HQIP

Healthcare Quality
Improvement Partnership

A guide to quality improvement methods

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Contents

HQIP Healthcare Quality Improvement Partnership

DNV·GL

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Introduction

Purpose

The purpose of this guidance is to signpost those working within, leading, commissioning and using healthcare services to a broad range of quality improvement methods. It should be especially useful to those putting together quality improvement programmes.

The Healthcare Quality Improvement Partnership (HQIP) has previously produced guidance for healthcare provider organisations in clinical audit, research and service review,[1] to allow staff to differentiate between these activities and to ensure ethical considerations and clinical governance practices are appropriately applied. Though that guidance remains useful, the quality improvement landscape continues to evolve.

There has been a focus in recent years upon clinical audit as a key healthcare quality improvement method, however other data-driven methods are in many instances more fitting and complementary to clinical audit, reviewing wider systems for assurance and improvement and offering solutions. A vast range of quality improvement methods exist and their applications are endless, with many branches of improvement science still in early stages of development in healthcare.

This guidance introduces a variety of quality improvement methods used in healthcare, based on the findings of a review of international literature. It describes when and how each method should be used and presents case examples and associated tools available to assist with implementation.

Our aim is to provide practical guidance to allow clinical and quality improvement staff to choose the most appropriate method for a problem identified. This guidance should also assist service users and commissioners of NHS funded services in understanding and assessing the quality improvement methods used by service providers.

Of course, quality improvement methods cannot drive progress alone and should also involve the following to be effective:

- Robust clinical governance arrangements for engagement
- Alignment with the regulation, accreditation and inspection agenda
- Service user input
- Network collaboration
- Review of the associated literature
- Application of solutions to findings

A number of tools available on the NHS Institute for Innovation and Improvement website, now administered by NHS Improving Quality, are referenced throughout this publication.[2]

1. HQIP, 2011. *A guide for clinical audit, research and service review*
2. Institution for Innovation and Improvement, 2006-2013. *Quality and service improvement tools for the NHS*

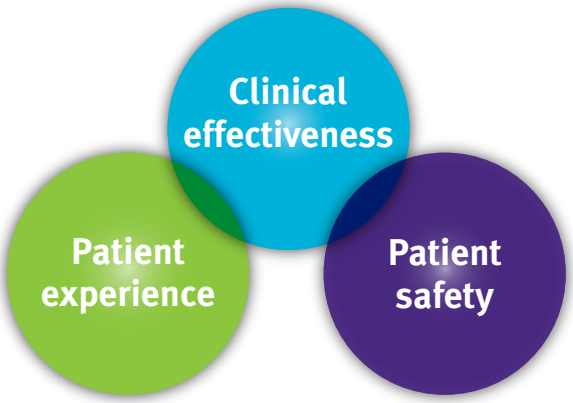
Definition of 'quality'

Much of the current thinking that defines quality in the NHS was set out in 'High quality care for all: NHS next stage review',[3] led by Lord Darzi. This definition has now been enshrined in legislation through the Health and Social Care Act 2012.[4]

It set out the following three dimensions which must all be present to provide a high quality service:

- Clinical effectiveness: quality care is care which is delivered according to the best evidence as to what is clinically effective in improving an individual's health outcomes
- Patient safety: quality care is care which is delivered so as to avoid all avoidable harm and risks to the individual's safety
- Patient experience: quality care is care which looks to give the individual as positive an experience of receiving and recovering from the care as possible, including being treated according to what that individual wants or needs and with compassion, dignity and respect

Figure 1. Definition of quality



3. Department of Health, 2008. *High quality care for all: NHS next stage review*
4. Health and Social Care Act 2012

'High Quality Care for All' also laid out a seven step framework for systematically thinking about how to improve quality, as shown in figure 2 below.[5]

