

## A Quality Improvement Project to Assess Timing of Initial Investigations in Stroke Medicine

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### Abstract

There are several investigations that can be completed in the acute phase of admission for patients with suspected stroke. These include receiving a CT Head scan and also blood tests specific for stroke. The national guidelines regarding CT Head scans detail they should be completed within 12 hours of admission[1] and the trust guidelines, local to where this quality improvement project was based, advise a CT Head should be completed within four hours of admission.[2]

The current national guidelines do not specify exact stroke blood tests, however trust guidelines give a specific set of blood tests that would be appropriate to be taken when a patient presents to A&E with a suspected stroke. These included FBC, U&E, blood glucose, ESR, cholesterol, TFTs, and coagulation screen.[2] The aim of this quality improvement project was to assess the timing of CT Head scans and blood tests and to implement a tool to ensure these are done in a timely fashion, within the emergency care setting. The project was completed through three PSDA cycles. The first was undertaken in an A&E department, which was soon to be closed and moved to a different site. The second cycle was then completed at the new site, to assess if there had been any change in timings of these interventions. In the previous site it was found that 97% of patients audited received a CT Head scan within four hours. At the new site it was found 94% patients received a CT Head within four hours, therefore both meeting trust targets on the whole. A full set of stroke blood tests were completed at the old site in 53% of patients and this decreased to 22% of patients at the new site. At this point it was decided an intervention should be implemented to ensure this did not continue. The intervention used was updating a stroke panel on the trust computer system (an easy to use, one-click button entitled "Stroke/TIA") with the correct blood tests and the use of this was promoted throughout the trust.

A post-intervention audit was completed three months after the tool was promoted and patients receiving the correct blood tests whilst in the A&E department increased to 75%. The amount of patients receiving a CT Head scan within four hours was 100% therefore meeting both trust and national guidelines. In conclusion, the stroke blood panel appears to have improved the amount of patients receiving the correct blood tests when admitted with suspected stroke and will continue to stay in place at the trust.

### Problem

On a stroke unit in the UK, it was observed by the junior doctors when reviewing patients on daily rounds that some of the initial stroke interventions were not fully completed or had experienced some delay in the emergency care setting. One intervention the junior doctors found particularly problematic was the time taken to ensure a full set of blood tests specific to stroke were completed. Although NICE guidelines and RCP National Clinical Guidelines for Stroke do not give a set of blood tests that should be completed specifically in the emergency care setting,[1,3] the stroke consultants on the stroke unit would expect many to have been done before arrival on the ward. These include a FBC, U&Es, Coagulation screen, glucose level, ESR, cholesterol, and TFTs. However, these tests were not always completed in the emergency department, meaning that for some patients it was days before junior doctors identified that not all of these blood tests had been done. Patients could potentially have been severely impacted by this if one of these urgent tests could have led to a diagnosis that caused or contributed to their risk of stroke.

The aims of this project were to measure the timing of investigations for patients with suspected stroke in the A&E

department (stroke blood tests and CT Head scans). These measurements were compared with both the national and local guidelines to assess if the trust, in which the QI took place, was meeting these targets. At the time of the first PSDA cycle, the emergency department was a few months from being moved to a new hospital. The measurements were then to be re-audited when the new hospital opened to evaluate if there had been any improvement in the times of these investigations.

### Background

This quality improvement project was based on evaluating initial emergency care investigations in patients with suspected stroke in the A&E department. In this particular trust, emergency care guidelines (written by a stroke consultant) are available detailing that patients with suspected stroke must have a CT Head within four hours (national guidelines state 12 hours).[1,2] Criteria for when CT Head should be done within one hour is also clearly stated on the guidelines, however for the purpose of this project we have evaluated whether suspected stroke patients had a CT Head within four hours.

There is also local guidance regarding which blood tests should be

initially taken for a patient with suspected stroke - these include FBC, U&Es, blood glucose, ESR, and cholesterol. Stroke consultants at the trust also recommend TFTs and coagulation screen.[2] For this project, it was discussed with the stroke consultants and also stroke nurse practitioners regarding when blood tests should be taken. It was agreed that these should be completed in the emergency care department, and ideally within 12 hours of admission, therefore when patients are seen in the stroke unit afterwards, these results would be readily available, and it would be less likely that these tests would be missed all together.

