

Quality and Productivity: Proven Case Study

Mechanical thrombectomy for large vessel occlusion stroke: improving clinical outcomes and reducing cost

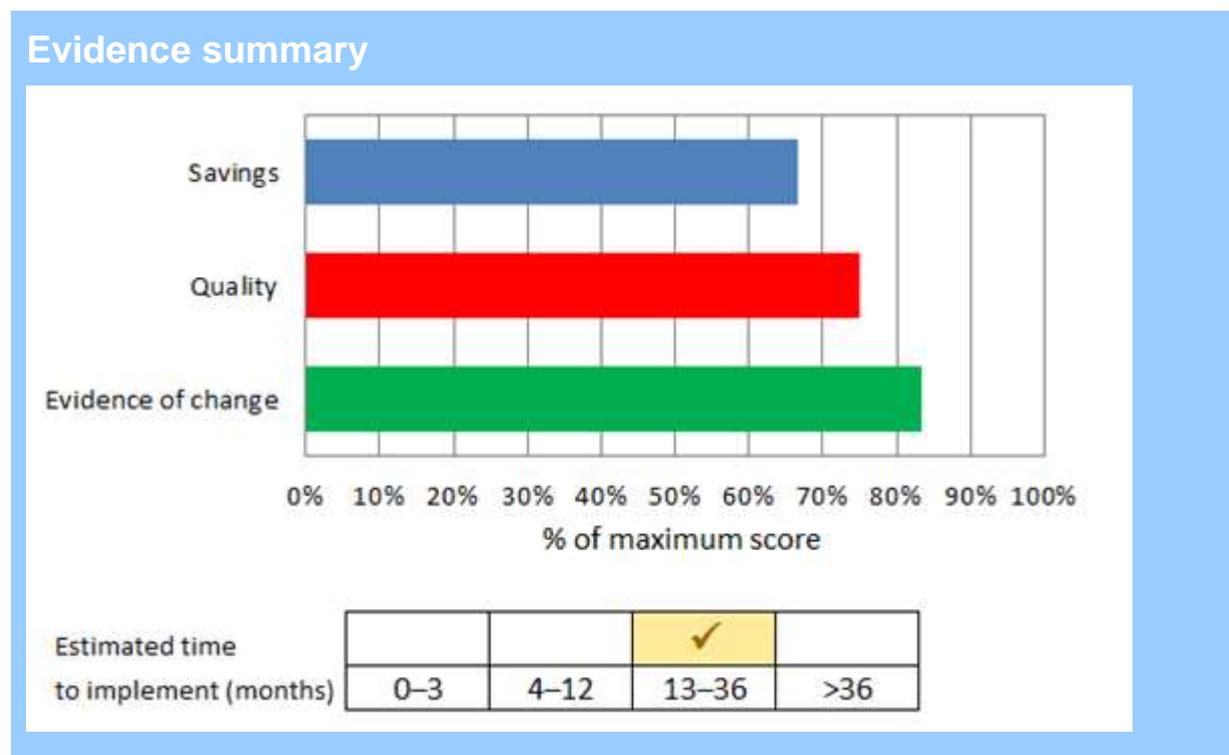
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Sharing good practice: What are 'Proven Quality and Productivity' case studies?

The NICE Quality and Productivity collection provides users with practical case studies that address the quality and productivity challenge in health and social care. All examples submitted are evaluated by NICE. This evaluation is based on the degree to which the initiative meets the NICE Quality and Productivity criteria: savings, quality, evidence and implementability. The first 3 criteria are given a score which are then combined to give an overall score. The assessment of the degree to which this particular case study meets the criteria is represented in the summary graphic below.

Proven Quality and Productivity examples are case studies that show evidence of implementation and can demonstrate efficiency savings and improvements in quality.



