

Prehospital video triage of potential stroke patients in north central London and east Kent: rapid mixed methods service evaluation

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First Look Draft

Scientific summary

Background

Optimising access to organised stroke care in the English NHS

Stroke is a major cause of death and disability. Because of limited specificity of screening tools for stroke, acute stroke services manage large numbers of patients who, although suspected to be having a stroke, turn out to have non-stroke conditions.

Remote specialist stroke assessment using videoconferencing may identify patients who do not need stroke treatment. To date, piloting and implementation of such technologies has been limited in England. Reported obstacles include technical issues (e.g. reliable audio-visual signal), and cultural barriers (e.g. ambulance clinicians' concern regarding benefits of potentially increasing time spent on-scene).

Prehospital video triage for stroke in North Central London and East Kent

In 2020, in response to the COVID-19 pandemic, alongside other service changes, National Health Service (NHS) services in North Central (NC) London and East Kent introduced 'prehospital video triage' for suspected stroke patients. This enabled ambulance clinicians to contact acute stroke clinicians for remote clinical assessment via videoconferencing. The aim was to establish whether a patient was suitable for conveyance to a Hyper Acute Stroke Unit (HASU) or if they should be on a different care pathway. The anticipated benefits of this system were to:

- Support appropriate referrals to HASUs or other pathways.
- Protect vulnerable older patients from risk of exposure to COVID-19.
- Ensure timely treatment for optimal patient outcomes.
- Help services run as efficiently as possible.

Objectives

Our evaluation questions (EQs), which we agreed with clinician and patient stakeholders, were the following:

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- EQ1. What evidence exists on prehospital video triage for suspected stroke patients, in terms of implementation, usability, safety, and outcomes?
- EQ2. Are the prehospital video triage services piloted in NC London and East Kent acceptable to their users (stroke clinicians and ambulance clinicians)?
- EQ3. Are the services effective in terms of usability and image/sound quality?
- EQ4. Do the services support appropriate, safe, and timely conveyance and treatment of suspected stroke patients?
- EQ5. Which factors influence uptake and impact of these services?
- EQ6. Which aspects of these services should be retained post COVID-19 and which adaptations (if any) are required to support their implementation?

Methods

Design

This was a rapid, formative, mixed methods service evaluation, which ran from July 2020 to September 2021. It focused on prehospital video triage for stroke, in terms of: 1) existing research evidence; 2) how stroke and ambulance clinicians experienced these services in NC London and East Kent (their implementation and perceived usability, acceptability, and safety); 3) impact on patient destination, conveyance times, and delivery of stroke clinical interventions.

Approach

- **Rapid reviews of evidence:** scoping review of previously published reviews (n=15) and rapid systematic review of published research and reviews (n=47). The aim was to establish evidence on remote triage of suspected stroke patients, focusing on factors influencing implementation, associated outcomes (e.g. clinical, financial, and resource impacts), safety and security of services, and conceptual frameworks and methods used to study such services.
- **Qualitative analysis** of ambulance and stroke clinician views on implementation, usability, safety, and further development of prehospital video triage implemented in NC London and East Kent. We analysed 27 interviews, including stroke consultant

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physicians (NC London, n=7; East Kent, n=2) and ambulance clinicians (NC London, n=11; East Kent, n=7); 9 non-participant observations, including governance meetings and training events (NC London n=6, East Kent, n=3); and 23 relevant documents, including meeting minutes, training documentation, and service pathways (NC London, n=15, East Kent n=8). Our analysis was guided by a conceptual framework describing factors that influence adoption and sustainability of innovations in healthcare, including national and local contexts, nature of the innovation, and implementation approaches employed.

- **Survey of ambulance clinicians:** we developed a survey tool with local service representatives, to analyse ambulance clinicians' perceptions of the usability, safety, and implementation of prehospital video triage in NC London and East Kent. There were 233 respondents in total, with 159 in NC London (response rate, $159/550=28.9\%$) and 74 in East Kent (response rate, $74/424=17.5\%$). We disaggregated responses by area, and for each survey item conducted a Chi-Square Test of Independence to assess whether patterns of responses in the two areas differed significantly.
- **Quantitative analysis:** we analysed ambulance conveyance data from NC London and East Kent on patient destination and conveyance times (April-September 2020, n=1400 patients), and national stroke audit data on delivery of stroke clinical interventions (aggregated at team-level, July 2018 to December 2020, n=137,650 patients). We analysed patient destination using between-region difference-in-differences regression analysis; we analysed conveyance times descriptively; we analysed delivery of stroke clinical interventions using between-region difference-in-differences regression analyses, with the rest of England as a comparator.
- **Formative feedback:** we shared progress and findings regularly with ambulance clinicians, stroke clinicians, and patient collaborators, to strengthen the evaluation approach and to support local service development.

