Implementing telemedicine to support specialist decision making in stroke care during the COVID-19 pandemic

Appendix 1: Case studies

Case study 1: South East Coast Ambulance Service and East Kent Hospitals University Foundation Trust

Dr David Hargroves, Consultant Physician and Clinical Lead for Stroke Medicine at EKHUFT

In November 2018, a telemedicine pilot was set up between South East Coast Ambulance and East Kent Hospitals University Foundation Trust to test the feasibility of direct calls between clinicians in order to triage patients who are FAST+ before arrival at hospital.

The pilot sought to explore the feasibility of earlier, ambulance-based triage for FAST+ patients to reduce the number of stroke mimics being conveyed past their local EDs unnecessarily. It also sought to test whether earlier triage by a stroke consultant could potentially speed up 'door-to-needle' times once patients were at hospital by enabling better preparation.

A secure link was set up on FaceTime (via iPad) between South East Coast Ambulance Service NHS Foundation Trust staff based in Thanet and East Kent Hospitals University NHS Foundation Trust consultants in two hospitals. The pilot ran for 5 hours each evening over a 2-week period.

This pilot went through a thorough governance process within South East Coast Ambulance Service NHS Foundation and East Kent Hospitals University NHS Foundation Trust regarding confidentiality and patient safety. There was staff engagement at both sites and communication in person and via email. There was also engagement with a stroke survivor group in Thanet for their views.

The pilot demonstrated that telemedicine can substantially reduce door-to-scanner time by preparing the thrombolysis team before the arrival of the patient. However longer connection times and some poor-quality images were issues that needed to be addressed prior to adoption.

During the COVID-19 pandemic, rapid adoption of FaceTime to 24/7 stroke consultants in hours and neurology registrars out of hours for all equivocal primary stroke patients/minor stroke/TIA patients has been implemented. Analysis of outcomes/experience has been submitted through a National Institute for Health Research (NIHR) COVID-19 grant extension; the following pathway is currently in operation.

Case study 2: Virtual wards rounds in stroke care at Western Sussex Hospitals NHS Foundation Trust

Dr Rajen Patel, Consultant Stroke Physician, Western Sussex Hospitals NHS Foundation Trust

With the recent coronavirus outbreak there have been innovative new ways of working using IT in the hospital setting to protect not only our patients but also our staff. Worthing Hospital is a district general hospital with an acute stroke unit providing 24/7 thrombolysis, acute stroke care, ongoing stroke rehabilitation and daily TIA clinics. This work is covered by 3 WTE consultants, and to ensure that we minimised the risk of coronavirus infection to our patients and staff, we decided to adopt virtual ward rounds, utilising and building on our experience with telemedicine, which is already currently being used for hyperacute stroke calls. Fortunately, our IT systems within the trust allow patient observations, blood results, patient notes, imaging and prescription charts all to be viewed electronically. By using FaceTime on a ward iPad, the junior doctors who are physically present with the patients and donned in PPE, would be able to connect to the stroke consultants' iPad for a virtual ward round review. The stroke consultant would have sight of all of the patient information outlined above, allowing them to make decisions akin to them being physically present on a ward round, despite them being in a remote location. The consultant would also be able to make an entry in the medical notes by scribing on a history sheet, which could later be filed in the patients' medical notes.

The small hurdle that we needed to overcome was that the initial medical clerking would not be scanned into the electronic system until discharge (with the rest of the admission notes). Therefore, any new patient to the stroke unit would have their admission notes scanned by the ward clerk, so that they were electronically visible by the stroke consultant on the ward round.

The above process has enabled us to provide effective stroke consultant input to stroke patients with or without coronavirus. It also means that the juniors only have to focus their attention on patient interaction rather than using multiple computer systems while donned in PPE. We have also found that patients do not seem phased by having to speak to a consultant on an iPad screen rather than in person.

This system also allows the stroke consultants to provide rapid reviews in other areas such as the ED, not only for acute stroke calls but also to prevent unnecessary admission to hospital for a stroke review or inappropriate referral to the TIA clinic.

In the scenario where a stroke consultant has to self-isolate but is still well enough to work, the above system could still be implemented from the stroke consultants' home premises, allowing some resilience to be built into the stroke service at that site. It also opens up the possibility of cross-site or organisation working if appropriate IT systems are in place.

All in all the system works well and has multiple benefits, especially with the current coronavirus outbreak. Whether it will replace traditional face-to-face doctor-patient assessment in the future altogether remains to be seen.

Case study 3: NHS Lanarkshire

Professor Mark Barber, Consultant Geriatrician, NHS Lanarkshire

(https://journals.sagepub.com/doi/10.1177/0036933013507868)

Prior to the development of the NHS Lanarkshire telestroke network, acute patients presenting to their local Lanarkshire hospital were assessed and then referred to Glasgow for thrombolysis. While an excellent service was provided on arrival, this incorporated large transport delays in the thrombolysis process for those treated and unnecessary transfers if patients were then considered ineligible.

