

## Improving the likelihood of neurology patients being examined using patient feedback

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### Abstract

We aimed to establish whether recall of elements of the neurological examination can be improved by use of a simple patient assessment score.

In a previous study we demonstrated that in-patients referred to neurology at two United Kingdom (UK) hospitals were not fully examined prior to referral; we therefore designed a larger quality improvement report with 80% power to detect a 10% increase in tendon hammer or ophthalmoscope use following an educational intervention.

In-patients referred to neurology over a four month period (in hospitals in the UK (10), Jordan (1), Sweden (2), and the United Arab Emirates (1)) were asked whether they recalled being examined with a tendon hammer (T), ophthalmoscope (O), and stethoscope (S) since admission. The results were disseminated to local medical teams using various techniques (including Grand Round presentations, email, posters, discounted equipment). Data were then collected for a further four month period post-intervention.

Pre-intervention and post-intervention data were available for 11 centres with 407 & 391 patients in each arm respectively. Median age of patients was 51 (range 13-100) and 49 (range 16-95) years respectively, with 44.72% and 44.76% being male in each group. 264 patients (64.86%) recalled being examined with a tendon hammer in the pre-intervention arm, which significantly improved to 298 (76.21%) ( $p < 0.001$ ). Only 119 patients (29.24%) recollected examination with an ophthalmoscope pre-intervention, which significantly improved to 149 (38.11%) ( $p = 0.009$ ). The majority of patients (321 (78.87%)) pre-intervention recalled examination with a stethoscope, which significantly improved to 330 (84.4%) to a lesser extent ( $p = 0.045$ ).

Results indicate that most patients are not fully examined prior to neurology referral yet a simple assessment score and educational intervention can improve recall of elements of the neurological examination and thus the likelihood of patients being examined neurologically. This is the largest and - to our knowledge - only study to assess this issue. This has implications for national neurological educators.

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### Problem

The need to increase awareness of the importance of a full neurological examination, including ophthalmoscopy and assessment of tendon reflexes, in medical in-patients.

### Background

Approximately 10% of patients seen in accident and emergency (A&E) departments and 10-20% of patients subsequently admitted to hospital have a primary neurological problem,[1] thus it is essential that patients are examined neurologically at the time of admission.

Following serious unexpected incidents (SUI)[2] in the lead study centre (Birmingham, United Kingdom) in 2008, a number of strategies were deployed (audit, training, education, and curriculum development) to improve the quality of neurological assessment, especially in relation to ophthalmoscopy and assessment of tendon reflexes (items which constitute 6 of 22 essential aspects of the

neurological examination).[3] The recurrence of further neurological 'near misses' suggested that these improvement strategies were not effective. We therefore developed a simple patient assessment score by asking the patient if they could recall being examined with a tendon hammer, ophthalmoscope and stethoscope (TOS).

### Baseline measurement

Using this patient assessment score we performed a pilot quality improvement (QI) project, the TOS study, to establish the methodology. We demonstrated that in-patients referred to neurology at two United Kingdom (UK) hospitals were not appropriately examined prior to referral:[4] 67% recollected being examined with a tendon hammer and 52% said they had been examined with an ophthalmoscope, whilst 96% recalled examination with a stethoscope. In comparison, we collected control data by applying TOS scores to 45 in-patients on a neurology ward: 100% recalled examination with a tendon hammer, 97.8% with an ophthalmoscope and 86.7% with a stethoscope.[5] This is not an isolated problem: a US study found that of 350 patients who attended the emergency department with neurological

symptoms requiring ophthalmoscopy (mainly headache) only 14% were examined with an ophthalmoscope.[6]

We aimed to establish whether recall of elements of the neurological examination could be improved by use of a simple patient assessment score. Power calculations were based on our previous work,[4] with a target total of 800 patients we had 80% power to detect a 10% increase in tendon hammer or ophthalmoscope use following an educational intervention.

See supplementary file: ds6448.docx - "Figures 1, 2a, 2b, 2c, 2d"

## Design

The development of a patient assessment score to evaluate the completeness of neurological examination by medical staff. A prospective, before and after, study assessing whether introduction of the score resulted in improved neurological examination based on patient feedback.

## Strategy

From September 2013, in-patients referred to neurology over a four month period in 10 hospitals in the UK, two in Sweden and one each in Jordan and United Arab Emirates respectively were asked by the neurology team (registrar or consultant) whether they recalled being examined with a tendon hammer, ophthalmoscope, and stethoscope since admission.

The results from this first period of data collection were disseminated to local medical teams using techniques including Grand Round presentations, email, posters, and information on discounted equipment. The choice of intervention used at each centre was determined by the local investigator. The intervention period was two to three months. Data were then collected from a similar number of patients for a further four month period post-intervention. By performing data collection within one UK academic year (as the majority of centres were in the UK) we aimed to minimise any change in rotating medical staff.

Stethoscope was used as a control measure as we assumed all patients were examined with a stethoscope. Exclusion criteria included patients who were unable to answer yes or no to each of the three questions due to confusion, dysphasia, or language barrier.

Each centre collected their own data using a standardised proforma, which was then reviewed and collated centrally. We used Fisher's exact test to examine the significance of the association between pre and post-intervention data. As a QI report no ethical approval was required.

