Institution: Newcastle University

Unit of Assessment: UoA2

Title of case study: Re-organisation of ambulance services and increased public awareness of stroke symptoms through the Act FAST campaign have improved outcomes for stroke.

1. Summary of the impact

Stroke is a major health burden to patients, carers and the NHS, with UK costs estimated at £15.5bn annually. Clot-busting agents (thrombolytics) can substantially improve the consequences of ischaemic stroke, but only if administered rapidly. Newcastle research that recognised the importance of rapid referral to a stroke unit allowed reconfiguration of ambulance services for direct transport of victims to a specialised centre. Newcastle work also validated a test developed for paramedics to recognise the signs of stroke, which was developed as the nationwide Face-Arms-Speech-Time (Act FAST) campaign. Use of thrombolytics has increased eightfold between 2005 and 2012, and there has been a considerable increase in public awareness of FAST.

2. Underpinning research

Newcastle researchers

Professor Gary Ford CBE acted as Principal Investigator across all underpinning studies, and was the only member of Newcastle academic staff involved in the research. He left Newcastle University in October 2013.

The challenge of stroke and rapid diagnosis

In the UK alone, over 150,000 people have a stroke annually and 1.1 million people, of all ages, live with stroke (EV a). The annual costs of stroke, which include health and informal care costs and loss of productivity, are estimated to be up to £15.5bn billion. Treatment exists for ischaemic stroke in the form of clot-busting drugs, called thrombolytics, but these are only effective if administered rapidly: each hour over 714km of nerve fibre are lost. Translated into an example of functional loss, every 10-minute delay results in a further 12 out of every 1000 patients having impaired walking ability at discharge, demonstrating the importance of rapid diagnosis and transfer to a specialist centre (Saver *et al.* 2013, DOI: 10.1001/jama.2013.6959). Thrombolytics are most effective if administered within three hours (EV d), and beyond 4.5 hours the chances that the treatment will help or harm the patients are approximately equal. This highlights the importance of rapid diagnosis and transport to a specialised unit.

A National Audit Office report from 2005 ("*Reducing Brain Damage: Faster access to better stroke care*") stated that the rate of thrombolytic treatment in England was below 1%, because of two major contributing factors: firstly, "*the lack of public awareness of the fact that stroke is a medical emergency, and that appropriate treatment within the first few hours can make the difference between recovery and serious disability"* and secondly "*Ambulance Trusts, Accident and Emergency departments, Radiology departments and specialist stroke teams do not routinely provide an effective, integrated emergency response to stroke that includes rapid triage and access to scanning"*.

Newcastle research addressed these two challenges by: 1) recognising that paramedics could diagnose stroke with a high degree of accuracy; 2) testing the theory that re-organising ambulance services would allow more rapid admission of a patient directly to a stroke unit; and 3) developing a protocol to increase public awareness of stroke as a medical emergency.

Re-organisation of stroke services

Until 1997, suspected stroke patients admitted to the Newcastle Hospitals NHS Foundation Trust were first taken by ambulance to one of two Emergency Departments before onward referral to the specialist acute stroke unit. To improve the speed of access of acute-stroke patients to a dedicated acute stroke unit, a protocol was established in Newcastle in 1997 and assessed after 15 months (R1). The protocol required paramedics to assess patients using the Face-Arm-Speech-Time (FAST) test (see below), with its outcome determining whether patients were admitted directly by

the acute stroke unit, rather than by the Emergency Departments. During this time, 123 patients were admitted to the acute stroke unit. Admissions increased during the first year from an average of three to 13 patients per month, with diagnostic accuracy above 80%, showing that re-organisation of the service allowed acute-stroke patients to be directed appropriately and thus have a greater chance of rapid treatment.

