Prehospital video triage of potential stroke patients in North Central London and East Kent: rapid mixed-methods service evaluation

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Scientific summary

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Scientific summary

Background

Optimising access to organised stroke care in the NHS in England

Stroke is a major cause of death and disability. Because of the 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 the 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, 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:

- supporting appropriate referrals to HASUs or other pathways
- protecting vulnerable older patients from risk of exposure to COVID-19
- ensuring timely treatment for optimal patient outcomes
- helping services run as efficiently as possible.

Objectives

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

- 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 (i.e. stroke clinicians and ambulance clinicians)?
- EQ3 – are the services effective in terms of usability and image/sound quality?
- EQ4 – do the services support the appropriate, safe and timely conveyance and treatment of suspected stroke patients?
- EQ5 – which factors influence the uptake and impact of these services?
- EQ6 – which aspects of these services should be retained post COVID-19 and what 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) and (3) impact on patient destination, conveyance times and delivery of stroke clinical interventions.

Approach

Rapid reviews of evidence

A scoping review of previously published reviews ($n = 15$) and a rapid systematic review of published research and reviews ($n = 47$, from MEDLINE, Cochrane Library, CINAHL, EMBASE and Web of Science) were carried out. 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), the safety and security of services, and the conceptual frameworks and methods used to study such services. The review included primary research of various designs, including RCTs, feasibility studies, pilots, service evaluations, implementation studies (qualitative) and health economic studies. It excluded research focusing on interventions that did not involve remote stroke specialist input or digital communication technologies, research focusing on mobile stroke units, non-peer reviewed studies, and commentaries/editorials, grey literature, conference proceedings or opinion pieces.

Qualitative analysis

We carried out a qualitative analysis of ambulance and stroke clinician views on the implementation, usability, safety and further development of the prehospital video triage implemented in NC London and East Kent. We analysed 27 interviews, including stroke consultant physicians (NC London, $n = 7$; East Kent, $n = 2$) and ambulance clinicians (NC London, $n = 11$; East Kent, $n = 7$); nine 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 the adoption and sustainability of innovations in health care, including national and local contexts, the nature of the innovation and the 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, $n = 159/550$, 28.9%) and 74 in East Kent (response rate, $n = 74/424$, 17.5%). We disaggregated responses by area and, for each survey item, conducted a chi-squared test of independence to assess whether or not 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 to September 2020, $n = 1400$ patients) and national stroke audit data on delivery of stroke clinical interventions (aggregated at a 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; and we analysed delivery of stroke clinical interventions using between-region difference-in-differences regression analyses, with the rest of England (RoE) 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 North Central 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 or not the 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 the 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 among NC London ambulance clinicians.

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

Usability

- ***Qualitative analysis***: ambulance and stroke clinicians reported that prehospital video triage was straightforward to use; some ambulance clinicians suggested training and 'refresher' courses could be beneficial. Staff in NC London's approach to training was more active, with both face-to-face training 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 East Kent respondents (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 that 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 the introduction of prehospital video triage.
- ***Survey***: the 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 the appropriate, safe and timely conveyance and treatment of suspected stroke patients?

- ***Analysis of national stroke audit data***: following the introduction of prehospital video triage, time from symptom onset to stroke patients' arrival at the hospital and HASU did not increase. There were several significant increases and no significant reductions in the timely delivery of stroke clinical interventions in NC London and East Kent (relative to changes observed in 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 the safety of prehospital video triage. 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 the 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, owing to the limited specificity of screening instruments; in addition, the COVID-19 pandemic added significant patient safety risk to inappropriate patient conveyance, acting as a 'burning platform' for change. These drivers shaped the *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 clinicians, 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 and 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, in both other regions and other health-care specialties.
- Many stroke clinicians had to conduct assessments alongside their other duties: this was found to be disruptive, placing pressure on clinicians and with potential implications for the ***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 the 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 – in terms of both interviews and observations of meetings where safety issues were analysed – suggest that safety was imperative 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

- Services studied were based in south-east England, because prehospital triage had not been implemented elsewhere at that time. Furthermore, 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 NHS in England, which may limit the extent to which lessons on the studied services might be translated to other contexts.
- We were unable to interview several key stakeholder groups, including patients and carers, managers and those involved in the wider system (e.g. hospital management, commissioners and the voluntary sector). We could interview only two stroke clinicians (including the service lead) in East Kent.
- Our survey recruited a convenience sample; responses were too low to permit further disaggregation of responses, for example by frequency of use of prehospital video triage.
- Ambulance journey data covered only areas where prehospital video triage had been introduced and only following the introduction of the triage services. Therefore, the analysis of this data had no historical or regional comparators.
- We could not request national stroke audit data at the patient level, so were limited in the analyses we could employ in terms of risk-adjustment or matched controls.
- 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 of prehospital video triage, using national controls
- mixed-method research to analyse the sustainability and roll-out of prehospital video triage in other settings.

The authors recently commenced a new research project, PHOTONIC, funded by the National Institute for Health and Care Research Health and Social Care Delivery Research programme, which will address many of these issues. For further information, see https://fundingawards.nihr.ac.uk/award/NIHR133779.

Study registration

This study is registered as PROSPERO CRD42021254209.

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