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## **Evaluation of a continuous monitoring and multi-level feedback initiative to improve quality of anaesthetic care and perioperative workflow efficiency**

### **Final Report (Draft Version 2)**

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## Scientific summary

### Background

Effective monitoring and feedback is essential if clinical teams and individuals are to understand variations in care, detect and respond to opportunities to improve standards and evaluate the impact of changes to services.

Anaesthetists as a professional group have a high degree of patient contact in the perioperative pathway yet receive little routine feedback on patient experience or outcomes such as pain and post-operative nausea. Feedback on such outcome measures often occurs irregularly in acute care organisations through clinical audit projects, but these information streams are discontinuous and not geared towards continuous monitoring and improvement. Recent reviews have highlighted that, from the anaesthetist's perspective, current perioperative quality indicators lack sensitivity and specificity. Furthermore, there exists limited evidence concerning the reliability and validity of measures that can be used to monitor patient satisfaction with anaesthetic care. A clear need exists for the development of routine monitoring and feedback of quality of anaesthetic care, from the post-operative period, to support improvement in anaesthetic practice.

Studies show that providing feedback to clinicians can be an effective improvement intervention and results in generally small to moderate positive effects upon professional practice. Initiatives that use feedback are more effective than those that don't and feedback paired with an educational strategy or implementation plan is more effective than using simple passive feedback alone. Research suggests that a large range of feedback characteristics may influence its effectiveness as a quality improvement mechanism.

### Objective

To conduct a comprehensive, mixed methods, quasi-experimental evaluation of the impact of a departmental continuous quality monitoring and feedback initiative for quality of anaesthetic care, within a London teaching hospital over a three year period.

### The intervention

The feedback initiative was developed and implemented as part of the Collaboration for Leadership in Applied Health Research and Care (CLAHRC) North West London portfolio of quality improvement projects and was given the title IMPAQT (Improving Anaesthetic Quality). Based upon industrial quality improvement models, the initiative was conceived as a continuous quality monitoring and feedback programme for anaesthetists. It comprised continuous measurement of anaesthetic quality indicators in the post anaesthetic care unit of the primary site coupled with continuous monthly feedback of personal-level case data to 44 consultant anaesthetists. Baseline data collection of anaesthetic quality indicators began in March 2010 at St Mary's Hospital main theatre suite. The intervention model was then implemented in two main phases: 1) implementation of basic, passive monthly feedback using a simple summary statistical report (from October 2010), and

2) implementation of an enhanced feedback protocol (from July 2012 until the end of the project in November 2013).

Basic feedback consisted of the provision of monthly personal data summaries in tabled form with limited longitudinal and comparative graphical representations. In the enhanced phase of the programme, a more statistically sophisticated report was developed in response to user requests, including monthly detailed case category breakdown, specialty-specific information, deviant case details, enhanced comparative and longitudinal data and institution-wide dissemination. Basic data feedback was enhanced with broader professional engagement activities including regular presentation of statistical results, consultative interviews by the research team, topic-focused engagement and facilitated peer interaction upon specific specialty areas (e.g. pain management after gynaecological surgery).

## **Methods**

### **Qualitative evaluation**

Longitudinal, qualitative work stream which ran parallel to the intervention work and took a realist evaluative perspective on the project. The realist position provides a framework for identifying not only what outcomes are produced by an intervention, but how they are produced and how the intervention interacts with varying local conditions to produce outcomes. In total, interviews were conducted with 24 Consultant Anaesthetists, six Surgical Nursing Leads and five Perioperative Service Leads, in two phases.

### **Survey evaluation**

A longitudinal evaluative end-user survey study was undertaken, with three time points corresponding to baseline, basic feedback and enhanced feedback conditions, across three participating sites. The items included scales designed to quantify the effectiveness of current quality indicators, data feedback and the usefulness of the feedback for improvement, along with attitudes to quality improvement within the local working environment. In total 70 individual anaesthetists completed the survey at one or more time points.

### **Quasi-experimental evaluation**

Evaluation of the impact of the anaesthetics quality monitoring and feedback initiative upon anaesthetic quality indicators and perioperative outcomes utilised a single group longitudinal design, with multiple study epochs. Interrupted time series analysis was used as the primary evaluative model with interrupts representing multiple intervention time points corresponding to the onset of basic and enhanced feedback protocols. The perioperative indicators modelled included: patient temperature upon arrival in recovery (2 metrics), patient-reported quality of recovery scale score (2 metrics), post-operative pain (2 metrics), post-operative nausea (2 metrics), surgical site infection rate and 30-day post-operative mortality rate. The study anaesthetist cohort included 50235 cases,

performed by 44 anaesthetists over the course of the study, with 22670 cases performed at the primary hospital site.

