Systematic review of the application of quality improvement methodologies from the manufacturing industry to surgical healthcare

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CRD summary
The authors concluded that quality improvement methodologies from industry could have significant effects on improving surgical care, from reduced infection rates to increased operating room efficiency. The evidence was generally of suboptimal quality. The conclusion reflects the evidence presented, but some identified methodological limitations should be considered when interpreting the reliability of this review.

Authors' objectives
To evaluate the effects of quality improvement methodologies (used in industry) for improving the quality of care for surgical patients.

Searching
Several resources including CINAHL, EMBASE, MEDLINE, PsycINFO and the Cochrane Database of Systematic Reviews were searched up to November 2010. Search terms were reported and there were no language or date restrictions. The reference lists of identified studies were scanned for further studies.

Study selection
Eligible for inclusion were published studies that described one of the following quality improvement methodologies: plan-do-check-act or plan-do-study-act cycles, statistical process control or statistical quality control, continuous quality improvement, total quality management, Six Sigma, Lean, and Lean Six Sigma. The population of interest was hospital-based surgical patients. Excluded were conference abstracts, editorials, letters, opinion, audit or review.

Study designs and the application of interventions varied amongst the included studies. Interventions aimed to reduce in complications or improved outcomes; improved antibiotic usage; and reductions in infections, theatre delays, pain, and length of hospital stay. Over half of studies were conducted in the USA; one study was located in the UK.

Studies were selected independently by two reviewers. Disagreements were resolved by consensus.

Assessment of study quality
There was no formal assessment of study quality.

Data extraction
Data were extracted to demonstrate the direction of effect on the various outcomes of interest and p-values were presented to indicate statistical significance.

Two reviewers independently extracted data.

Methods of synthesis
A narrative synthesis was presented. Study characteristics were presented in tables.

Results of the review
Thirty-four studies were included. There was one cluster randomised controlled trial (267,917 patients). The remainder were time-series (22 studies); a controlled before-and-after design (one study), and uncontrolled before-after designs (10 studies).

Results from the randomised controlled trial showed that a low intensity continuous quality improvement intervention successfully increased the use of two coronary artery bypass graft surgery process-of-care measures (pre-operative beta-blockade therapy and internal mammary artery grafting) in patients aged 75 years and older. The increase was statistically significant (p=0.04) for the use of beta-blockade therapy.
Statistically significant improvements were found for infection control (two studies reported on Six Sigma and Lean interventions); reduced complications/improved outcomes related to anal sphincter preservation, and 30-day mortality following coronary artery bypass graft (two studies reported on Six Sigma and total quality management methodologies); reduced delay to start of surgery (two studies reported on continuous quality improvement, and plan-do-check-act); and post-operative pain on ambulation (one study of continuous quality improvement methodology). Antibiotic use prior to surgery was significantly increased in two of four studies measuring this outcome, using total quality management and Six Sigma methodologies.

Reductions were also reported for length of hospital stay (one study using Lean Six Sigma methodology), theatre delay (one study using Six Sigma); infection control (one study using statistical process control); and pain (one study reported on plan-do-check-act). Statistical significance was not reported.

Cost information
Two older studies based on the American healthcare system reported on costs as a main objective. One study concluded that total quality management reduced medication replacement costs in the operating theatre from US $656 to $160 per month at one year. The other study reported that continuous quality improvement reduced the cost of carotid endarterectomy from $13,900 to $7,700 at one year, with no reported change in morbidity.

Authors' conclusions
Quality improvement methodologies from industry could have significant effects on improving surgical care, from reduced infection rates to increased operating room efficiency. The evidence was generally of suboptimal quality.

CRD commentary
The review question was clear and inclusion criteria were specified for all aspects apart from outcome, which was broadly defined. Several relevant data sources were searched, and attempts were made to minimise language bias. Publication bias was a possibility (acknowledged by the authors). The review processes for study selection and data extraction were conducted with attempts to minimise error and bias. There was no reported quality assessment.

Most included study designs were considered to have an inherent high risk of bias, but the known quality of the randomised controlled trial would have been helpful in determining the reliability of its results. Study characteristics were presented, and this indicated a high level of clinical variation. The authors drew attention to limitations of small number of studies within each analysis, poor data quality, and the lack of clarity in defining the included interventions.

The authors' conclusion reflects the evidence presented, but these methodological limitations should be considered when interpreting the reliability of this review.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that rigorous randomised multi-centre studies that addressed patient-important outcomes, potential harms and costs, were needed to bring evidence-based management into the same league as evidence-based medicine.

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