Results

We present our results organised by our evaluation questions.

What evidence exists on prehospital video triage for suspected stroke patients, in terms of implementation, usability, safety, and outcomes?

- Our *scoping review and rapid systematic review* found limited, but growing evidence on prehospital video triage for stroke. Much of this evidence was based on pilot or feasibility research, using both simulated and ‘real-world’ settings.
- *Usability*: stable network coverage and clear audio-visual signals were important to successful patient assessment. Communication between ambulance and stroke clinicians was also important, in ensuring that stroke clinicians could access appropriate patient information.
- *Training* of both ambulance and stroke clinicians was an important facilitator of effective prehospital video triage, for example using simulations to enable clear understanding of new protocols and effective use of communications technology.
- Research on *outcomes* of prehospital video triage tended to focus on stroke clinical interventions, for example indicating reductions in time from arrival at hospital to brain scan or thrombolysis.
- *Key gaps*: there was little evidence on the impact of prehospital video triage on such issues as appropriate patient destination, patient safety and experience, and cost-effectiveness.

Were the prehospital video triage services piloted in NC London and East Kent acceptable to their users (stroke clinicians and ambulance clinicians)?

- *Qualitative analysis*: some ambulance clinicians in both areas were concerned about whether potential benefits of accessing specialist secondary care stroke expertise might be outweighed by delays in patient conveyance. However, most ambulance and stroke clinicians supported the new services, citing improvements in appropriate patient conveyance and potential reductions in service pressures. Ambulance clinicians felt more confident and reassured about their conveyance decisions, and felt they were learning more about stroke through their communications with stroke clinicians. Stroke clinicians noted that the service did not involve a significant change in practice, beyond conducting assessments earlier to gain advance knowledge of

patients. However, many stroke clinicians reported conducting prehospital video triage alongside their other duties: this placed pressure on clinicians, potentially limiting quality of communication and sustainability of prehospital video triage.

- **Ambulance clinician survey:** 86% of respondents found prehospital video triage an improvement on 'business as usual' and 88% wanted the new services to continue. However, these positive views were significantly stronger amongst NC London ambulance clinicians.

Were the services effective in terms of usability and image/sound quality?

Usability

- **Qualitative analysis:** ambulance and stroke clinicians said prehospital video triage was straightforward to use; some ambulance clinicians suggested training and 'refresher' courses could be beneficial. NC London's approach to training was more active, with both face-to-face and distribution of video information, whereas in East Kent protocols were distributed via e-mail and an online portal.
- **Survey:** a higher proportion of NC London respondents (94%) rated the service as usable than in East Kent (78%), possibly reflecting NC London's active approach to training, where 91% of respondents reported having received sufficient training, in contrast to East Kent, where 42% did.

Image/sound quality

- **Qualitative analysis:** ambulance and stroke clinicians reported image and sound quality were sufficient to conduct prehospital video triage, but that connections could be disrupted by limited Wi-Fi coverage. Under such circumstances, ambulance clinicians reverted to conveyance protocols that operated before introduction of prehospital video triage.
- **Survey:** confirmed that ambulance clinicians (77%) agreed that the prehospital video triage services were usable in terms of audio-visual quality; NC London clinicians were more positive.

Did the services support appropriate, safe, and timely conveyance and treatment of suspected stroke patients?

- ***Analysis of national stroke audit data:*** Following introduction of prehospital video triage, time from symptom onset to stroke patients' arrival at hospital and HASU did not increase. There were several significant increases and no significant reductions in timely delivery of stroke clinical interventions in NC London and East Kent (relative to changes observed in the Rest of England (RoE)). However, other factors, such as reorganisation of local stroke services, may have contributed significantly to these improvements.
- ***Qualitative analysis:*** leaders implemented processes to monitor and manage safety incidents. Meeting observations suggested there were few such incidents, with each analysed to identify improvements. Interviews suggested that ambulance and stroke clinicians felt prehospital video triage was safe.
- ***Survey:*** 82% of respondents had no concerns about safety of the services. However, in NC London, 91% had no concerns, while in East Kent, 62% had no concerns.

Which factors influenced uptake and impact of these services?