Improving paramedic and public recognition of stroke

Research carried out by Professor Gary Ford CBE at Newcastle tested the hypothesis that paramedics could recognise acute stroke using a simple, quick protocol (R1, 2), and direct the patient to the appropriate unit for prompt action. This protocol, named FAST for "Face Arm Speech Time" (or sometimes "Test"), was developed from the Cincinnati Prehospital Stroke Scale (CPSS). The FAST test contains three elements of the CPSS which were modified to use assessment of spontaneous speech rather than repetition of a sentence. This allows the test to be performed more quickly, reducing assessment time and enabling a positively-identified stroke patient to be transferred to a stroke unit without delay. The FAST test was also developed to complement existing assessments that paramedics were familiar with such as conscious level. Newcastle research found that paramedics correctly diagnosed stroke in 79% of patients using FAST (R2), and that there was good agreement between paramedic identification of stroke and later confirmation by a specialist (R3).

3. References to the research

(Newcastle researchers in bold type, citation counts from Scopus, July 2013)

R1. Harbison J, Massey A, Barnett L, Hodge D, **Ford GA**. Rapid ambulance protocol for acute stroke. *Lancet*. 1999;353:1935. DOI: 10.1016/S0140-6736(99)00966-6. **Cited by 46**

R2. Harbison J, Hossain O, Jenkinson D, Davis J, Louw SJ, **Ford GA**. Diagnostic accuracy of stroke referrals from primary care, emergency room physicians, and ambulance staff using the face arm speech test. *Stroke*. 2003;34:71-76. DOI: 10.1161/01.STR.0000044170.46643.5E. **Cited by 124**

R3. Nor AM, McAllister C, Louw SJ, Dyker AG, Davis M, Jenkinson D, **Ford GA**. Agreement between ambulance paramedic- and physician-recorded neurological signs with face arm speech test (FAST) in acute stroke patients. *Stroke*. 2004;35:1355-1359. DOI: 10.1161/01.STR.0000128529.63156.c5. **Cited by 57**

Relevant funding awards, by funder

- 2001-2003 *Acute Stroke Admissions - Referral Patterns, Diagnostic Accuracy and Development of Stroke Recognition Instruments for Accident*. The Stroke Association £90,902.

4. Details of the impact

Adoption of FAST into national guidelines

In July 2008, FAST was included in NICE clinical guideline 68: "*In people with sudden onset of neurological symptoms a validated tool, such as FAST (Face Arm Speech Test* [sic]*), should be used outside hospital to screen for a diagnosis of stroke or TIA* [transient ischemic attack: a mini-stroke]" (EV b, pg. 8).

The 2012 National Clinical Guideline for stroke (EV c) addresses both of the major barriers to rapid stroke care, recommending first that "*All patients seen with an acute neurological syndrome suspected to be a stroke should be transferred directly to a specialised hyperacute stroke unit*". Secondly, R2 is included as the sole source of evidence for the recommendation that *"People seen by ambulance staff outside hospital, who have sudden onset of neurological symptoms, should be screened using a validated tool (eg FAST) to diagnose stroke*." The guideline also states that "*The FAST is accepted as the tool of choice for prehospital clinicians*."

The effect of Newcastle work of re-organisation of stroke services

As a direct result of Newcastle research that demonstrated the effectiveness of sending acute-stroke patients directly to a dedicated unit, stroke services in two cites were reconfigured. In December 2008, a new model was implemented to deliver acute stroke services in the Greater Manchester region, which led to a substantial increase in thrombolysis treatments given: from 10 eligible patients in 2006, 12 in 2007, to 20 in 2008 and 69 in 2009 (EV e, pg. 19). Between 2009 and 2010 a new model was introduced in London that included eight hyper-acute stroke units (HASUs) and in February 2010 stroke care in North Central London was merged into one HASU to deliver a single standard of care. According to latest available figures, thrombolysis rates increased in North Central London from 3.5% in February 2009 to 12% by October 2010, and mortality rate decreased from above 30% in 2006 to below 10% in 2011 (EV d, pg. 7). Administration of thrombolytics within 4.5 hours has been found to be significantly associated with a favourable outcome, in terms of measures of disability such as the modified Rankin scale and functional scales such as the Glasgow Outcome Scale (Hacke *et al.* 2008, DOI 10.1056/NEJMoa0804656). However, this same study found no significant difference in mortality rate between the group treated with thrombolytics and placebo, a plausible explanation being that the decrease in mortality rate seen in North Central London was due to more rapid transport to hospital.