A 'mesh' network was developed; this allowed six consultants from three separate sites to join a single rota covering all three hospitals. During normal working hours, the on-call consultant would provide face-to-face assessments on their own site and telemedicine-based assessments to the other two sites. Out of hours, the assessments would generally be performed using telestroke equipment in the consultant's own home. Nursing staff were trained in neurological examination (NIHSS) to assist in remote neurological assessment as there was not consistent experienced junior doctor cover.

The three stroke units were linked using standard videoconferencing equipment on integrated services digital network lines. Although siting the units in the EDs was considered, it was felt that placing the technology within the stroke area would ensure that the equipment was closely monitored so it would consistently function. The stroke units checked the equipment by dialling into one of the other stroke units on a daily basis.

Because of the importance of a written record of the decision-making process in the patient's clinical record, a system was developed using the Stroke Audit In Lanarkshire (SAIL) software to allow stroke specialists to record the clinical findings electronically from home – or a distant hospital – and have this record immediately printed off in the stroke unit and filed in the patient's case record. The clinical record included important times with regard to the stroke journey and initiated the audit process for the assessed patient.

Case study 4: East of England

Lynda Sibson, Telemedicine Manager, East of England Stroke Telemedicine Stakeholder Partnership

The out-of-hours East of England regional stroke telemedicine service was introduced in 2010 to address the inequitable access to stroke thrombolysis across the region. The East of England is a largely rural area covering 7,500 square miles with a population of 5.6 million. With an estimated 6,000 patients per annum presenting with a stroke, providing timely access to stroke thrombolysis across this wide and largely rural population was a challenge.

From November 2010, a videoconferencing telemedicine software solution, *Visionable*, currently hosted in a secure Amazon cloud, allowed the stroke consultants to rapidly link with the referring hospital, providing real-time, rapid access to stroke expertise when and where it was required. Prior to telemedicine, many stroke patients were transferred between hospitals to access thrombolysis, only to be outside the timeframe for treatment on arrival at the treating hospital.

The stroke telemedicine consultants are also able to securely access the patient's CT scan via the image exchange portal (IEP) system. The IEP allows each hospital to transmit the patient's CT scans through to our dedicated 'blue-light' institution. The CT scanners at the referring hospital are linked with the IEP system, enabling automatic routing of the relevant CT scans out of hours. The stroke telemedicine consultants are then able to access the internet-based web browser and review the patient's CT scan via a three-factor authentication process. If the patient's CT scan is not available via IEP, the *Visionable* software has a desktop-sharing feature, enabling the local stroke team to access their local PACS on the stroke telemedicine cart and share this view with the stroke telemedicine consultant.

Each hospital has two telemedicine carts; one based in the ED and one based on the hyperacute stroke unit (HASU). Each cart is a mobile, wireless-enabled trolley, housing a hospital-specific PC that runs the telemedicine software and is easily moved to the end of the patient's bed, as needed. The on-call stroke telemedicine consultant is based at home, with a standard laptop, using the *Visionable* software, enabling them to clearly see and hear the patient, their relatives and the local clinical team in a 'virtual' consulting room.

Case study 5: Royal Berkshire NHS Foundation Trust

Dr Kiruba Nagaratnam, Consultant Stroke Physician and Geriatrician, Royal Berkshire NHS Foundation Trust

The Royal Berkshire NHS Foundation Trust have worked with Brainomix to develop a novel working practice to support remote decision working during the COVID-19 pandemic. A full report of this initiative can be found on the Oxford AHSN website (www.oxfordahsn.org/our-work/covid-19/covid-19-case-studies/ai-technology-speeds-up-stroke-care-and-reduces-costs/). The pathway is shown on page 32.

Adapting stroke services during the COVID-19 pandemic: an implementation guide

VIRTUAL

Stroke clinician receives notification from 🔴 Brainomix

Stroke clinician reviews the images virtually using e-Stroke Suite

CT scan becomes available on 🔴 Brainomix

Patient for thrombolysis

Stroke clinician informs thrombolysis Nurse of **treatment decision**

Not for thrombolysis

EMERGENCY DEPARTMENT

If no response within **5 minutes,** Nurse calls **Stroke on-call directly**

'Front door' clinician prescribes **Alteplase**

'Front door' clinician prescribes **medication as required**

Thrombolysis Nurse **notifies** all Stroke clinicians via **communication system.**

'Front door' clinician requests **CT scan**

FAST +

'Front door' clinician ensures patient is stable and performs **rapid medical assessment**

FAST -

Non-Stroke pathway commenced

AMBULANCE

Patient directed to '**HOT ED'**

Patient directed to '**COLD ED'**

Covid-19 Positive / Suspected

Suspected Stroke patient comes in via **ambulance**

Covid-19 Negative