- ***Qualitative analysis:*** several factors helped enable rapid development, implementation, and uptake of prehospital video triage.
- In terms of *national/international context*, appropriate conveyance of suspected stroke patients is a longstanding challenge, due to the limited specificity of screening instruments; also, the COVID-19 pandemic added significant patient safety risk to inappropriate patient conveyance, acting as a 'burning platform' for change. These drivers shaped *local context*, encouraging adoption of governance processes that facilitated innovation. Ambulance and stroke clinicians' desire to provide appropriate care to stroke and non-stroke patients also enabled uptake of these services.

- *Collaborative leadership* was important: ambulance and stroke clinical leads worked locally with senior management and frontline clinician, but also engaged wider system governance to obtain support for these changes.
- *Prehospital video triage itself* was attractive: ambulance and stroke clinicians found the process straightforward, offering advantages over ‘business as usual’, in terms of getting the patient to the most appropriate service for the best care.

Which aspects of these services should be retained post COVID-19 and which adaptations (if any) are required to support their implementation?

- ***Interviews and survey***: ambulance and stroke clinicians were emphatic that prehospital video triage represented an improvement on previous processes and should continue. Many suggested it should be implemented more widely, both in other regions and healthcare specialities.
- Many stroke clinicians had to conduct assessments alongside their other duties: this was found disruptive, placing pressure on clinicians (and with potential implications for *sustainability* of prehospital video triage).
- More active approaches to ***training*** were preferred by clinicians: such approaches may encourage increased collaboration between ambulance and stroke clinicians.

Conclusions

- ***Implementation***: prehospital video triage can be implemented rapidly. By drawing on a relevant theory of implementation and sustainability of innovations, we were able to establish that influential factors included context, implementation approaches, and the characteristics of the prehospital video triage services themselves. These factors were interrelated: for example, the COVID-19 pandemic acted as a ‘burning platform’, encouraging more local professional and organisational receptivity to new ways of working.
- ***Acceptability and usability***: ambulance and stroke clinicians overall found prehospital video triage acceptable and usable. The technology was seen as straightforward to use

and generally reliable. A potentially important factor was the level of training offered, with more active approaches preferred by ambulance clinicians. Stroke clinicians reported concerns about delivering prehospital video triage alongside their other duties, suggesting that addressing this issue would be important to ensuring sustainability of the service.

- ***Impact on safety and quality***: almost all stroke patients' ambulance journeys to HASUs remained within recommended conveyance time thresholds. Analysis of time from symptom onset to arrival at hospital and stroke services suggests that, despite additional time spent on scene, prehospital video triage can be delivered while supporting timely patient conveyance. In terms of stroke care delivery, we found several significant increases in delivery of key clinical interventions following introduction of prehospital video triage (above and beyond what was seen elsewhere in England), although other changes to service organisation that took place concurrently may have contributed significantly. Our qualitative data - both in terms of interviews and observations of meetings where safety issues were analysed - suggest that safety was of high importance to the clinicians delivering these services and that their experiences led them to be confident that the services were indeed delivering safe care and wider service and system benefits.

Limitations

- First, services studied were based in Southeast England, because none had been implemented elsewhere at that time. Further, local stroke services had been reorganised meaning the local HASU was not co-located with an Emergency Department, which may have increased pressure to use the triage service. The services studied were introduced during an unprecedented period of change in the English NHS, which may limit the extent to which lessons on the studied services might be translated to other contexts.
- Second, we were unable to interview several key stakeholder groups, including patients and carers, managers, and the wider system. We could only interview two stroke clinicians (including the service lead) in East Kent.

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- Third, our survey recruited a convenience sample; responses were too low to permit further disaggregation of responses, e.g. by frequency of use of prehospital video triage.
- Fourth, ambulance journey data only covered areas where prehospital video triage had been introduced and only following introduction of the triage services. Therefore, these analyses had no historical or regional comparators.
- Fifth, we could not request national stroke audit data at patient level, so were limited in the analyses we could employ in terms of risk-adjustment or matched controls).
- Sixth, national stroke audit data did not cover potential patient safety issues related to appropriate patient conveyance. However, we observed meetings where these data were discussed, which confirmed that such incidents were rare and analysed actively.

Future research

Future research may include:

- Qualitative research focusing on patients, carers, clinicians, and managers in stroke and non-stroke settings; and representatives of the wider context (senior managers, commissioners, patient representative groups, and wider system governance).
- Quantitative analysis of patient-level data on conveyance, care delivery, outcomes, and cost-effectiveness (again, focusing on stroke and non-stroke patients), pre- and post-implementation, using national controls.
- Mixed method research to analyse sustainability and roll-out of services in other settings.
- The authors recently commenced a new research project, PHOTONIC, funded by NIHR HS&DR programme, which will address many of these issues. For further information, see <https://fundingawards.nihr.ac.uk/award/NIHR133779>.

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