

Title:

Continuous monitoring and feedback of quality of recovery indicators for anaesthetists: A qualitative investigation of reported effects on professional behaviour

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Current abstract word count: 249

Current overall word count: 4,976

Running title:

Qualitative evaluation of a feedback initiative

Abstract

Background: Research suggests that providing clinicians with feedback on their performance can result in professional behaviour change and improved clinical outcomes. Departments would benefit from understanding which characteristics of feedback support effective quality monitoring, professional behaviour change and service improvement. This study aimed to report the experience of anaesthetists participating in a long-term initiative to provide comprehensive personalised feedback to consultants on patient-reported quality of recovery indicators in a large London Teaching Hospital. **Methods:** Semi-structured interviews were conducted with 13 Consultant Anaesthetists, six Surgical Nursing Leads, the Theatre Manager and the Clinical Co-Ordinator for Recovery. Transcripts were qualitatively analysed for themes linked to the perceived value of the initiative, its acceptability and its effects upon professional practice. **Results:** Analysis of qualitative data from participant interviews suggested that effective quality indicators must address areas that are within the control of the anaesthetist. Graphical data presentation, both longitudinal (personal variation over time) and comparative (peer-group distributions), was found to be preferable to summary statistics and provided useful and complementary perspectives for improvement. Developing trust in the reliability and credibility of the data through co-development of data reports with clinical input into areas such as case-mix adjustment, was important for engagement. Making feedback specifically relevant to the recipient supported professional learning within a supportive and open collaborative environment. **Conclusion:** This study investigated the requirements for effective feedback on quality of anaesthetic care for anaesthetists, highlighting the mechanisms by which feedback can translate into improvements in practice at the individual and peer-group level.

Key words:

- Feedback
- Perioperative Care
- Patient Safety
- Quality Improvement
- Quality Indicators, Healthcare
- Quality of recovery
- Patient reported outcomes
- Patient satisfaction

In the UK, the processes by which quality of care is monitored and reviewed have received considerable attention following well-publicised failures to deliver acceptable standards of care.¹⁻³ In anaesthesia, as in other areas, the requirement to monitor quality of care delivered at the level of the individual practitioner has received considerable attention as part of the implementation of clinician revalidation in the UK (the process by which all licensed doctors are required to demonstrate that they are fit to practice).⁴ There is a need to define criteria by which practicing anaesthetists can monitor and review their own performance.⁵

Significant research effort has been committed to defining valid and reliable quality indicators.⁶⁻⁸ The majority of perioperative quality indicators, however, lack sensitivity or specificity for anaesthetists.⁹ Measurement scales such as the Quality of Recovery (QoR) score have been developed to quantify the important dimensions of recovery from the patient's perspective.¹⁰ Patients report a preference for freedom from pain and post-operative nausea above other potential outcomes.¹¹

Feedback in a healthcare context has been described as 'any summary of clinical performance of health care over a specified period of time, given in a written, electronic or verbal format'.¹² Considerable uncertainty remains around the optimal employment of feedback from quality indicators within a quality improvement or professional development framework.¹³⁻¹⁴

Previous studies and systematic reviews have demonstrated that providing clinicians with feedback on their performance can result in professional behaviour change and improved clinical outcomes.^{12 15-17} Studies suggest that a number of characteristics increase the effectiveness of feedback: the perceived relevance and validity of the data; the credibility and specificity of the data; its source and timeliness; the way in which it is benchmarked; the avoidance of individual profiling; and the persistence of the feedback over time accompanied with additional components (e.g. clinical reminders/educational meetings) to support improvement.^{12 17-23} Analysis of the predictors of perceived usefulness of data on

quality of care for anaesthetists has shown that the most important characteristics for effective feedback are 1) the local relevance of quality indicators, and 2) the perceived credibility of the data.²⁴

Evaluations of feedback have been conducted in other clinical areas but not in a perioperative unit using personalised, individualised feedback for anaesthetists, based on quality indicators measured in the recovery room.^{23 25-27} We implemented and evaluated one such intervention in the anaesthetics department of a large teaching hospital, demonstrating positive impact upon the rated quality of feedback available to anaesthetists, in addition to patient-reported quality of recovery indicators.²⁸ The aim of the qualitative study reported here is to analyse participants' perspectives concerning the value of the initiative, identify practical considerations in designing effective feedback for quality improvement in anaesthesia and to understand the practical, social and psychological mechanisms by which provision of feedback results in change in professional practice.

Methods

Setting and Intervention

The intervention comprised a quality monitoring and feedback initiative at a large London Teaching Hospital in the UK with an annual surgical case load of over 14,000 patients, including acute and elective general surgery, trauma and orthopaedics, along with gynaecology and a number of specialist surgical services. Anaesthetists within the hospital have mixed subspecialty practices.

