Temporal variations in quality of acute stroke care and outcomes in London hyperacute stroke units: a mixed-methods study

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Scientific summary

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Scientific summary

Introduction

There is conflicting evidence as to whether or not patients presenting with acute stroke symptoms receive lower quality of care and have worse outcomes if they are admitted to hospital outside normal weekday working hours or at weekends (the so-called 'weekend effect'). Some studies have shown that acute stroke patients admitted at weekends have lower quality of care and higher mortality, whereas others have shown the opposite. The politics surrounding this phenomenon raised a number of relevant issues for research: first, exposure of differences in outcomes across the week was having an impact politically, and it was necessary to answer the question of whether this was a true effect or an artefact of the patient mix or the quality of the data; second, it was important to measure other outcomes and care processes, as well as mortality; and, third, to change the approach towards acknowledging patterns of temporal variation. This movement is characterised by the idea that certain times of the day, or days of the week, are associated with poorer outcomes for the patient, but that this is not necessarily limited to the weekend or night-time. Therefore, the concept of 'out-of-hours' working or the so-called 'weekend effect', which once dominated the discourse of the literature on temporal variation, has been re-evaluated.

Several possible causes for temporal variation are proposed, but there are likely to be many relevant factors associated with out-of-hours working, including differences in patient case mix affecting outcomes between patients admitted at different times of the week; reduced staffing levels reduced access to supporting investigations; lower seniority and clinical experience of available staff, and less familiarity of staff with patients; less familiarity with unit-specific processes and policies, and insufficient training to address this; and fewer supervisory staff and less supervisor familiarity with the staff they supervise. Evaluation of these studies is further complicated by recent evidence that stroke incidence reporting at the weekend may be unreliable in older studies. Recent work, based on data from the Stroke Sentinel National Audit Programme data set, further shows that care quality and outcomes in acute stroke vary across the week. This work concluded that binary comparisons of weekend with weekday, or in-hours with out-of-hours, processes and their effects oversimplify more likely variations by day of the week and the time of day. Furthermore, no studies have investigated the impact of time of admission on disability following a stroke.

Following these findings, the aim of this study was to investigate variations in the quality of acute stroke care and outcomes by day and time of admission in London hyperacute stroke units. National audit data were used for all patients in London who had a stroke during a 12-month period recorded by the Sentinel Stroke National Audit Programme. We hypothesised that there would be no variation in care quality measures across the week and no variation in outcomes in London hyperacute stroke units.

Aims and objectives

This study aimed to identify the extent to which London hyperacute stroke units were providing 24 hours a day, 7 days a week (24/7), care and factors influencing this. The research provides an opportunity to examine how and if a range of organisational factors influence 24/7, provision of stroke care, and to assess the extent to which temporal patterns of provision are reflected in patient outcomes, including

mortality, length of stay and functional independence. The research also aimed to explore service developments related to temporal consistency. These lessons are of potential value to people who commission, organise and run stroke services, both in London and across any area of the English NHS that seeks to develop or provide 24/7 hyperacute stroke care. They may also have relevance to research in and provision of 24/7 care in other areas of health care, such as emergency and intensive care, treatment of myocardial infarction and elective surgery.

Objective 1

To investigate the extent to which evidence-based care received by stroke patients differs between in-hours and out-of-hours services in London hyperacute stroke units.

Objective 2

To investigate the extent to which clinical outcomes differ between in-hours and out-of-hours services in the London hyperacute stroke units.

Objective 3

To investigate how in-hours and out-of-hours services are organised and provided in London hyperacute stroke units.

Objective 4

To investigate how these services are perceived by stakeholders (including stroke clinicians, patients and carers).

Objective 5

To investigate the costs of acute stroke care in London hyperacute stroke units on different days and at different times of admission.

Methods

We took a mixed-methods approach to study if, how and why there was temporal variation in stroke care and outcomes. Variation in quality of acute stroke care and outcomes was studied through a prospective cohort study, using anonymised patient-level data from the Sentinel Stroke National Audit Programme. The factors influencing variations in care and outcomes were studied through interview and observation data, and analysed using thematic analysis. To study the impact of nursing on care delivery and outcomes, we identified the characteristics of the nurse staffing on the hyperacute stroke unit at the time that each patient was admitted to the hospital, and tested whether or not these factors were associated with delivery of care processes and outcomes.

A total of 7094 patients with a primary diagnosis of stroke admitted between January and December 2014 were included in our Sentinel Stroke National Audit Programme data set. We interviewed hyperacute stroke unit staff ($n = 76$), including doctors, nurses, therapists and administrators, and 31 patients and carers. In addition, we conducted non-participant observations of delivery of care at different times of the day and week ($n = 45$, $\approx$102 hours). We analysed the data for thematic content relating to the ability of staff to provide evidence-based interventions consistently at different times of the day and week.

