Quality improvement in perioperative medicine: driving the revolution

ABSTRACT

Perioperative medicine and quality improvement are both emerging fields with the potential to contribute to safer and more reliable care for surgical patients. One key component has been the evolution of the national audit project programme. This article describes the current state of quality improvement within perioperative medicine, the evolution of the national audit project programme and the effects it has produced on the quality of patient care. The article also highlights opportunities for health-care professionals to engage with this innovative area of medicine.

Perioperative medicine and quality are terms which are intrinsically linked. The Royal College of Anaesthetists' (2015) definition of perioperative medicine encompasses reducing variation in practice and improving patient outcomes. Combine this with the principles of safety, efficiency and equity, long implicit within the field of anaesthesia, and one arrives at the definition of quality improvement provided by the Health Foundation (2013). The synergy between the two concepts is clear. Perioperative medicine provides a structure for the care of patients through diagnosis, surgery and recovery, and quality metrics provide the analysis of how well these aims have been achieved. Thus quality improvement allows clinicians to measure and improve each facet of the patient journey, increasing safety and efficiency while limiting variation.

Quality improvement has existed within health care for decades (Chassin and Loeb, 2011), evolving from domains such as clinical governance, local audit, and mortality and morbidity meetings. Recently, efforts have been made to form these disparate and often ineffective tools into a coordinated approach.

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Quality improvement methodology now forms a staple part of medical curricula, with teaching programmes and skills in high demand (Royal College of Anaesthetists, 2010). The Academy of Medical Royal Colleges (2016) has mandated that quality improvement science underpins all levels of medical training.

As a new and evolving field, perioperative medicine has already sought to put quality improvement at the heart of its mandate for improving patient care. This is evidenced in the joint consensus statement between the American Society for Enhanced Recovery and the Perioperative Quality Initiative published this year (Moonesinghe et al, 2017). While perioperative medicine has the ability to embed quality improvement methodology at an early stage, in anaesthesia this process has developed over time.

In 2000, the Royal College of Anaesthetists first attempted to standardize the process and output of local audit projects via the publication of *Raising the Standard*, a compendium of audit recipes for individual institutions (Royal College of Anaesthetists, 2006). While this gave focus to topics of interest, processes and outcomes measured, the lack of a central repository for these results made it difficult to look across a larger scale. The ability to precisely identify, define and measure a problem is integral to the process of quality improvement. To enable this to take place individual institutional audit has evolved into the national audit project programme, coordinated by the National Clinical Audit and Patient Outcomes Programme, commissioned by the Healthcare Quality Improvement Partnership for NHS England. The Healthcare Quality Improvement Partnership maintains the National Audit Registry, currently comprising 32 separate topics (Healthcare Quality Improvement Partnership, 2017).

Currently the success of national audit projects is determined by a combination of the driving force of the project organizers and the engagement of health-care professionals on the shop floor. Increasingly, however, participation in national audit projects is being prioritized by the Department of Health, by linking data collection to tariff payments and embedding national audit project results in policy documents such as *The Five Year Forward View* (NHS, 2014). Completeness of data collection is increasingly considered a quality metric and there is a suggestion from national audit projects that the simple act of collecting data may improve practice at a local level, potentially through a type of 'Hawthorne effect' (Holden, 2001).

The combination of incentivized participation at an executive level and increased education and encouragement at a grassroots level means that not only is quality improvement open to all levels of health-care professional, it is increasingly seen as a responsibility of all members of the perioperative care team.

Aims

This article presents an overview of three ongoing national quality improvement initiatives (Healthcare Quality Improvement Partnership-commissioned audit projects) relevant to perioperative medicine. It describes the obstacles to implementation of effective quality improvement in clinical practice, the limitations of these initiatives and potential solutions. Finally, it highlights opportunities for health-care professionals to engage in and contribute to improvement science.

Audit projects

The National Emergency Laparotomy Audit

The National Emergency Laparotomy Audit (NELA) is an Healthcare Quality Improvement Partnership-commissioned

audit led by a partnership of the Royal College of Anaesthetists, Health Services Research Centre and the Royal College of Surgeons. Designed to analyse and report processes and outcomes related to emergency laparotomy surgery, the audit began in 2012 and released its second report for data collected between December 2014 and November 2015 (NELA Project Team, 2016).

The National Emergency Laparotomy Audit evolved in conjunction with the Enhanced Peri-Operative Care for High-risk Patients (EPOCH) trial, following emerging work suggesting increased perioperative mortality rates and widespread inter-hospital variation in care for patients undergoing emergency laparotomy (Pearse, 2014).

From inception the National Emergency Laparotomy Audit has sought to measure not only surgical outcomes (e.g. mortality, length of stay) but also compliance with process markers. These process markers include interventions made along the patient journey which, if delivered within an appropriate timeframe, are consistent with considered best practice, e.g. delivery of antibiotics within 1 hour of detected sepsis.