## **Productivity analysis**

Interviews were conducted with the perioperative service manager, the lead nurse for the Post-Anaesthetic Care Unit and six Surgical Nursing Leads from the primary site to identify and interpret themes related to productivity. Ward Wait Time (WWT) was compared pre and post feedback, defined as the interval between the receiving ward being contacted after the patient was deemed ready for discharge from the PACU unit and handover of the patient.

## **Results**

### **Qualitative evaluation**

Results provided a rich understanding of the causal mechanisms of effectiveness for monitoring performance and making improvements to practice based on quality indicators, along with a developmental perspective on acceptability and engagement over time. Clinicians clearly agreed with the rationale for the initiative, recognising the existence of a problem and the need for a solution. Clinicians emphasised that the right quality indicators needed to be selected with the right characteristics (i.e. they must be specific, relevant and meaningful) in order to promote the necessary level of trust in the data and demonstrate fitness for purpose. The interviewees explored the translation of information into action at two levels of the healthcare system; the departmental level and the individual clinician level; crucially, the mechanisms of effective data use were different at each level.

The issue of anonymity was important to end-users and appeared to demonstrate a process of maturity that was longitudinally dependent and tied to end-users' growing confidence in the intent of the feedback system. At the individual level, with a desire to receive normative feedback, people wanted to identify and contact high performers in order to obtain support and ideas for behaviour change. Dealing with case mix variations (and the intra-professional issues it gave rise to) was identified as a critical success factor for initiatives of this type. Our analysis suggests that a combination of normative comparison (i.e. genuine peer benchmarking) and individual trends over time may have the greatest effect. The need to transform hard data into usable information and the experience of healthcare professionals in doing so can be viewed as a powerful message emerging from this study.

Interviewees clearly identified a role for this initiative in revalidation and participating in quality monitoring and acting upon the results is an identified dimension of good medical practice. The connection of the initiative with revalidation and appraisal appeared to significantly increase levels of engagement throughout the evolution of the project.

### **Survey evaluation**

Results suggest that anaesthetists perceive a range of factors as important in determining the usefulness of feedback. Specifically, the local departmental context and its support of quality improvement is an important determinant of how instrumental feedback from monitoring quality indicators is likely to be. Furthermore, feedback that is tailored to be relevant to the personal professional practice of the individual clinician is an important predictor of usefulness. In terms of the feedback content and design characteristics that anaesthetists value most, the perceived credibility of the data and the local relevance of the quality indicators are paramount.

In the longitudinal evaluation, the survey data from the primary site demonstrated a significant improvement in perceptions of quality indicators, feedback, data use and overall effectiveness of quality monitoring between baseline and implementation of basic feedback. For the majority of the survey measures, there was a significant improvement at the secondary study sites between the baseline condition and implementation of the enhanced feedback protocol.

### **Interrupted time series analysis**

The observed response to the implementation of basic feedback in the quality indicators assessed was, on the whole, limited and the hypothesised benefits of implementing basic feedback were generally not observed in the data. Whilst the average weekly temperature of patients arriving in recovery increased by .082 degrees in response to the onset of basic feedback, in contrast, the weekly proportion of patients arriving in recovery with temperature under 36 degrees increased between the baseline and basic feedback condition too by 3.3%.

The second study hypothesis concerned the effect of implementing enhanced feedback in a group that had been receiving routine basic feedback previously. Escalating the intensity of feedback through implementation of an enhanced feedback protocol had a positive effect across a greater range of measures than implementation of basic feedback. After implementation of enhanced feedback, patients were on average warmer upon arrival in recovery by .064 degrees. Both the mean patient reported quality of recovery scale score and proportion of patients reporting high quality recovery showed small improvements in the rate of change between basic and enhanced feedback conditions (change in trend for mean scale score = .009 on a 17-point scale and change in trend for proportion of patients = .001%).

The two measures of post operative pain demonstrated consistent positive responses to the implementation of the enhanced feedback protocol, with significant improvement in both level and rate of change in the proportion of patients reporting freedom from severe pain (change in level = 7.2% of patients; change in trend = .004%) and those reporting no or mild pain upon arrival in recovery (change in level = 12% of patients; change in trend = .003%). The proportion of patients with nurse-reported absence of nausea similarly increased by 5.8% in response to the implementation of enhanced feedback, coupled with an improvement in the rate of change in this measure (change in trend = .001%), though no significant effect was detected for patient-reported freedom from post operative nausea. No significant effect of the implementation of enhanced feedback upon surgical site infection rate was detected. Thirty-day post-operative mortality appeared to show a complex response to the implementation of enhanced feedback, with a modest increase in level (0.8%) coupled with a modest improvement in the rate of change over time (change in trend = -.001%).

