and saves time when moving patients across transition points in the pathway. Feedback from patients is also positive.” [5].

To cope with the growing demand for training, the team has established a **social enterprise**: Cognition Matters (www.cognitionmatters.org.uk). This is a service initiative set up by the University of Birmingham to allow recovery of costs from sale of the BCoS and training, which ensures that our program of training and development is sustainable for the future. The work has won several enterprise/social enterprise awards in recognition of the importance and potential impact of the project [6].

International uptake, training and translation.

In 2012 the Brain and Cognition Centre in Guangzhou (third city of China) was launched with £200K funding investment from the Municipal Government and £200K matched funding from the Municipal Hospital. As part of this initiative the test has been **translated** into 3 Chinese languages (Taiwanese Mandarin, Mainland Putonghua, and Cantonese version). The UoB research team have delivered BCoS training to 20 neurologists in the GZ First Municipal People’s Hospital, and are continuing this support with fortnightly Skype meetings. This project will seek to validate and subsequently implement BCoS in their stroke care services. In this short time, the Chinese BCoS has been used to assess 200 individuals attending the hospital and its associated health clinics. It is expected that this collaboration will enable broader dissemination of the Chinese BCoS to the Mainland. A parallel project has been launched with Hong Kong University Department of Communication Sciences. Since 2012 the team has received requests to approve translation into Hindi Urdu, Spanish, Greek, French and Korean, suggesting that international uptake will continue to expand.

Influence on clinical practice for other causes of brain injury.

The impact of the BCoS is extended by its recent adaption for assessment of patients with Traumatic Brain Injury. The BCoS-TBI has been developed in conjunction with the head trauma specialists at the Queen Elizabeth Hospital Birmingham and extends the BCoS project with measures sensitive to the sequelae of traumatic brain injury (e.g., speed of information processing and executive dysfunction). In becoming one of the country’s 22 major trauma centres delivering specialist care to military and civilian’s traumatic brain injury, the Queen Elizabeth Hospital Birmingham is currently evaluating the BCoS-TBI as the first line routine cognitive screen for all patients receiving trauma services. In the last 18 months the BCoS-TBI has also been incorporated into the Commissioning for Quality and Innovation (CQUIN) initiative for the neurosurgery service at the Queen Elizabeth Hospital Birmingham.

5. Sources to corroborate the impact (indicative maximum of 10 references)

- 1) From a letter of endorsement from a Clinical specialist, Occupational Therapist Stroke Services, Wolverhampton NHS trust.
- 2) Interviewed by NIHR Clinical Research Network Newsletter, May 2010
http://www.crnc.nihr.ac.uk/Resources/NIHR%20CRN%20CC/Documents/NFTNW_Issue1_2010.pdf
- 3) Interview featured in “My Research Journey”, a UK Stroke Research Network National Podcast for the World Stroke Day, Nov 2011.
http://www.crnc.nihr.ac.uk/news/news_archive/news2011/myresearchjourney_insight
- 4) Bisiker J and Bickerton W-L (2013) Using a comprehensive and standardised cognitive screen (BCoS) to guide cognitive rehabilitation in stroke. *British Journal of Occupational Therapy*, 76(3): 151-156
- 5) From a letter of endorsement from Consultant Clinical Psychologist, Hertfordshire Neurological Services, 25/09/13.
- 6) The team has received external recognition for the social enterprise idea in translating the research innovation to commercial and social benefits evidenced by winning the following awards given or judged by external bodies to the University: 2011 Winner of the Enterprising Birmingham Business Showcase; 2010 Social Enterprise Catalyst Award, HEFCE and UnLtd; 2009 Winner of the Big Idea Competition, University of Birmingham