We aimed to analyse data from both admissions in-hours (0800-1700, when the emergency department is staffed by a mixture of junior and more experienced senior doctors as well as stroke specialist nurses) and compare this to out-of-hours (1700-0800, when the A&E department has less senior staff members on site).

## Baseline measurement

For this project, 32 patients admitted to A&E with suspected stroke were analysed per audit (three audits in total.) Not all admissions were able to be analysed as the criteria was only patients with suspected stroke presenting to the emergency department between these dates. Patients with suspected/confirmed TIAs or other neurological conditions were therefore not included in this project.

Baseline measurements included; admission date, exact time of admission, patient's age, type of stroke, time between admission and CT Head scan, time between admission and full set of blood tests specific for stroke. The initial data also included time between CT Head and other interventions (if applicable) such as time of thrombolysis and aspirin therapy, however it was felt 32 patients, and due to missing data from drug charts, did not provide enough data to fully analyse trends in these areas. It was therefore decided to concentrate on time of CT Head scans and stroke blood tests. These were measured using patient's notes/A&E clerking documents to ascertain exact time of admission and also the online computer system to analyse time of CT Head scans and what time blood tests were requested and taken.

Baseline measurements, at the initial hospital emergency department, showed that the department was, overall, meeting the trust targets for time between admission and CT Head scans in patients with suspected stroke (97% of the audit participants received a CT Head within four hours of arrival to A&E). However, results showed a significant deficit in the amount of patients that had received the full set of blood tests recommended (only 53% of these patients received all relevant blood tests recommended by the trust. It was found these trends were very similar both in and out-of-hours and the time of admission did not significantly affect how quickly CT Head/bloods were completed.

## Design

This quality improvement project was completed over the course of eight months at a NHS Foundation Trust. The baseline

measurements were completed at a district general hospital. The first and second PDSA cycles were completed following the opening of a new A&E on a different site (new acute hospital) which would clerk all new admissions for the trust. Patients admitted with stroke would then be transferred to the previous hospital for ongoing care if required (base site). The post-intervention audit was completed approximately three months after opening of the new A&E department.

The purpose of this quality improvement project was to re-audit these baseline measurements, when the new hospital had opened to assess if these investigations (CT Head and stroke blood tests) were done within similar time frames. The project team was primarily a foundation level trainee, with help and advice from my senior colleagues on the stroke ward (two consultants and two stroke nurse practitioners.) The project was discussed on a regular basis.

Recommendations, from the first PDSA cycle, were to update the blood panel on the computer system to ensure all staff members using this could order the correct tests, in one simple click of a button. It was then recommended that this should be widely promoted throughout all hospitals in the trust and in the emergency care department, via staff induction sessions, emails, and on the weekly update that staff receives. These recommendations would be a long-term solution as the computer panel for "stroke bloods" once implemented would stay on the system and staff members would be more aware to use and encourage use of the blood panel. The panel was put into place on a certain date and the response was re-audited in three months' time.

## Strategy

PDSA cycle 1: Due to the opening of a new A&E department at a new hospital (which would clerk all admissions for the trust) and the previous A&E department closing, it was vital to re-audit the baseline measurements in the new emergency department. The question being asked was "Does a change of hospital site for the emergency department affect the timing of CT Head and blood tests in patients with suspected stroke?" It could then be ascertained if these delays in stroke bloods were continuing to be a problem within the new department. During discussions with the stroke team at the previous site, it was difficult to hypothesise whether timings of these investigations would improve, for example due to improved access to imaging, such as CT Scans, within the new hospital. It was anticipated that due to the improved level of senior staffing 24 hours a day at the new hospital that the level of correct stroke blood testing may also improve, however it was also discussed that the opening of a new hospital could also negatively impact the completion of these tests due to new staff members or current staff taking time to learn their way around a new department.

Once the new emergency department had opened in June 2015, a second audit was completed evaluating data from the new site to assess these changes. It was found that the timing of CT Head scanning was similar at the new site but the timing of blood tests had shown significant deterioration. It was clear from these results that improvement strategies should be therefore be focused on the

stroke blood tests in the emergency department at the new site.