Quality indicators were monitored in recovery for all surgical patients, including patient temperature upon arrival in recovery, patient-reported pain and nausea, patient experienced quality of recovery and patient flow.^{9-10,29} In the UK, national guidance on prevention of inadvertent hypothermia specifies that patients should have a core temperature maintained to exceed 36 degrees before, during and after surgery.²⁹ The objective was to enable monitoring and regulation of professional practice at individual and peer-group levels through compliance with normothermia guidelines, appropriate use of analgesics and antiemetics, providing data to describe variations in patient experience during recovery and reduction of delays in transferring patients to surgical wards. Monthly anonymous, personalised data reports for individual consultant anaesthetists were developed and the design iterated over time using a continuous quality improvement approach. The pilot phase of the programme was implemented in September 2010 with several subsequent iterations following feedback from anaesthetists. Due to low numbers of trainee cases, rapid rotation patterns and difficulty in isolating the performance of trainees from supervising consultants, trainees did not receive personalised feedback.

The feedback reports contained detailed break-down of individual-level data, trends over time and comparisons with anonymised peers and unit averages (see additional file for examples). The programme was run by a consultant in the department who facilitated the emergence of standards and

norms for practice, through case mix sub-group break down and peer-to-peer discussions around the data as part of the intervention.

Evaluation

Ethics

This study was approved at the host organisation as a service development project following advice from the National Research Ethics Service (NRES). Informed consent was gained from all participants, the right to withdraw was explained and the data obtained were treated as confidential.

Participants

Forty-four Consultant Anaesthetists participated in the initiative and were invited (by the clinical lead and the research team) to be interviewed as part of the evaluation in the March – June 2012 period. Participants had been receiving feedback for a period of approximately 18 months when the interviews were conducted. In addition to the Consultant Anaesthetists, the research team interviewed Surgical Nursing Leads, the Theatre Manager and the Clinical Co-Ordinator for Recovery in order to sample the perspectives of broader stakeholders within the organisational setting in which the feedback intervention took place.

Data Collection

A semi-structured interview schedule was developed in accordance with the research questions and piloted with three consultant anaesthetists. An overview of the structure of the interview schedule (including topic areas covered) is provided in Table One. A total of 21 interviews were conducted by a trained qualitative research team (of experienced social scientists) who were not part of the clinical

department, each lasting between 30 and 60 minutes. Thirteen hours of interviews were obtained and the audio transcribed for analysis.

[INSERT TABLE ONE HERE]

Analysis

Qualitative analysis was conducted principally by a research psychologist (DD) using thematic analysis, informed by principles of Grounded Theory.³⁰⁻³¹ The data were initially open-coded using NVivo software (version 10). Codes were then refined and grouped into broader hierarchical themes with input from a multidisciplinary research team (inductive approach), and guided by the research aims and prior theory (deductive approach). Coding was iterated until saturation occurred (no new themes emerged) and multiple reviews by a team of one Consultant Anaesthetist, one Intensivist, one Junior Doctor and one Senior Social Sciences Researcher were used to develop consensus on interpretation. Specific attention was paid to identification of disconfirming evidence (views and perceptions that did not fit within the emerging themes or that represented varying or extreme views), in accordance with established principles of qualitative analysis.³²⁻³³ These measures, coupled with attention to data saturation, ensured that the emergent narrative was representative of the perceptions and experiences of participants in the programme.

Results

Thirteen Consultant Anaesthetists agreed to be interviewed, representing a range of perspectives including sub-specialty groups and Service Leads (two Service Directors and the Chief of Service). Semi-structured interviews were also conducted with six Surgical Nursing Leads, the Theatre Manager and the Clinical Co-Ordinator for Recovery. Of the thirteen Consultant Anaesthetists that were interviewed, seven were male and six were female. They had been working in the organisation for between two and 32 years ($M = 12.08$ years). This was broadly reflective of the department at the time of data collection (28 males and 16 females/ $M = 10.68$ years).

The final data coding framework comprised five high level themes with 58 individual codes and 26 mid-level categories. Table Two demonstrates the relationship between the five high level themes and example lower level coding categories.

[INSERT TABLE TWO HERE]

In accordance with best practice in qualitative research, individual codes and categories were combined into a narrative that represents the range of respondents' perspectives and representative quotes were selected to ground the researcher commentary in the raw data. Although the overall comments on the potential value of the initiative were positive, variable views were expressed on how best to implement the intervention and develop and use the statistical reports, demonstrating that a range of perspectives were sampled.

With reference to the research aims, two main thematic areas were dominant: 1) the **design** of quality measures and feedback, and 2) the **use** of feedback in departmental quality improvement and individual professional behaviour change. Description and analysis of each theme, and their respective sub-

themes, is provided below, to illustrate the range of views and depth of insight generated within each area.