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Details of initiative

Purpose	To improve patient clinical outcomes by treating large vessel occlusive stroke using an interventional neuroradiology procedure called mechanical thrombectomy.
Description (including scope)	<p>The Stroke Association (2016) states that acute ischaemic stroke is the leading cause of disability and the second largest cause of death in Europe for people aged over 55.</p> <p>According to Evers et al. (2004), 50% of the total cost of managing stroke is from the initial hospitalisation and rehabilitation services required. Stroke severity is also a cost predictor in all phases of care.</p> <p>Outcomes for patients presenting with severe stroke because of large vessel occlusion have not improved much over recent years.</p> <p>Mechanical thrombectomy is one of the numerous advances in the field of endovascular technology.</p> <p>Endovascular techniques to diagnose and treat cerebral bleeding and for thrombolysis have been in use for several years, but the removal of clots to enable revascularisation of cerebral vessels is a relatively new technique. This change in treatment required a redesign of the treatment pathway.</p> <p>Mechanical thrombectomy is widely used in Europe and the USA, but is relatively new to the UK. Since January 2010, after clinical governance and trust board approval, the University Hospital of North Midlands (UHNM) has used endovascular treatment for patients with large vessel occlusions.</p> <p>Dippel et al. (2014) have shown that, for large vessel occlusion strokes, mechanical thrombectomy is better in terms of safety and efficacy than previously used intravenous thrombolytic drugs. UHNM states that it now has one of the lowest mortality rates in the UK because of its use of mechanical thrombectomy. Significant cost savings have been realised as a result of reduced patient disability and reduced length of hospital stay.</p>
Topic	Long-term conditions, mobilisation, productive care, urgent and emergency care.
Other information	<p>Stroke is the second single most common cause of death in the world, causing 6.7 million deaths each year (World Health Organization 2014). The burden of disease (disability, illness and premature deaths) caused by stroke is set to double worldwide by 2030 (Feigin et al. 2013). Stroke affects 152,000 people annually in the UK; that is 1 person every 3 minutes 27 seconds (Townsend et al. 2012).</p> <p>Severe strokes are often correlated with large vessel occlusion, which is associated with increased mortality, morbidity, poor</p>

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clinical outcomes and therefore higher overall cost burden (Smith et al. 2009).

There have been significant cost-saving benefits to the NHS and social care providers from reduced hospital bed stay and reduced disability. There is no additional burden to the NHS because the majority of patients are admitted directly to the Stroke Unit after the procedure without the need for ITU support.

Mechanical thrombectomy consists of arterial catheterisation to the site of occlusion within the brain and delivery of a mechanical treatment and/or a thrombolytic agent. This is a specialised technique where a blood clot within a blood vessel in the brain is removed using a mechanical clot-retrieval device inserted through an artery in the patient's groin.

Savings delivered

Amount of savings delivered	<p>The procedure is paid for by commissioners and the trust has demonstrated the following annual savings:</p> <ul style="list-style-type: none">• £0.8 million savings from a reduction in the length of stay in hospital• £1.6 million savings from a reduction in social care costs <p>Cost to the commissioners is estimated at £0.5million per annum. This is anticipated to reduce as the procedure becomes established within national tariff.</p>
Type of saving	<p>Most of the savings are non-cash releasing, but there is additional capacity created in the hospital and social care time is released for other duties. Some may be cash releasing, depending on local circumstances.</p>
Any costs required to achieve the savings	<p>There are no repetitive costs stated. However, input from hospital stroke teams, anaesthetics, A&E and ITU staff may be required.</p>
Programme budget	<p>Neurological.</p>
Supporting evidence	<p>The savings are achieved by a reduction in bed days in hospital and from costs associated with social care.</p> <p>Informal care represents the second cost component of managing stroke in the UK health economy, and represents 27% of the overall cost.</p> <p>Stroke management in residential care homes for disabled frail older people and by community nursing teams for disabled adults is correlated with the severity of disability.</p> <p>The modified Rankin Scale (mRS) is a scale for measuring the degree of disability or dependence in the daily activities of people</p>

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who have suffered neurological disability such as a stroke. The scale runs from 0-6, running from perfect health without symptoms to death.

The new treatment offers significant cost savings by helping people to achieve functional independence (mRS 0–2) rather than functional dependence (mRS 3+).