PDSA Cycle 2: Outcomes of the QI project at the previous A&E (old hospital) and at the current A&E department (new hospital) were presented at a departmental care of the elderly/stroke meeting. This gave an opportunity to share the information found – particularly highlighting the decline in percentage of patients receiving the correct stroke blood tests in the emergency care setting. This therefore highlighted to all staff present at the meeting, the importance of ensuring these blood tests are carried out in the A&E department. Senior staff members present at the meeting planned to inform their colleagues and junior staff of this.

The idea of using an amended “stroke bloods” panel on the shared computer system throughout the trust (for every patient with a suspected stroke) was introduced and it was decided this then needed to be promoted throughout the trust to increase awareness and compliance of staff using this tool. A panel for stroke bloods already existed within the trust but did not contain all of the correct blood tests and was not widely used. The IT department was contacted to reconstruct this panel on the system which was to be titled “Stroke/TIA bloods” and include blood tests FBC, U&E, CRP, Coagulation screen, ESR, TFTs, and cholesterol/HDL at one click of a button and this was implemented within two days.

The communication department was then also contacted to assist with promotion of this blood panel, via the weekly staff update page and emails to staff members. The stroke specialist nurses were informed and encouraged to use this as best practice and encourage others in the A&E department to also use the tool. There were some difficulties when initially discussing this tool with the A&E department as a consultant highlighted that a large amount of pressure is put on A&E departments already, therefore did not feel it was their responsibility to ensure stroke blood tests are done. On further discussion, it was explained that the tool was designed to ensure requesting stroke bloods on the computer system a quick and easy task, in one click of a button, which should only benefit the A&E staff. The consultant was then in agreement with this and the tool was promoted within the trust. Three months following the introduction of this tool, a third audit was completed to assess if the tool had had any impact upon timing of the stroke blood tests.

## Results

Results from PDSA Cycle 1: The timings of CT Head scans in patients with stroke were very similar at the new hospital, with 94% patients meeting the four hour criteria (previously 97%). However, in the new emergency department, results of the stroke blood tests had declined. Previously 53% patients received required blood tests in the first 24 hours of care and at the new hospital this figure had decreased to 22% of patients being admitted with suspected stroke not receiving all the necessary blood tests within 12 hours of admission. This indicated that blood tests required in stroke patients were still not widely recognised within the emergency care setting. This can lead to many patients not receiving these blood tests not only in the acute phase of their admission, but also in the later stages as there is no current guidelines for inpatient care of stroke, with regards to blood tests and when these should be completed.

Results from PSDA Cycle 2: Following the implementation of the “stroke panel” on the trust computer systems, it was promoted within the trust using the aforementioned methods. Three months was then allowed for the tool to start being used by A&E staff members and stroke specialist nurses and a re-audit was completed to evaluate the success of this tool.

All patients in the post-measurement audit were patients with suspected stroke (same criteria as the previous two audits.) The results from this cycle now showed that 100% of patients audited received a CT Head scan within four hours of arrival to hospital – an improvement on the previous results in which 94% patients received a CT Head scan within four hours. Overall, this shows that the trust continued to meet both trust and national guidelines in this area.

The results from the post measurement audit showed that 75% of patients received the relevant stroke blood tests within 24 hours of admission. This is a large increase from 22% in the previous results. This shows that it is likely that more A&E staff and stroke specialist nurses who are clerking patients with suspected stroke are using the tool and subsequently the stroke bloods are being completed within a reasonable amount of time. This helps meet trust guidelines for stroke-specific blood tests and ensures relevant tests for secondary prevention are completed in the acute phase.

## Lessons and limitations

During this quality improvement project there were many lessons learnt. Firstly in a dynamic department such as A&E, many different doctors, nurses, and other healthcare professionals work in many different ways. This can make it very hard when trying to design and implement best practice in a certain area, because many healthcare professionals have set ways of working and it can be difficult to determine which way would produce the best outcome. For this particular QI project, it was helpful to discuss this with the senior colleagues in both emergency care and stroke to find an agreed criterion for stroke blood tests and when they should be completed.

Furthermore, it was much easier to audit against the factors with set national and regional guidelines but as these do not exist for the some of the areas being audited, it was decided to use trust guidelines, to understand what standard should be aimed for.