Themes:

1. The design of quality measures and feedback

The selection of quality indicators for monitoring

Interviewees emphasised the challenges involved in developing an effective quality monitoring system for anaesthesia and post-operative care. It was acknowledged that “quality of care” covered a broad range of areas from the perspective of the patient:

Anaesthetist: *“...We get them out of theatre and out of the recovery and we think that they are okay but then they have headaches, sore throats or constipation...”*

It was stressed that feedback on anaesthetic care needed to take the subjective nature of patient experience into account, particularly in areas such as the measurement of post-operative pain:

Anaesthetist: *“And so if they expect to have no pain whatsoever and they had a bit of pain, now that’s a catastrophe. But if they expected it to be hugely painful then that’s a different number...It’s very difficult to measure.”*

Interviewees highlighted the importance of being able to exert some control over the outcomes of the quality indicators that were being monitored. Effective measures were perceived to be “improvable” and hence sensitive to positive changes in anaesthetic practice:

Anaesthetist: *“I’ve found post-op nausea and vomiting to be a very clear outcome and it’s got a very clear treatment to control it perioperatively. So it’s very easy to know what to address to improve it.”*

However, contextual factors such as the type of surgical procedure being performed, the patient undergoing surgery and the team that the anaesthetist is situated within were also thought to influence outcomes:

Anaesthetist (Perioperative Service Lead): *“Our capacity to influence overall patient outcome is immense but because we are part of a very large team, it’s very difficult to single out what difference that individual anaesthetist makes.”*

Anaesthetist (Perioperative Service Lead): *“That again depends on what operation you’re having, some people are always going to be – tonsils – I hate that operation because they’re always going to have a sore throat no matter what you do.”*

Anaesthetist (Perioperative Service Lead): *“You can give the same anaesthetic to two people who seem identical and one wakes up great and you think, “Oh, great”, and the other wakes up awful and you think, “Ah...”There’s patient factors, there’s anaesthetist factors and there’s just luck sometimes...”*

The presentation of data from quality indicators

Both anaesthetists and perioperative nursing staff expressed a preference for graphical presentation of data over numerical summary statistics, which were considered to be less conducive with understanding areas for improvement. In response to early feedback reports that contained summary statistical data, respondents called for more graphical output:

Anaesthetist: *“I like the fact that it is a graphic, not a number. I found this much more effective.”*

Surgical Nursing Lead: *“Especially the graphics....it’s very easy to spot the difference and what’s going on.”*

The value of two complimentary approaches to presentation of statistical data was highlighted by respondents, enabling users to benchmark their performance both against their own baseline and within a comparable or normative peer group:

Anaesthetist: *“For me to improve my practice I would need to first have my comparable data over a month or over a year. And also how does my data compare to other anaesthetists that do exactly the same thing? And I think then you get a more accurate idea of how you can improve ...or whether you need to improve.”*

Longitudinal presentation of personal/unit data in a time series was considered important for identifying trends and causes of variation over time:

Surgical Nursing Lead: *“But if you can see a trend then you can predict, well, Thursdays are not a very good day, we need extra staff to really give that extra push to get patients up and to do recovery. You can factor that in.”*

A comparative view in which individual consultants and surgical wards could locate their own scores within an anonymised distribution of their peers was additionally considered to be both helpful and motivating:

Anaesthetist: *“I have never ever seen myself graded against others in the department before so actually that was quite good ... it is nice to see where you are in the department as a wholebecause those measures are fairly iron tight.”*

Where comparative data were concerned, however, respondents emphasised that both the data and feedback presentation should be credible and trustworthy in order for individuals to engage with the messages that the reports conveyed. Providing assurances for confidentiality and presenting sufficient breakdown of data to account for case mix issues were imperative and providing meaningfully comparable data for sub-specialty groups was a major area of iteration between early and final versions of the feedback:

Anaesthetist: *“You need to compare like to like. It’s pointless comparing my practice with a colleague who does nothing like me, who does different kinds of cases, different kinds of pathologies.”*

Anaesthetist (Perioperative Service Lead): *“Only consultant resistance and, I suppose, almost embarrassment at having your own figures published. And I think that’s where having it anonymised works well.”*

In terms of the level of data that was fed back, participants emphasised the need for high granular detail and specificity, allowing users to identify individual outlying cases within their own caseload. This was considered important as it maximised the relevance of personal performance data, facilitated recall of specific events and supported continuous learning:

Anaesthetist (Perioperative Service Lead): *“Because if you do 99 things well and one thing badly, you can’t remember the bad thing and you think, “Oh, maybe it didn’t happen”, whereas if you had the information on that and you went, “Okay, so that day I didn’t do that”....then you learn from it.”*