This reconfiguration of stroke care led to NHS London and the Greater Manchester and Cheshire Cardiac and Stroke Network winning the 2009 and 2010 Health Service Journal (HSJ) award for Clinical Service Redesign, respectively (EV d, e).

Adoption of FAST as a national campaign

The effectiveness of FAST in paramedic use led to its adoption as a public recognition instrument. The first body to make use of the validated FAST test was the Stroke Association, who state on their website that "*Professor Gary Ford's team at Newcastle University showed that ambulance paramedics can use the Face Arm Speech Time (FAST) test to recognise when someone is having a stroke. The study, funded by The Stroke Association, found that paramedics using the FAST test could identify a stroke just as accurately as specially trained doctors*." (EV f).

Poster from the Department of Health's national FAST campaign, launched in 2009 (EV g)

The work went on to inform the Department of Health's nationwide Act FAST campaign, to help members of the public recognise the signs of stroke and to act quickly to ensure that thrombolytics are administered within the short window of opportunity. This campaign, originally launched in February 2009, has seen several waves of activity, the latest in March 2013. The memorable imagery includes the use of a "flaming head" and has appeared on national TV, posters and bus stops (EV g). The Director of Research and Information at the Stroke Association states: "*I write to confirm that the work you did in assessing the reliability of using FAST by paramedics was key to the Stroke Association's decision to use FAST in our bus stop campaign and then in the Department of Health using it in the flaming head campaign*." (EV h).

A National Audit Office report from February 2010 (EV i, pg 22-23) stated that the Act FAST campaign had been seen by 92% of the 2000 people that responded to a survey on its use. The same survey found that from before to after the campaign, public awareness of the symptoms of stroke increased from 15% to 82%. The report also states that an audit of one hyper-acute stroke centre saw a 171% increase in the number of patients presenting within three hours of a stroke between 2008 and 2009. Following a renewal of the Act FAST campaign in 2012, there was a 25% rise in stroke-related 999 calls and a 19% increase in stroke sufferers being seen more quickly (EV g).

As a result of the re-organisation of stroke services and the introduction of the Act FAST campaign, thrombolysis treatment for those stroke patients who will benefit have increased nationwide fivefold

between 2006-7 and 2008-9 (EV i, pg. 24). The thrombolysis intervention rate has continued to grow: from less than 1% in 2005[1], to 8% by late 2011, according to the Stroke Improvement National Audit Programme (SINAP, EV j).

5. Sources to corroborate the impact

EV a. The Stroke Association, stroke statistics: http://www.stroke.org.uk/sites/default/files/Stroke%20statistics.pdf

EV b. NICE clinical guideline 68, July 2008: http://www.nice.org.uk/nicemedia/live/12018/41316/41316.pdf

EV c. National Clinical Guidelines for stroke, September 2012: http://www.rcplondon.ac.uk/sites/default/files/national-clinical-guidelines-for-stroke-fourth-edition.pdf

EV d. Harvard Business School Special Version report for UCL Partners Value In Healthcare Delivery Program, June 2011: http://islondon.files.wordpress.com/2012/06/mountford-et-al-2010-reconfiguring-stroke-care-in-north-central-london_hbs-special-edition.pdf

EV e. National Audit Office report "Progress in Improving Stroke Care: A Good Practice Guide", February 2010: http://www.nao.org.uk/wp-content/uploads/2010/02/0910291_good_practice.pdf

EV f. The Stroke Association: http://www.stroke.org.uk/research/achievements/fast

EV g. Department of Health news story, March 2013: https://www.gov.uk/government/news/act-fast-shows-anyone-can-be-a-stroke-saver

EV h. Letter from the Director of Research and Information at the Stroke Association, copy available on request.

EV i. National Audit Office report: Office "Progress in improving stroke care", February 2010: http://www.nao.org.uk/wp-content/uploads/2010/02/0910291.pdf

EV j. Royal College of Physicians Stroke Improvement National Audit Programme (SINAP) Comprehensive Report December 2011: http://www.rcplondon.ac.uk/sites/default/files/documents/sinap-generic-comprehensive-report-march_2012_0.pdf