The National Emergency Laparotomy Audit has produced three main reports since its beginning. An organizational audit examined the structures and frameworks in place nationally for delivery of emergency laparotomy surgery. The subsequent two reports presented results for adherence to process measures and produced case mix adjusted, standardized mortality ratio data for individual hospitals by combining data from the Office for National Statistics. These are presented as funnel plots, with two and three standard deviation lines marking the accepted thresholds for 'outlier' centres (*Figure 1*).

The 2016 report's recommendations focus on providing appropriate pathways of care for emergency laparotomy patients in order to provide the structure for achieving the process measures described, for example the ability to access computed tomography imaging, reported by a consultant radiologist in a timely manner, or the presence of both consultant surgeon and anaesthetist in theatre for high-risk cases. The 2016 report confirmed the high-risk nature of emergency laparotomy surgery, showing 30-day mortality rates of 11.1%. It also demonstrated improvements in key process measures between audit years, for example, a larger proportion of patients being risk assessed before surgery (64% *vs* 56% the preceding year) (NELA Project Team, 2016).

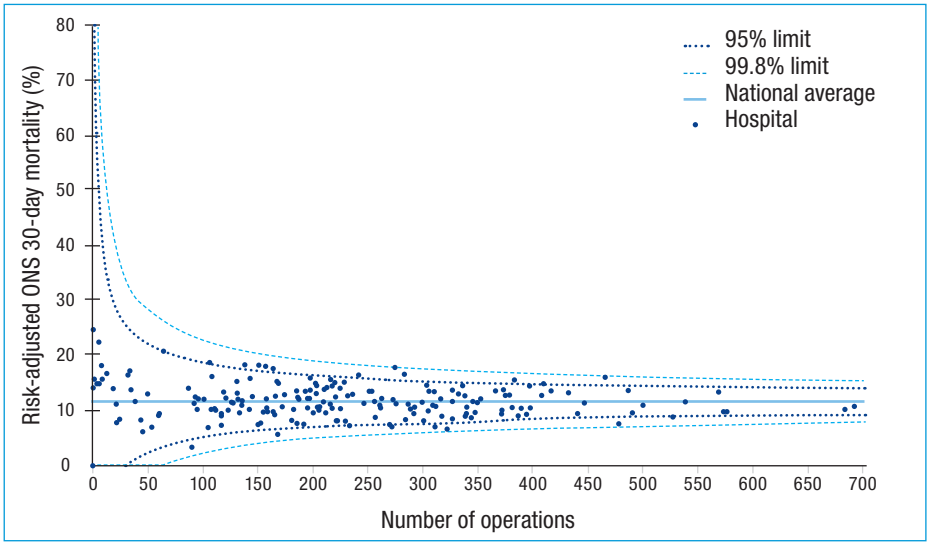


Figure 1. Funnel plot showing risk-adjusted Office of National Statistics (ONS) 30-day mortality after emergency laparotomy against number of operations performed per year with 2 and 3 standard deviation lines. From NELA Project Team (2016).

The National Hip Fracture Database

The National Hip Fracture Database runs within the Falls and Fragility Fracture Audit programme commissioned by the Royal College of Physicians, in conjunction with the British Orthopaedic Association and the British Geriatrics Society. It is one of the longest running database and audit programmes in the UK, beginning in 2007 and issuing annual reports since 2009. Orthopaedics has a strong pedigree in this area – the National Joint Registry also hosted by Healthcare Quality Improvement Partnership is the largest of its kind in the world (Healthcare Quality Improvement Partnership, 2017).

Like the National Emergency Laparotomy Audit, the National Hip Fracture Database has identified key process measures which influence patient outcomes. These include logistical measures such as timely admission to an orthopaedic ward, clinical measures such as receiving a perioperative medical assessment, adherence to gold standard treatments like intramedullary nailing for subtronchanteric fractures. The National Hip Fracture Database generates and presents a large amount of data, which can be viewed online per institution.

Gathering data and generating improvement are rarely synonymous, however, and it is in this respect that the National Hip Fracture Database stands out. The audit programme is comprehensive, with every eligible hospital participating in data submission, 177 in the last report. This has captured data on hip fracture cases for England, Wales and Northern Ireland, nearly 65 000 patients per year (Royal College of Physicians, 2017).

The National Hip Fracture Database has used its established longevity and experience within this field to evolve the audit over time. Currently there is a clear focus on improving the quality of service delivery and outcomes using data generated by the reports.