A further lesson learnt was in regards to implementing an intervention designed during the QI project. It can be very difficult to ensure a new idea within a trust is properly promoted and also used by staff members in the future. As mentioned above, many members of staff have set ways of working and this can be a challenge to introduce a new idea and explain why this could be useful to both them and for patient care. During this QI project many of the junior members of staff were targeted for promotion, via the emergency care inductions. I believe this has had a positive impact on the outcomes as many junior staff appeared engaged and have used the tool, as well as also promoting it within the emergency care department.

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There were two main problems encountered during this project. To begin with it was planned that during this quality improvement project several factors would be looked at. These included timings of CT Head scans, timing of stroke blood tests and timing of aspirin or thrombolysis therapy, if applicable. During the first cycle, however, it became apparent that it was very difficult to consistently locate the old drug medication charts – therefore making it difficult to gather data on times patients had initially received aspirin/alteplase. When so little data was collected on these factors, it was decided to focus on the more easily measurable factors – the CT head scans and stroke blood tests.

A second problem was the large variation in which blood tests were done in the emergency care department and which were done on the stroke unit. On discussion with both A&E and stroke colleagues, many were confused about where these blood tests should be taken and consequently, a lot of patients did not get all the recommended blood tests at any point in their admission.

To ensure this intervention is sustainable and that staff continue to use the stroke tool for blood tests in patients with suspected stroke, it will be necessary to ensure the tool is promoted at each induction for new junior staff members. Some trainees will change departments as quickly as four monthly, therefore it is important that the senior A&E staff are aware of this tool and encourage their junior staff to use it regularly. The intervention itself is cost-effective as it remains on the trust computers for no added cost, therefore can hopefully stay on the computer systems for the foreseeable future.

Limitations to this project include the small sample sizes (32 patients used for each cycle). Due to extensive work looking through notes, it was unfortunate that only small sample sizes were feasible during each cycle. However, the number of patients was enough to show a snapshot of what timings were being achieved in the emergency department and further work could go into a further cycle with a larger sample size.

## Conclusion

Overall, the implementation and promotion of the stroke bloods panel has significantly improved results in the post-intervention audit. This has shown that it is likely due to increased awareness and use of the panel, a larger percentage of patients with suspected stroke received the correct blood tests whilst in the A&E department. This has then led to improved identification of risk factors for stroke in the emergency care setting, and also provided information regarding which secondary prevention measures need to be put into place for these patients. The overall results regarding CT Head scans have been excellent in all cycles of the quality improvement project - with 94% or more of patients meeting trust guidelines throughout. This quality improvement project has demonstrated that with simple tasks such as obtaining correct blood tests sometimes it is difficult for staff to identify whose responsibility it is, and it is beneficial to assess this frequently to ensure staff members are up-to-date on these issues.

This project adds to an area that is not commonly analysed in terms

of the timing of stroke blood tests and which specific tests should be completed in the acute phase. The national guidelines<sup>[1,3]</sup> do not provide a specific criterion for this, in terms of how soon the blood tests should be completed in this patient group. In this QI project, this led to the use of local guidelines and advice from stroke physicians within the trust to produce a measurable aim for the stroke blood tests, in which the audits could compare with. The aims of this project originally set to assess the timing of both CT Head scans and blood tests in the emergency care setting, and to compare this between the old and new hospital A&E departments. This has been achieved through the first PSDA cycle and led to a second cycle in which improvements have been made to current practice in this trust. Due to positive findings regarding CT Head results (meeting local and national targets), there was no need to implement any change to practice in this area.

These results are not completely generalisable because all A&E departments and hospitals use different ways of ensuring initial investigations are undertaken, and may already have a system for this in place. Particularly as local guidelines were used regarding stroke blood tests, this means that the results cannot be compared with other trusts as they may have different targets and guidelines on which blood tests are appropriate in suspected stroke patients. It would also be helpful to repeat this project with larger sample sizes, to increase the generalisability of the results.

However, this project could be replicated in other trusts if their own local guidelines were used as a measurable aim to audit against. The stroke blood panel is an intervention that could be put in place sustainably at many other centres that use computer systems to order blood tests, if the data suggested improvement was needed in that area.

## References

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## Declaration of interests

Nothing to declare

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## Ethical approval

This project was exempt from requiring ethical approval due to being a quality improvement project, designed to evaluate and improve timings of blood tests on a local scale within the hospitals in the trust, in line with local policy.