Main findings

Our analysis of the extent to which evidence-based care (objective 1), clinical outcomes (objective 2) and costs (objective 5) differ between in-hours and out-of-hours services in London hyperacute stroke units found the following:

- London hyperacute stroke units did not operate a 24/7 service in all aspects of acute stroke care, but nor are they designed to.
- There was no variation in 3-day mortality and modified Rankin Scale score at hospital discharge by day of admission.
- In accordance with national and local stroke standards, London hyperacute stroke units did not vary temporally in quality of care by day and time of admission across the week in terms of timely access to:
  - brain scanning
  - stroke nursing care
  - thrombolysis.
- Other time-dependent quality-of-care measures did vary significantly across the week in London hyperacute stroke units.
- Three patterns of variation were detected:
  - by time of day, but not by day of the week
  - by day of the week, but not by time of day
  - by time of day and by day of the week.
- There was little variation in the cost of care processes, including receipt of thrombolysis, across the week, although length of stay on the hyperacute stroke unit and total length of stay were longer for patients admitted at the weekend.
- When incorporating total length of stay, the additional mean cost per patient was £445–668, depending on when the patient was admitted during the weekend.
- Those who were admitted 20.00–07.59 on a weekday had similar costs to those who were admitted 08.00–19.59 on a weekday.

Our analysis of temporal variation in nurse staffing and the effect on quality-of-care measures (objectives 1–3) found the following:

- Many hyperacute stroke units timetabled nurses at higher bands (e.g. band 7) to take on senior nursing tasks, such as the nurse-in-charge role during the day on weekdays.
- Quality of care was better if the nurse in charge was on a higher band and/or there were more nurses on duty.
- The more senior the nurse in charge, then the less likely it was for a patient to see a stroke physician within the first 12 or 24 hours.
- Nurse staffing had a direct effect on quality-of-care measures soon after arrival at the hospital (brain scan within 1 hour, dysphagia screen within 4 hours and admission to a stroke unit within 4 hours).
- Wards were organised and made efficient by senior nurse care.
- In both the acute admission area and the ward area of hyperacute stroke units there are some specific tasks that require the attendance of a senior nurse.
- Senior nurse care was demonstrated to make a difference to some outcomes (brain scan within 1 hour and dysphagia screen within 4 hours), but this may be compromised if the senior nurse has to manage two areas.
- Junior nurses in some hyperacute stroke units were trained to perform certain tasks so that they could ‘act up’ to senior roles; however, they were still unable to juggle the many additional demands of the senior role.

Our analysis of how in-hours and out-of-hours services were organised and provided in London hyperacute stroke units (objective 3) and how such services were perceived by stakeholders (including stroke clinicians, patients and carers) (objective 4) revealed the following:

- The 24/7 stroke services were built on top of 'old-fashioned' models of team practice.
- This was minimally disruptive to previous practices: ward rounds and therapy rota models were not changed significantly.
- Consistency was achieved by:
  - adapting and extending roles
  - creating continuities between different times of day
  - building relationships and trust
  - prioritisation of 'front-door' interventions.
- There were unintended consequences of adaptations, however, such as delays in repatriation, higher levels of pressure for staff and increased admissions to the hyperacute stroke units at night.
- Variation persisted because of inconsistencies in:
  - medical, managerial and allied health professional staffing by time of day
  - delivery of therapist assessments
  - barriers in repatriation processes.

Our study has revealed a new way of thinking about temporal consistency, characterised by the following:

- Sentinel Stroke National Audit Programme and London stroke service standards dominated the timing of clinical events in the 'front-door' part of the patient pathway through setting of micro time limits (1 hour, 4 hours, etc.).
- Sentinel Stroke National Audit Programme metrics later in the patient pathway had longer time limits (24 hours and 72 hours) that are not indicative of clinical benefit, but reflect cultural norms about rotas and activities (e.g. ward rounds), and which have financial implications.
- Assessing temporal variation in events that occur more than 1 hour after arrival in terms of 'in-hours' and 'out-of-hours' arrival periods should take account of temporal structures, such as therapy rotas and ward rounds, which may determine timing of clinical contacts.
- Repatriation from the hyperacute stroke unit is temporally structured by working patterns of other departments and organisations.
- Measuring temporal concepts, such as clustering, pressure and bottlenecks, is as important as consistency.

Recommendations and future research priorities

For stroke and other services to achieve greater consistency in provision and outcomes of care, they will need to overcome cultural acceptance of 'difference' at weekends and at night. This will otherwise continue to restrict quality improvement and cause frustration for patients who cannot be repatriated or make therapeutic advances. To achieve this consistency, research should focus on:

- Optimal patterns of staffing and care delivery given resource constraints; for example, therapeutic coverage, rota lengths and ward rounds.
- Indepth analysis of interdependencies that influence 24/7 delivery of care, with services external to the hyperacute stroke unit, both within and beyond the host hospital.
- The impact of stroke admission at different times of the week on longer-term mortality and disability outcomes.
- Learning from other efforts to deliver clinical interventions 24/7 in stroke and other clinical settings.

Future research into temporal variation will continue to be based, at least in part, on clinical audit data, such as the Senitel Stroke National Audit Programme. Although we have outlined some limitations of this resource, its accuracy and coverage make it a unique and invaluable source of data. Research using these data should consider:

- Patterns of timing (e.g. clustering and limit-stretching periods of higher clinical risk) to accurately visualise temporal variation by times of admission, and to understand why these patterns occur.
- Linked outcomes other than mortality and modified Rankin Scale that are also important to patients (e.g. mood, quality of life and longer-term morbidity data).
- Patient-centred indicators of quality, which are obtained through primary data collection or retrospective patient record review, and analysed in terms of temporal variation. Important examples might include sedentary periods for patients, management of fluid balance, impaired swallow function, information about what types of intervention are being performed by therapists at each contact with patients and avoidable delays in repatriation.

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