Quality outcomes delivered

Impact on quality of care or population health

The economic burden of stroke is substantial for patients aged under 65 because of productivity loss: 1 in 4 stroke patients in the UK are of working age (under 65). Productivity loss is approximately £1.3 billion annually (Saka et al. 2009).

A 2002 UK study demonstrated that 65% of stroke patients had to give up their job, and 14% required an adjustment to their number of working hours (Kersten et al. 2002).

After implementing the endovascular treatment pathway at UHNM, 94% of patients with severe strokes due to large vessel occlusion were discharged to their own homes rather than to a nursing home; 23% were discharged home within 1 week. Before implementing the treatment pathway, when only intravenous tissue alteplase was used, 70% of patients were discharged to inpatient rehabilitation, with significant annual costs.

The new treatment has increased the number of patients with lower mRS scores. The mortality risk of patients with severe stroke has been reduced from 50% to 17%.

mRS scores are determined at follow-up outpatient clinics at 3 and 9 months to assess functional outcome. The 3-month mRS data show that about 50% of patients are functionally independent after their stroke, with a mRS score of less than 2. Patients who previously would have had a 50% risk of death now have complete functional independence after this new treatment.

Impact on patients, people who use services and/or population safety

The case study shows an increase in patient safety.

However, other guidance/evidence by Murray and Lopez (1997) indicates there may be a risk of complications, primarily from brain haemorrhage, which is mainly due to the use of the intravenous thrombolytic 'clot-busting' drug (alteplase). The Safe Implementation of Treatments in Stroke (SITS) registry (<https://sitsinternational.org>) shows that the rate of intracranial haemorrhage is not significantly different in patients receiving best medical treatment (alteplase) and those receiving mechanical thrombectomy. This has also been confirmed by the data from recent randomised control trials undertaken by Berkhemer et al. (2015); Campbell et al. (2015); Goyal et al.

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(2015); Jovin et al. (2015) and Saver et al. (2015).

The procedure itself has been shown to be safe, according to the evidence from clinical trials.

The impact on patients with complications after mechanical thrombectomy are no worse than with complications after standard best medical care. Mechanical thrombectomy also significantly reduces the risk of severe brain swelling (malignant cerebral oedema), a complication that often occurs (50% risk) in patients with large vessel occlusion whose treatment with best medical care has failed (Thomalla et al. 2003).

Impact on patients, people who use services, carers, public and/or population experience

There has been a significant increase in the proportion of patients who are discharged home rather than to nursing homes.

Supporting evidence

UHNM has the largest patient population treated by mechanical thrombectomy in the UK.

In the cohort of 275 patients presenting with severe strokes treated with mechanical thrombectomy, 3-month follow-up data are available for 240 patients. The 3-month follow-up data showed 46% of patients were alive and independent (with a mRS of 2 or less) and 58% patients had a good outcome (with mRS \leq 3).

Patients with severe strokes previously had a mortality risk of 50%. This new treatment has a direct impact on this patient population, reducing mortality to one of the lowest for such severe strokes in the UK, 17%.

Despite regular stroke awareness courses, there are still delays in the transfer of suitable patients from adjacent district hospitals, and those who live in rural areas and are a distance from the specialist centres.

Evidence of effectiveness

Evidence base for case study

[A Multi centre Randomised Clinical trial of Endovascular treatment for Acute ischemic stroke in the Netherlands](#) (MR CLEAN) showed an increase in the probability of a good clinical outcome for patients. Remaining functionally independent rose from 1 in 5 for patients on current treatment to 1 in 3 for patients allocated to mechanical thrombectomy. Results also demonstrated that the majority of patients with large vessel occlusion stroke treated with mechanical thrombectomy made a faster recovery, and brain scans revealed less brain damage after the new treatment method.