The observed positive effects of enhanced feedback upon patient temperature data, mean quality of recovery score, and measures of both post-operative pain and post-operative nausea, were robust after covariate analysis in which longitudinal variation in disease severity, patient age and gender were controlled. When further statistical models were fitted based upon stricter case inclusion criteria, limited to elective general anaesthetic cases, the implementation of enhanced feedback was still associated with significant improvement in level and slope in both proportion of patients with nurse-reported freedom from nausea and freedom from pain on arrival in recovery. Analysis of the impact of feedback upon a sub-group of anaesthetists defined by being ranked in the lower 50th percentile of scores during the baseline period, confirmed that the beneficial effects of enhanced feedback were replicated and strongest for this sub-group, particularly in the areas of post-operative pain management, control of post-operative nausea and overall patient-reported quality of recovery.

### **Productivity analysis**

Although most perioperative ward leads described the initiative as useful and recognised the importance of active clinical engagement, significant improvements in WWT were only reflected in three of the eight wards studied. Qualitative analysis of stakeholder interviews suggested that although they valued the feedback initiative, further organisational changes would be needed to progress improvement in ward transfer efficiency, including improvements to the local bed allocation and discharge process. Although there was strong consensus of support for the initiative, the interviews highlighted the need for an infrastructure to support change and shared goals targeted through a system wide approach that included broader understanding of hospital dynamics.

### **Conclusions and implications for healthcare**

Taken as a whole, the findings from this evaluation provide rich information concerning the effects of a comprehensive, long-term anaesthetic quality monitoring and feedback initiative on multiple dimensions of service performance. Furthermore, they provide insight into the process of development that took place within this initiative, of interactions between context, intervention and user, and document the experiences and perceptions of the anaesthetists that participated as end-users and co-designers of the feedback. Productive future directions for research include: 1) investigation of whether this model of a continuous feedback intervention will port successfully to other clinical specialties, 2) in-depth costs-benefits analysis of a continuous quality monitoring model compared with conventional discontinuous audit, and 3) how variations in context relating to the maturity of local electronic record systems affect implementation and outcome of similar initiatives.

The research findings give rise to the following specific implications:

- 1. Quality monitoring and feedback interventions represent a potentially important quality improvement mechanism, especially where investment is made in their long-term development and sustainment.**
- 2. The design of feedback, its perceived intent, fitness for purpose and context of use are all important considerations for success.**

3. It is essential to involve end users in the development of the feedback system, not only at conception, but to foster an ongoing sense of ownership of the data and a willingness to interact with it.
4. It is important to pair passive data dissemination with support, active engagement and opportunities for intra- and inter-professional dialogue, concerning how to respond to evidence of variations and opportunities for improvement.
5. Continuous feedback can make the natural variation inherent in human-intensive processes, such as health care, visible to improvement efforts. In so doing, subjective and intangible phenomena, such as patient satisfaction, may be objectified for more constructive conversations, enhanced shared decision-making and better control.
6. In the development of monitoring and feedback systems, appropriate attention must be given to how data is used and converted into information for specific user groups, such as clinicians, rather than simply focusing upon what to measure and how reliable those measures are.
7. The success of data feedback interventions should be evaluated using multiple dimensions, including social, organisational and professional outcomes, in addition to clinical endpoints.
8. Whilst downstream post-operative outcomes may be insensitive to the effects of an anaesthetic quality feedback intervention, process-of-care measures such as those associated with post-operative pain management, nausea and perioperative normothermia, are more receptive.
9. Within the health informatics field, considerable scope exists beyond this project to further test evolving theory and practice from improvement science and industrial process control related to how data can be used to support continuous improvement in process-based operations.
10. The trend towards a shift away from intermittent, snapshot audits of practice in favour of a continuous monitoring and continuous improvement model within health care organisations should be the subject of further investigation in terms of its implications for patients and quality of care.

Count: 2496



## Plain English summary

The experience of pain, nausea, comfort and well-being in the immediate post-operative recovery period is critical to patient satisfaction with surgical care. The quality of the anaesthetic care delivered by the anaesthetist is important in controlling pain and nausea and may influence longer term outcomes. Despite this, anaesthetists rarely receive routine feedback on the care that they provide. This is partly due to the challenges of measuring quality of anaesthesia, but additionally it is due to a lack of information systems capable of providing effective feedback. We know from research studies that feedback which is timely, continuous, trusted, non-judgemental and supported by local resources and action planning processes can improve professional practice and standards of care. In order to learn more about whether feedback could be effective for anaesthetists, we implemented and evaluated an initiative over 3 years to provide 44 anaesthetists with basic and subsequently enhanced personalised feedback. We attempted to determine: 1) whether this initiative improved anaesthetic quality measures over time, as evidenced by statistical trends, and 2) whether anaesthetists would engage with the feedback and view it as useful, through conducting surveys and interviews. We found that providing comprehensive personalised feedback to anaesthetists as part of a long-term programme, which they had co-designed, was effective in improving measures of post-operative pain, nausea and quality of recovery from surgery, as well as engaging the local professional group. We concluded that this feedback initiative could be of broader benefit to health care professionals and patients if implemented elsewhere.

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