2. Use of feedback for quality improvement and professional behaviour change

Use of feedback at the departmental level for service monitoring and quality improvement

The majority of interviewees spoke about the impact that the feedback initiative had upon their personal professional practice and broader departmental quality improvement activities. Interviewees with a leadership role thought that the continuous monitoring and feedback aspects of the initiative supported improvement at the department level, both through evidencing gains in service quality and providing motivation to raise standards:

Anaesthetist (Perioperative Service Lead): *“...And if we see we are down here in the lower ranks of quality in terms of nausea, vomiting and pain relief, that’s a tremendous incentive to move ourselves up to there...If I can show that my team have decreased nausea and vomiting, pain, increased temperature over time, that’s a result. That’s the continuous quality improvement thing.”*

Surgical Nursing Lead: *“Having data is always helpful when trying to improve practice because then you’ve got a starting point and then if you make improvements you’ve got figures that show your improvement.”*

Furthermore, the presence of objective data on quality of care issues meant that service leads were more confident in approaching other groups in the perioperative pathway over quality issues:

Theatre Manager: *“I would get the lead nurses and sit down with them and just go through some of the data. And say, ‘you know, we send this out to you every month. Do you read it? Do you take it on board? How do you think we can start making these changes, because the impact on recovery is sometimes very significant?’”*

The need for an effective balance between quality improvement and performance management was discussed and the issue of an appropriate level of anonymity raised. Some interviewees felt that reports should not be associated with performance management if they were going to be successful in promoting reflection and improvement:

Anaesthetist: *"I think most departments are going from a level of having no feedback to having some feedback and the initial introduction of this feedback was done in a very stepwise, gradual, non-threatening way because we knew that that would cause problems otherwise... And I think that was very successful and I think as a consequence that people have now embraced this information a lot more."*

Departmental leads, however, felt that they had a responsibility to act upon data that indicated low quality care or poor compliance with guidelines. It was thought to be important that anonymity could be bypassed if there was a risk of unsafe care being delivered:

Anaesthetist (Perioperative Service Lead): *"I think you have to have a crackable code [to identify individuals] if somebody can make the case that patient safety may be at risk if it's uncrackable."*

Use of feedback at the professional level for personal monitoring and behaviour change

At the level of the individual consultant anaesthetist, providing systematic and timely feedback on the patients' experience of recovery from surgery was welcome information that had previously been either incomplete or ad hoc in availability:

Anaesthetist: *"There's been no history of individualised feedback, so having data that relates to my own practice is phenomenally useful."*

Interviewees reported that providing feedback was of value because it supported individual level improvement in professional practice and was associated with professionalism:

Anaesthetist (Perioperative Service Lead): *"... I think feedback is very important for us to improve and look back on our practice and to change things that aren't working properly."*

Anaesthetist: *"It is professionalism....if you don't treat pain properly, you need to do something more"*

Similarly, recovery nursing leads emphasised the utility of systematic feedback on patient transfer times for improving patient flow and the patient's post-operative experience:

Surgical Nursing Lead: *"We've got access to data now; we know how long it takes for every single patient to be collected from recovery and I can communicate to staff and investigate any issues"*

Surgical Nursing Lead: *"I have no qualms with it being used because if we haven't got the information and the evidence then how can you improve?"*

Interviewees suggested that peer comparisons might be perceived as threatening by some individuals, but that it was important to encourage a constructive and responsible approach that involved the individual reviewing their own practice and actively looking for opportunities to improve practice:

Anaesthetist (Perioperative Service Lead): *"Well, I'd love to compare myself to somebody doing a very similar list, and if I'm worse than they are then obviously I'd be very upset about it (laughs). But I would probably do something about it."*

Anaesthetist (Perioperative Service Lead): *"And you look at it initially and you think, 'No, that can't be right. How can I be down here? Down at the bottom.' And the mature response is, 'Well, actually, perhaps I am. Let's go and really have a look at those patients and let's see if I can improve.'"*

Clinical Co-Ordinator for Recovery: *"I would look at the report and see that I'm doing very badly I would eliminate the reasons one by one to improve."*

It was suggested that review of practice might involve seeking support from colleagues in order to identify "high performers" or areas of best practice that could be emulated:

Anaesthetist: *“But if there is a problem like that, and you can’t see how you can improve it, then you have got to work out what the barrier is and I suppose you might then need to talk to a colleague about that, because if you are having pain problems and you are doing everything you could do, it could be your epidural technique, it could be something.”*

In this sense, interviewees reported that there were instances in which it was beneficial to identify individual’s data within the reports, but emphasised that it was important that this was undertaken in a supportive collaborative environment in which quality issues were discussed constructively rather than punitively:

Anaesthetist (Perioperative Service Lead): *“I don’t think we’re particularly adversarial here, and I think we generally, kind of, discuss things and we’re quite open with each other about our data and about how we do things.”*

The fact that the majority of consultants felt comfortable with the feedback reports and presentation of personal level data on quality of care was evidenced by interviewees commonly reporting use of the data during review and appraisal processes:

Anaesthetist: *“I take these numbers to my appraisal and then the next stage is going to be revalidation ... you can show how many cases you have done, your case mix and your results....I think it will be very useful.”*

During the interviews, many participants described specific improvements they had made to their own or observed in others’ practice, based on the feedback (see vignettes in Table Three). Many of these accounts followed a similar narrative, involving realisation that there was more variation in outcomes than had originally been presumed, personal review of practice/discussion with colleagues, implementation of a change in practice, and evaluation through monitoring the effects upon key quality

indicators. However, it was noted that feedback was less useful for those anaesthetists who had a small case load:

Anaesthetist: *“It’s a good thing, it is somewhere to start. I don’t necessarily, I don’t personally think that it’s useful data for me, because of what I have just said, my patient load in the main theatre is so small that I only do cases there on Tuesdays and I do cases here on the Thursdays on alternate weeks and the rest of the time I am in obstetrics and I don’t get data from that.”*

[INSERT TABLE THREE HERE]

Discussion

This study investigated the experiences of Consultant Anaesthetists, Perioperative Service and Nursing Leads participating in a continuous quality monitoring and feedback initiative based upon quality of recovery indicators. Whilst the use of anaesthetic quality indicators and the continuous quality improvement approach have become a popular topic in service development, there has been little investigation into the acceptability of such programmes from the clinician's perspective or the mechanisms by which quality monitoring and feedback might lead to improvement. The key practical findings from this study, including the potential impact of quality monitoring and feedback as an intervention and the lessons learnt concerning design of effective feedback, are summarised within Table Four.

[INSERT TABLE FOUR HERE]

Previous research into the effects of audit and feedback on professional behaviour and outcomes has found moderate positive effects, but provides little insight into the mechanisms by which a feedback intervention leads to improvement in outcomes.¹² In the current study, the participating anaesthetists predominantly reported that receiving continuous, regular feedback on quality of recovery was a useful tool to monitor and improve professional practice. Following iterations of early versions of the feedback in response to feature requests, the final format provided a valued and novel means of learning from anaesthetic outcomes in the immediate post-operative period, for the anaesthetist group. Receiving objective independent data on variation over time and variation across the local peer group, was commonly reported to provide insight into variations in personal practice that motivated individuals to take a number of actions to improve patient-reported outcomes. Reported actions included changes to specific areas of personal clinical practice (Table Three) and engaging in dialogue with peers to learn from "high performers" or develop consensus on best practice. At the service level, perioperative and

nursing leads were able to use the data to substantiate hitherto unmeasured variations, evidence problem areas and discuss remedial strategies with collaborating units and nursing teams.

The views and perceptions of participating anaesthetists helped shape the design of the data feedback intervention, the characteristics of which may facilitate development of similar programmes in parallel settings (Table Four). These included the selection of specific and relevant quality indicators, the provision of peer benchmarking and individual trends over time, and a granular breakdown of personal data to support the identification of outlying cases.

An important determinant of engagement identified in the current study was the perception of the credibility and specificity of the quality indicators, used to provide feedback to anaesthetists. This extends the findings of previous research which suggested that the relevance of quality indicators to the local service area and trustworthiness/freedom from bias were important predictors of perceived usefulness of quality indicators by anaesthetists and other professional groups.^{17-18 23-24} In particular, the relevance of using post-operative pain and nausea and vomiting as continuously collected indicators of quality of anaesthetic care was emphasised in the current study; indicators which have been empirically linked to prolonged post-operative stay after ambulatory surgery³⁴ and overall patient satisfaction.³⁵

Our analysis suggests that a combination of normative comparison (peer benchmarking) and individual-level data presented in time series may have the greatest impact, the latter finding being aligned with run and control chart theory, commonly used in quality improvement.³⁶⁻³⁷ Requests were made for successively more granular break-down of personal data (stratified by patient demographics, time period and procedure type, with identification of individual outlying cases that had single or multiple metrics out of acceptable range). The move away from aggregated data (e.g. monthly average figures for the whole department) was supportive of individuals' and sub-groups' efforts to pinpoint specific areas of care delivery that were potentially problematic and that may be masked when data is reported

at a higher level of aggregation. We surmise that the capability to disaggregate data in this way should be a feature of any monitoring system that aims to support improvement in practice and this holds implications for the way in which future audit and feedback should be conducted, both at local and national level.