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	This case study compliments Mechanical clot retrieval for treating acute ischaemic stroke (NICE guidance IPG548, February 2016).
Evidence of deliverables from implementation	This involved an acute service redesign with active collaboration of the various teams from the radiology, stroke, neurology, ITU, anaesthetist and emergency departments. There is evidence of systematic follow-up and reporting of results. It has also created a culture change within the organisation by changing the way severe strokes are treated.
Where implemented	This initiative has been successfully implemented at the UHNM.
Degree to which the actual benefits matched assumptions	As expected.
If initiative has been replicated how frequently/widely has it been replicated	At 10 March 2016, there are additional centres in London (St George's, Charing Cross and Queen's Square), Belfast, Bristol, Liverpool, Newcastle upon Tyne, Middlesbrough, Cardiff and Birmingham where this new treatment pathway has been replicated.
Supporting evidence	<p>Results of 5 recent endovascular trials by Berkhemer et al. (2015); Campbell et al. (2015); Goyal et al. (2015); Jovin et al. (2015) and Saver et al. (2015) showed the superiority of mechanical thrombectomy when compared with intravenous thrombolysis as measured by functional independence of mRS 0–2 at 90 days.</p> <p>These 5 randomised controlled trials showed the respective absolute difference in superiority for mechanical thrombectomy compared with the previous treatment of intravenous thrombolysis in patients with acute severe strokes. There are now data from 1,876 patients from 7 randomised controlled trials using modern stent retriever devices that show better outcomes in the endovascular treatment groups. The number needed to treat is 4 for 1 more patient to be alive and independent (with the range of 3.2 to 7.1). These trials showed endovascular treatment was safe, with no increase in mortality.</p>

Details of implementation

Implementation details	An interventional neuroradiologist based at UHNM initiated the mechanical thrombectomy treatment pathway locally after their experience working at a hospital in Europe. The support of the stroke team at UHNM was obtained.
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The starting point for using mechanical thrombectomy at UHNM was to present the case for change to clinical governance and gain trust board approval. A working group was convened and team leads were identified with the common aim of improving patient safety and clinical outcomes.

A range of professionals from various directorates were involved in implementing the initiative, with major input from the stroke team, anaesthetics (who provide the rapid general anaesthesia and sedation service), A&E (who initiate the pathway) and ITU for post-procedure care. Interventional radiology nursing and radiographers were also required to provide an out-of-hours service for the initiative. Inclusion criteria and a treatment pathway for this project were defined and agreed at an early stage. A robust database was created to audit patient outcomes and estimate financial cost-saving benefits.

Close working relationships and motivation led to the successful implementation of a sustainable pathway. Each team member had a defined role and was involved in the stages of patient care.

The early clinical success created an organisational change in culture when treating severe stroke patients. The results from good clinical outcomes were presented to the local clinical commissioning groups, which then agreed to fund mechanical thrombectomy via specialised commissioning.

Time taken to implement

The initiative has taken between 1 and 3 years to be fully implemented at new centres in the NHS. This includes the time required to discuss and agree the initiative with key stakeholders and commissioners.

Ease of implementation

Implementation of the initiative requires the involvement of a range of professionals from various specialties.

Input was needed from the stroke team and anaesthetics, the A&E department and ITU. Interventional radiology nursing and radiographers were also required.

Level of support and commitment

The initiative has achieved good buy-in from key stakeholders.

Barriers to implementation

An interventional neuroradiologist is required to set up, implement and lead the initiative. The costs of funding an interventional neuroradiologist role can be a barrier to change and needs to be considered locally.

The funding for mechanical thrombectomy was initially absorbed

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by the radiology budget at UHNM. Two interventional neuroradiologists provided a 24/7 service for patients who needed the procedure. The aim is to increase staffing to make this pathway sustainable on a long-term basis.

Stroke pathways are being reorganised into specialty centres and local commissioning arrangements are required to develop this initiative. Well-funded infrastructure for rapid patient transfer including air ambulance and other in-hospital measures should be in place, which needs input from the Department of Health.

Risks

If funds are not reserved over the medium-to-long term, this could jeopardise the continuation of the procedure.

Supporting evidence

The cost to train a person through a dedicated interventional neuroradiology fellowship is £29,705–£46,708 per annum.

Further evidence

Dependencies

None.

Contacts and resources

Contacts and resources

If you require any further information please email: qualityandproductivity@nice.org.uk and we will forward your enquiry and contact details to the provider of this case study. Please quote reference 14/0006 in your email.

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