The 2016 report highlights positive examples of negative outlier centres working the national audit team to improve performance. One example given is Worthing Hospital. A mortality outlier in 2010, it has subsequently improved to a crude mortality rate significantly better than the national average (Royal College of Physicians, 2016). Throughout the National Hip Fracture Database website are examples of how the audit has supported institutions, including a case study where an expert team was invited into an outlier hospital to help with analysis and improvement.

The National Hip Fracture Database is charting progress in the area of hip fracture management, showing a declining 30-day mortality trend from 8.5% in 2011 to 7.1% in 2015. Despite this, mortality at 1 year following hip fracture still approaches one third, suggesting another common theme in clinical audit of the 30-day mortality not telling the whole story.

The Paediatric Intensive Care Network

The Paediatric Intensive Care Network is another Healthcare Quality Improvement

Partnership-commissioned initiative produced in collaboration with the Paediatric Intensive Care Society. Since beginning in 2001 it has recorded data for this specialized population amounting to approximately 20 000 cases per year (Universities of Leeds and Leicester, 2016).

While not the largest clinical audit in Healthcare Quality Improvement Partnership's portfolio, its reports have produced interesting insights into some of the problems encountered within the National Audit Project process. In its 2016 report the Paediatric Intensive Care Network highlighted large geographical variations in performance, based on case mix and admission criteria. Previous reports have been used to shape and inform new quality metrics and areas for investigation, such as rates of readmission to critical care within 48 hours, as well as a focus on processes such as retrieval to tertiary centre care by specialist transfer teams. This is important as the report also details potential problems with the use of accepted measures of quality like mortality rates in this population.

Combined audit data from 2013 to 2015 revealed that 96% of patients admitted to paediatric critical care are discharged alive, suggesting that measuring mortality rates is an important but insensitive marker of quality. Despite this the 2016 report did identify one centre as an outlier for case mix-adjusted mortality, with a higher number of observed *vs* expected deaths (*Figure 2*). Following identification of the outlier centre, the audit went through a rigorous statistical process to investigate this, ultimately concluding that the findings were the result of deficiencies in the case adjustment model used rather than a clinically significant result. This illustrates the importance of rigorous investigation and sensitive handling of potential outlier data.

Discussion

Quality improvement is synonymous with perioperative medicine and national audit projects can provide information which acts as a catalyst to allow quality improvement to take place at a local level. One of the first steps of any quality improvement project is to identify a problem to fix or a goal to achieve. Second the current level of performance relative to that objective must be ascertained. Ideas and solutions to bridge the gap in performance are planned and executed and finally, the service is re-evaluated to identify whether improvement has occurred. This model for quality improvement has been summarized elsewhere as 'plan, do, study, act' or PDSA cycles (Taylor et al, 2014).

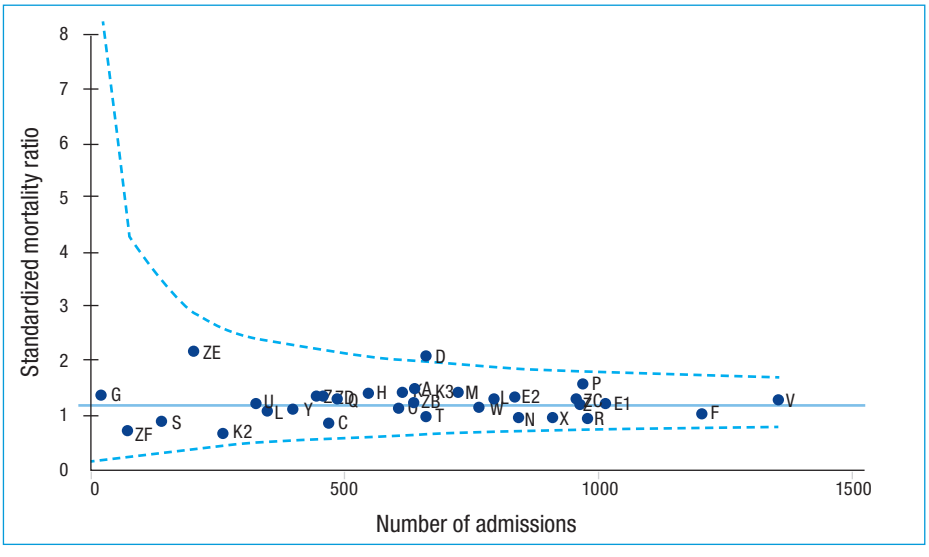
At a local level, implementing change can be a daunting process with numerous obstacles to tackle. These include unwillingness to change, the burden of data collection and limitations in data interpretation skills to name a few. Engaging with national audit projects is part of the solution, but these projects have their own issues and limitations. Engagement with a national audit project at a local level fosters acceptance of the validity of the problem being investigated and investment in creating a solution. In some respects, national audit projects can ease the burden of local audit and quality improvement projects. The processes and outcomes to be measured are already decided and the remaining issues centre around the logistics of ensuring quality local data collection, in a timely fashion. Complicated statistical data analysis is done for local hospitals at a national level and established centres associated with the national audit projects, which are skilled in the interpretation and analysis of such data, can help local centres with data interpretation.