Anaesthetists reported that the institutional context and the way that the initiative was implemented was important for acceptance and engagement by the local professional group. The programme was peer led, championed by a consultant anaesthetist within the department and it was clear that framing this initiative as departmental performance management, or financially/productivity-oriented would have achieved a different response from the professional group. The importance of appropriate leadership and in particular peer-led feedback on performance, for this type of initiative, has been highlighted by prior research.³⁸

Continuous review and learning from feedback on patient-reported outcomes was reported to be synonymous with professionalism, in line with research into excellence in anaesthesia which identifies continuous learning from challenges in an ongoing cycle of development in a supportive environment, as an important enabler.³⁹ Participants reported experiencing perceived social pressure as a result of the initiative to conform to emerging norms for acceptable performance within the department, without the explicit threat of formal sanctions. There was a strong understanding that ultimately departmental patient safety had to be balanced with the protection of individual clinicians whilst acknowledging variations in case mix across sub-specialty practice.

Interviewees reported a need for more support and guidelines in identifying exactly when information needs to be acted upon. Research has shown that low baseline compliance with desired practice increases the effectiveness of feedback.¹² This finding can be linked to the emerging awareness of the need for active rather than passive feedback where the interest of the recipient has been engaged,

through processes such as goal setting, continuous education, or reflection on the implications of the information for improving care.⁴⁰ A clear implication of our work is that 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 in practice.

In terms of study strengths and limitations, whilst exploring the perceptions of anaesthetists was essential in understanding how the programme was received and translated into changes in professional behaviour, the possibility of bias introduced through a self-selecting sample and the interview process itself must be acknowledged. In order to counter these effects, all consultant anaesthetists were encouraged to participate by the clinical lead for the project, all interviews were conducted by a trained qualitative research team who were not part of the clinical unit, a semi-structured interview schedule was used and the data were subject to a systematic process of analysis and review by a multidisciplinary team to check accuracy and interpretation. A strength of qualitative research is its ability to provide rich descriptions of mechanisms of effect, appropriate to this study's aims.⁴¹

Case study research is by its nature context-specific and the fact that this initiative developed over four years, led by a consultant anaesthetist with research collaborators and developed with broad input from the local consultant peer group, should not be ignored when considering the portability and repeatability of the study findings. Similarly, other departments may have a different experience in trying to engage clinicians and trainees at all grades, implement changes and share outcomes. However, the perceived benefit from this project has been in enabling individuals to rapidly and regularly see their current performance data in the context of historical trends and in comparison with their peers, and we believe it is this fundamental principal that is the important generalisable intervention. Further research is required to test whether similar models of quality monitoring and feedback will be as effective in changing practice in other contexts.

This study reports one of the first attempts to systematically introduce and examine a comprehensive, personalised quality monitoring and feedback process for consultant anaesthetists, based upon patient reported quality of recovery from surgery. Our findings provide novel and practical information concerning the mechanisms by which audit and feedback interventions result in professional behaviour change within anaesthesia and how a professional clinical peer group reacts to systematic data feedback. The lessons learnt from this study support application of anaesthetic quality indicators within the context of a clinical unit's continuous quality improvement activities.

Details of authors' contributions

JB, GA, SJB, AS and AB were co-investigators on the grant that supported this work and all contributed to the conception and design of the study. JB was principal investigator and primary PhD supervisor to DD and AB was secondary PhD supervisor to DD. JB collected the data upon which this study is based. Data analysis was led by DD with input from JB, GA and SJB. DD and JB drafted the manuscript and all authors contributed to substantial revisions of the manuscript and development of intellectual content. All authors approved the final version to be published.

Acknowledgements

We are greatly indebted to the consultant anaesthetist group and Post Anaesthetic Care Unit staff for their continued support of this work. The authors would also like to thank Igor Wei and Floor Aleva for their support with data collection and Joanna Moore for her input to the qualitative analysis process.

Declaration of interests

The authors declare that there is no conflict of interest.

Funding

This work was supported by funding from the National Institute for Health Research (NIHR) Health Services and Delivery Research (HSDR) Programme (project number 11/1015/21), the Collaboration for Leadership in Applied Health Research and Care (CLAHRC) and the NIHR Imperial Patient Safety Translational Research Centre and the NIHR Comprehensive Biomedical Research Centre based at Imperial College Healthcare NHS Trust and Imperial College London. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health.