## Results

Pre-intervention and post-intervention data were available for 11 centres with 407 and 391 patients in each arm respectively (Table 1). Three UK centres were only able to perform the pre-intervention

phase due to staff changes. The median ages of patients were 51 (range 13-100) and 49 (range 16-95) years respectively, with 44.72% and 44.76% being male in each group. 264 patients (64.86%) recalled being examined with a tendon hammer in the pre-intervention arm, which significantly improved to 298 (76.21%) ( $p < 0.001$ ). Only 119 patients (29.24%) recollected examination with an ophthalmoscope pre-intervention, which significantly improved to 149 (38.11%) ( $p = 0.009$ ). The majority of patients (321 (78.87%)) pre-intervention recalled examination with a stethoscope, which also improved to 330 (84.4%) but to a lesser extent ( $p = 0.045$ ) (Figure 1). Individual hospital (sub-group) analyses were not performed as our power calculations were based on pooled data from all centres.

See supplementary file: ds6247.docx - "Table 1"

## Lessons and limitations

This is the largest and, to our knowledge, only study to assess patient recall of elements of the neurological examination internationally and shows considerable levels of variation in all the countries studied (Table 1, Figures 2a-d). The study has been completed for less than the cost of a tendon hammer through collaboration. Yet by simply feeding the TOS scores and the rationale back to the local medical teams and remeasurement we found a significant improvement in the TOS scores for all measures.

Comparing the data for UHB and City Hospital (the two centres involved in the initial TOS Study)[4] we do not note any major sustained changes. This suggests that continuous reinforcement is required to ensure that lessons learnt by one group of doctors are not forgotten when they rotate onto other posts.

The issue of incomplete neurological examination is complex. One suggested reason is a lack of equipment, in particular access to ophthalmoscopes. Providing more ophthalmoscopes in the acute medical unit is a temporary solution as these tend to disappear rapidly.[4] One proposed solution is the Walton neurostand,[7] a ward based trolley with examination equipment attached to it. Others advocate alternatives to direct ophthalmoscopy including non-mydratic ocular fundus photography, but at \$25,000 per camera this is an expensive solution.[6,8] New developments in smartphone applications for retinal photography could hold promise as an alternative to conventional ophthalmoscopy and is currently being trialled in Kenya.[9] As part of our intervention UK centres were offered a 10% discount code for ophthalmoscopes and other medical equipment bought through two online retailers. Only four people used the discount code to purchase equipment indicating that despite financial incentives, doctors are not forthcoming in purchasing their own neurological examination tools.

In combination with equipment issues, neurophobia (a fear of neurology) contributes significantly to poor neurological examination skills. Neurophobia stems from inadequate undergraduate and postgraduate exposure to neurology teaching and practical neurological situations, and is prevalent in medical students and junior doctors alike.[10,11] One misconception is that neurological examination is time-consuming, when in fact a rapid neurological

assessment can be completed within three minutes.[10] The study provided an opportunity for a discussion between the study authors and many other colleagues within our respective hospitals - one of the arguments put forward by some was that there is a lack of formal evidence to show, for example, that ophthalmoscopy decreases mortality or morbidity. The reality is that such serious neurological conditions are rare events, and a valid study would likely need to be orders of magnitude larger than ours.

Ten of the centres in this study were from the UK and a recent audit of acute neurology services highlighted wide variation of access for patients presenting with acute neurological conditions in the United Kingdom.[12] Thus the situation could be worse in those hospitals with even more limited access to neurologists than in this study or conversely perhaps non-neurologists are less likely to assess a patient neurologically if they have decided they are going to refer the patient to neurology anyway. These factors could only be established via wider use of TOS in different contexts.

We would encourage neurologists and acute physicians on post-take ward rounds to assess TOS scores on all patients with a neurological problem. This provides a measure of whether a patient has been assessed neurologically and can also be a teaching opportunity to highlight the importance of the neurological examination. Patient assessment scores could also be used in other medical specialties to assess appropriate examination such as rectal examination in gastrointestinal bleeding or the Hall-Pike manoeuvre in episodic vertigo. Although just because a patient recalls being examined does not imply competency of assessment, it should be self evident that there is increased likelihood of the relevant physical signs being elicited if the appropriate examination has been undertaken.

## Conclusion

Results indicate that most patients are not fully examined prior to neurology referral yet a simple assessment score and educational intervention can improve recall of elements of the neurological examination and thus the likelihood of patients being examined neurologically. The TOS data are a potentially powerful instrument for change at multiple levels, with implications for national undergraduate and postgraduate neurological education.

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## Declaration of interests

Nothing to declare.

## Acknowledgements

We are grateful to the many colleagues and patients in all the institutions listed below who contributed to this quality improvement report. Peter Nightingale (statistician at University Hospitals Birmingham) analysed the data.

No funding.

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10, Willmot M 1,11, Hayton T 1,12, Lunn MP 13, Nicholl DJ 1,2 on behalf of the TOS investigators

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## Ethical approval

As a quality improvement report no ethical approval was required as there was no patient intervention (although we did write to the Chair of the South Birmingham Research Ethics Committee - who agreed with this view)