However, questions remain about the efficacy of national audit projects. Following the publication of national reports and local hospital data it remains unclear to what extent this information is used on the ground. If a centre is a national outlier for mortality, this will likely generate interest and prompt further investigation at departmental and executive level, but what of the hospital where results fall within the recommended tolerances, or are simply 'average'? In an ideal world, this would prompt a similar reaction to that of a negative outlier finding, stimulating further improvement to strive towards the best quality care possible. However, in reality centres may simply accept the result and move on, focusing scarce resources elsewhere. To address this, many national audit projects are moving away from presenting a two standard deviation line on their mortality funnel charts, while centres outside three standard deviations are still highlighted for investigation.

There is an additional concern regarding the outcomes measured in national audit projects. As presented here, accepted normal measures of quality such as mortality may not be appropriate to investigating a particular clinical area. There may be a larger emphasis on the measurement of processes and structures. These process measures are in general chosen using the best available evidence for the best possible practice for the particular clinical condition, occasionally expert consensus opinion may be all the evidence available. This becomes an issue when results are returned which see centres with good outcome data but poor compliance with process measures. This should stimulate the same degree of interest as negative findings and further investigation into what makes this centre different from others should occur.

The next key step in developing the field of quality improvement must be bridging the gap between national audit project results and grassroots organizational and cultural change. In order to accomplish this both existing and newly commissioned national audit projects

Figure 2. Standardized mortality ratios measured against number of admissions to individual paediatric intensive care units. From Universities of Leeds and Leicester (2016).



will be required to adapt to a changing landscape of health care. Priorities will include making use of new and emerging technologies such as the use of artificial intelligence systems and neural networks to decrease the time burden on individual clinicians and improve data quality (Gabel et al, 2016).

At every level within a hospital, different data are required within different timeframes. Currently a major drawback of national audit projects is the slow gestation between the collection of data and publication of results. The ideal platform for quality improvement requires sustainable data collection and clear presentation of results within a shorter timeframe, usually mesocycles of between 1 and 3 months. This enables analysis of the data, reflection on problems, introduction of solutions and subsequent re-measurement. National audit projects are increasingly using more sophisticated tools such as online dashboards, to deliver individual hospital information for use at a local level, updated at regular intervals.

This concept has been expanded by the Perioperative Quality Improvement Programme. Commissioned by the Royal College of Anaesthetists, this aims to measure process and outcomes relevant to perioperative medicine in 70 000 patients over 4 years. This will involve the production of quarterly and annual reports targeted at specific groups of health-care professionals to allow timely generation of quality improvement projects.

Conclusions

Quality improvement is beginning to thrive within the NHS and given its natural synergy with the principles of perioperative medicine, it should continue to do so in this new and exciting field. Perioperative physicians are uniquely placed to contribute to quality improvement and as they strive to structure new pathways of care for patients coming through the operating theatre, it is skills in quality improvement that will enable them to judge the success or failure of such schemes.

The ethos of patient care put forward by perioperative medicine can also help shape quality improvement research and development. Seeing the patient as a whole instead of siloed by individual conditions is one of the next challenges for quality improvement. The ability to consider the quality of care the patient receives as the sum total of presenting complaint, comorbid state and perioperative complications remains one of the next biggest challenges in this new and exciting field.

Quality improvement should be a part of every doctor's skill set and inventory and is increasingly being prioritized by educational and regulatory establishments. With the introduction of more numerous and complex national audit projects comes the opportunity to participate at every level of the quality improvement process, from data collection to analysis of local or national level data to planning innovative projects and solutions to problems. The national audit projects provide the opportunity to embed further research into specific process measures and even the methodology of the projects themselves. National audit projects allow a focus on evaluating what happens when research theory meets clinical reality, with much of the difference being related to human factors. The national audit projects allow a research framework to explore these issues and problems in the way a standard randomized controlled trial would never be able to. The ability to investigate clinical problems and areas not amenable to standard research methods is a fundamental and exciting part of delivering effective quality improvement in a clinical setting. **BJHM**

Resources

For further information on national audit projects and quality improvement, please see www.hqip.org.uk and www.pqip.org.uk

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Conflict of interest: none. This article represents the authors' own opinions and does not represent the official view of any organization.

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KEY POINTS

- Quality improvement processes are at the heart of the concept of perioperative medicine.
- National audit projects are robust structures that exist to deliver high quality quality improvement initiatives.
- National audit projects provide a structure to embed novel research techniques and allow health-care professionals of all levels to engage with quality improvement.