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Table One: Simplified overview of semi-structured interview topic guide

Topic	Focus of interview questions
Respondent experience and views on effective feedback	<ul style="list-style-type: none"> • The important aspects of quality of care relevant to anaesthetics practice • What existing feedback was available to clinicians, prior to the study initiative
Evaluation of the study initiative	<ul style="list-style-type: none"> • Thoughts on the initiative and the feedback reports provided • Initial reactions to seeing feedback data • Approach to using the information contained within the feedback reports
Departmental perspective	<ul style="list-style-type: none"> • The potential value of the initiative to the department • Views on how the department should be using the data going forwards (if at all).
Project stakeholder questions	<ul style="list-style-type: none"> • Implications of the feedback initiative for the broader anaesthetics specialty • The role of initiatives of this type in clinician revalidation
Future development	<ul style="list-style-type: none"> • Opportunity to suggest any specific measures, features or functionality that participants would like to see included in future versions of the reports. • Any further support required in order for the feedback data to be used effectively to improve patient care.
Broader context	<ul style="list-style-type: none"> • Barriers to engagement with and utilisation of the initiative • The role of the organisational context and levels of transparency and

	the impact of this (if any) on the success of the feedback initiative
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Table Two: Emergent thematic framework from the qualitative analysis: High level themes with examples of lower level coding categories

High-level theme	Examples of low-level coding categories
Value of feedback for clinicians.	Importance of receiving feedback on patient experience in order to provide high quality care.
	Anaesthetists at this trust generally did not receive systematic feedback from recovery before the initiative began.
	The use of feedback was associated with professionalism and the concept of being 'a good anaesthetist'.
Selection of quality indicators and reporting format.	Quality of care covers a broad range of factors, some of which are very difficult to objectively conceptualise, categorise and measure.
	Nausea and pain are important quality indicators for feedback, from the patient's perspective
	Trust in the metrics recorded is important.
	High specificity of feedback is important.
	Need for perceived control over the outcomes of quality indicators.
	Peer comparisons would be more useful if case mix was considered.
	It would be useful to be able to instantly see your own feedback as trends over time.
	The ideal combination is normative feedback and individual feedback over time.
	The need for anonymity.
Preference for graphics over numbers and statistics.	
Application of feedback to departmental quality improvement	Feedback reports should not be viewed punitively.
	Data must be identifiable at some level if they reflect potential patient safety issues and severe outliers need to be dealt with via governance procedures.
	Case mix needs to be effectively incorporated in order to use feedback reports for any type of performance management.

and professional behaviour change.	Feedback reports quantify/objectify an anaesthetist's understanding of their own performance which promotes reflection on practice and actions to drive potential improvement.
	Feedback reports can provide reassurance to anaesthetists and are useful as evidence for revalidation and appraisal.
	Further support is required to optimise the translation of feedback into improvements.
	It is particularly difficult for anaesthetists with small caseloads to use feedback effectively.
The context for feedback initiatives.	Additional factors such as members of the surgical team, the specific procedure and the specific patient also influence a patient's quality of recovery and therefore reduce the level of control that an anaesthetist has over outcomes.
	Maintaining the feedback reports increases demands on time and resources in the department.
	People are generally comfortable with the collection and discussion of performance data in this organisation.
Cumulative and serial effects of the intervention.	Initial scepticism fades over time and people identify more benefits to receiving feedback.
	As the available longitudinal data accumulates, the value of the feedback increases as a driver for improvement.
	Importance of ongoing iterations being made to the feedback reports (e.g. requests for 6-monthly/yearly summary data, improved specialty-level benchmarking and refinements to data collection processes).
	Need for even greater organisational transparency to surround the initiative as it continues.

Table Three. Example vignettes of spontaneous review and action to improve quality of care based on feedback reports

Summary of practice area	Anaesthetist's reported reaction to feedback
Use of intravenous preparation to ensure analgaesic effect early in recovery for gynaecological patients	<p><i>"I thought: 'My goodness, I do quite a lot of patients'; 'my goodness, oh, some of them are in more pain than I thought they would be in'. And I did some things to change it; so I changed my own practice a little bit, particularly on the gynaecology patients... we were using a Diclofenac suppository which doesn't really start working in recovery – it's working about half an hour later; whereas I changed it to an intravenous preparation of Ketorolac, which is working in recovery and works quite nicely."</i></p>
Effect of nitrous oxide on Post-Operative Nausea and Vomiting	<p><i>"Yes, I started off quite nauseous...I use quite a lot of nitrous oxide, I noticed that I was down below half way in my nausea and vomiting [rating], I stopped using it and I got above half way. I did not believe before that that nitrous used by an experienced man would influence PONV, I was wrong, and that showed it to me."</i></p>
Increased use of morphine in non-regional block patients undergoing localised procedures	<p><i>"...what is interesting, I was convinced as a regional anaesthetist that I was very close to God in terms of analgesia and my patients had no pain. What I was doing was only concentrating on those patients whom I put a block in, and only going back into recovery to see those patients for the wonderful pleasure of getting the accolade from the patients saying, 'I've no pain.' I wasn't going to see the other operations where I couldn't do a block. What that</i></p>

	<p><i>[the feedback report] said to me is, actually, some of my patients are in quite a lot of pain. So I went back to see them and they were, and since then I've, basically, given more morphine, quite simply, and I think it has had an influence. It's still not perfect but it's pushed that [the trendline] in that direction. So these very basic data have called things to my attention."</i></p>
<p>Use of forced warm air blankets in anaesthetic room to maintain perioperative normothermia</p>	<p><i>"I'm now more obsessive about temperature control because the most objective [metric] is temperature, I know I can push that up, and so I now have hot air blowers on the patients in the anaesthetic room if I'm going to be in there for a while rather than leave them cooling off for fifteen minutes, because you never catch that fifteen minutes up. So, yeah, it's had an impact."</i></p>
<p>Improvement to analgesics</p>	<p><i>"Yeah, I have. I am using – I was already doing it anyway, starting to, and it has made me think I should do it more. I'm being a lot more heavy handed with opioids, particularly towards the end of the case. I'm thumbing in a lot more."</i></p>
<p>Active warming for short duration cases</p>	<p><i>"Yes, I think some of the shorter cases, where I wouldn't previously think it was necessary to actively warm the patients, and I think I realised that even the shorter case patients could [become cold] quicker than I anticipated, I think. So yeah, more warming"</i></p>
<p>Reduction of unnecessary antiemetics</p>	<p><i>"I've cut down on the amount of antiemetic I give. I used to give everybody Cyclizine as routine and that does make people a little bit drowsy – it's an anti sickness drug and so now I speak to Ondansetron and Dexamethasone, if I'm not worried about giving</i></p>

	<p><i>Dexamethasone. If not, I'll just give Ondansetron. So I'll only give Cyclizine if they're a high risk. So I've cut down on that because my PONV scores were so good – I thought, "Well why am I making everybody drowsy?"</i></p>
<p>Level of analgesics for specific patient groups</p>	<p><i>"From the feedback reports, I saw that my bariatric patients were in a bit more pain than anyone else so it just made me think about giving more analgesia than I'd already been giving them and for some of my orthopaedic patients too."</i></p>
<p>Change in level and type of opiates</p>	<p><i>"So I've changed my practice regarding analgesia management inter-operatively...Well, I've looked at the reports, see that my numbers are not where I like them to be and then I just thought "Well, under those circumstances I need to change my practice" so I've changed the amount and the type of opiate I'm giving."</i></p>

Table Four: Lessons learnt concerning effective quality monitoring and feedback to stimulate improvement in practice

<i>Peer-led quality monitoring and feedback as an intervention to improve care</i>	
Impact on professional behaviour	<ul style="list-style-type: none"> • Systematic, regular feedback on the patient experience of recovery from surgery is potentially very useful to anaesthetists seeking to monitor their own practice. • Periodic review of personal outcome data was regarded as a mark of professionalism • Having outcome data linked to variations in practice stimulates conversations with peers around the best approach, can lead to new insight into best practice and can constructively challenge current practice. • Simply providing personalised data feedback (knowledge of results) can stimulate professional behaviour change and improvements in practice and this effect can be enhanced through coordinated peer-led quality monitoring and improvement initiatives
Impact at service level	<ul style="list-style-type: none"> • Objective measurement and systematic feedback makes variations in care visible, where otherwise variations might go undetected. • Continuous feedback of performance data enables evaluation of quality improvement initiatives and other changes to practice, supporting a more objective and scientific approach to service development. • Investment in sustained quality monitoring and feedback at the individual

	<p>professional level supports clinician revalidation and appraisal processes and provides evidence of fitness to practice.</p>
<p><i>Design of effective quality monitoring and feedback processes</i></p>	
<p>Measures of quality</p>	<ul style="list-style-type: none"> • Quality of care is multi-dimensional and from the patient's perspective, subjective. Quality measures must be appropriately designed and selected • Effective measures for improvement must address areas that are within the control of the anaesthetist
<p>Data presentation</p>	<ul style="list-style-type: none"> • Graphical data presentation is often preferable over numerical statistics • Longitudinal (personal variation over time) and comparative (peer-group distributions) are useful complementary views of performance data that clinicians find motivating
<p>Data analytics</p>	<ul style="list-style-type: none"> • Developing trust in the reliability and credibility of the data through, for example, case mix adjustment, is an important step in implementing a quality monitoring and feedback process • Making data feedback specifically relevant to the recipient and providing high granular detail is supportive of continuous professional learning and maximises the usefulness of the data
<p>Institutional context</p>	<ul style="list-style-type: none"> • Level of anonymity and departmental oversight for quality data should be agreed with all stakeholders in order to balance clinician-led improvement with departmental assurance of patient safety

	<ul style="list-style-type: none">• Dialogue regarding performance variations must take place within a supportive collaborative environment which rewards continuous improvement rather than imposing punitive sanctions
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