Figure 2. The quality framework

1 Bring clarity to quality	There must be clear and accepted definitions of what high quality care looks like, which patients, commissioners and providers can unite around. NHS England will commission the National Institute for Health and Care Excellence (NICE) to produce NICE Quality Standards setting out what high quality care looks likes for a particular condition, pathway or patient group, covering the majority of care that the NHS provides. Rather than representing the essential standards of quality and safety that the Care Quality Commission will regulate against, they will be aspirational, yet achievable, supporting the whole system in striving for excellence. As such, the Quality Standards of today will need to become the essential standards of tomorrow.
2/3 Measure and publish quality	The system can only hope to improve what it measures. There must be robust, relevant and timely information transparently available on the quality of care being provided at every level of the system. This information should be used to drive quality improvement at the front line, for the purposes of accountability and to support patient choice. The NHS Outcomes Framework sets out the national quality goals which the NHS will be aiming to deliver, and will be used by the Secretary of State, through the Mandate, to hold the NHS Commissioning Board to account. The NHS Commissioning Board, in turn, will develop a Commissioning Outcomes Framework, drawing on NICE Quality Standards, to hold clinical commissioning groups to account for the outcomes they are achieving for their populations. Provider organisations and their clinical teams should be drawing on the wealth of comparative quality indicators, including from clinical audits, to drive improvement across all services. All measures of quality at every level of the system, must be made transparently available to support accountability, patient choice and prioritisation.
4 Reward quality	Payments and incentives must be structured to encourage quality improvement. Monitor will design payment mechanisms such as the tariff. The NHS Commissioning Board will develop standard contracts, CQUINs and the Quality and Outcomes Framework (primary care payment mechanism) to incentivise providers to deliver high quality care, drawing on NICE Quality Standards. Clinical commissioning groups and other commissioners will use these payment mechanisms to contract with providers for the delivery of high quality care and to manage those contracts. The NHSCB will use the quality premium, linked to indicators in the Commissioning Outcomes Framework, to reward commissioners for securing improvement in particular outcomes.
5 Leadership for quality	Leadership nationally and locally is essential for quality improvement to be embedded, encouraged and rewarded. The National Quality Board brings together different parts of the system nationally to provide leadership for quality, ensuring that there is alignment between how the different organisations carry out their responsibilities. Clinical Senates and Clinical Networks will provide leadership locally and regionally for quality improvement to commissioners and healthcare professionals. Health and Wellbeing Boards will provide local leadership for quality improvement, with local health and care commissioners coming together with the local community to jointly assess needs and determine a joint health and wellbeing strategy to improve outcomes. Professional bodies and Royal Colleges have a critical role to play in supporting healthcare professionals in their pursuit of delivering high quality care.
6 Innovate for quality	Continuous quality improvement requires health services to search for and apply innovative approaches to delivering healthcare, consistently and comprehensively across the system. Academic Health Science Networks will bring together the local NHS, universities, public health and social care to work with industry to identify and spread proven innovations and best practice to improve the quality and productivity of health care resulting in better patient outcomes and population health. Academic Health Science Centres who seek out new and innovative ways of caring for people will be nested within these networks. NICE's technology appraisal process and the associated compliance regime ensure innovations that will deliver quality improvement are assessed expediently and that funding for NICE recommended drugs and treatments is made available across the NHS, promoting rapid and consistent patient access in line with the NHS constitution.
7 Safeguard quality	Any system that strives for quality improvement must, at the same time, ensure that the essential standards of safety and quality are maintained. In respect of individuals, the professional regulatory bodies already publish and regularly update clear standards of competence and conduct for regulated health and social care professionals. This report describes how the system will prevent, identify and respond to serious quality failures. Each part of the system must fulfil their distinct roles and responsibilities in relation to quality, as well as working together in a culture of open and honest cooperation in the best interests of patients.

5. National Quality Board, 2013. *Quality in the new health system*

Good governance

Most healthcare organisations' governance arrangements include clinical audit. However, the use of other quality improvement methods is not always captured. The key to resolving this is to develop quality improvement programmes that focus on the issue that needs to be investigated and improved, then choosing the right methodology for the job.

Whatever the method chosen, open and transparent presentation and monitoring of the outcomes of quality improvement initiatives are essential, including review and scrutiny of exception reports, with patient and board member representation.

Regulation, accreditation and inspection

National statutory and mandatory requirements for clinical audit and quality improvement are numerous. They include:

- The NHS standard contract,[6] which requires all providers of NHS commissioned services to participate in the National Clinical Audit and Patient Outcomes (NCAPOP) programmes[7] which are relevant to the services they provide
- The statutory requirement to produce annual Quality Accounts[8]
- The regulatory regimes operated by the Care Quality Commission and Monitor

HQIP has produced a comprehensive guide to the legislation (Statutory and mandatory requirements for clinical audit.[9]) which includes links to relevant supporting guidance.

New guidance on the governance of quality improvement activities has been produced and can be found on the HQIP website.[10]

Commissioners have a duty as parties to the NHS standard contract to monitor the quality of the services they commission. HQIP is currently developing new guidance on this and other aspects of the commissioners role in improving quality.

Patients may wish to review published information from the CQC and other organisations on the quality of services of the healthcare providers offering treatments and procedures they are considering. Information is available through NHS Choices (www.nhschoices.net) and on the CQC website (www.cqc.org.uk).

Patient involvement in quality improvement

Those experiencing healthcare systems first hand can provide insightful feedback on the quality of services and how they might be improved. They can also provide useful personal perspectives which should be captured.

Figure 3. Capturing patient experience for insight and perspective

6. NHS England, 2014/15. *NHS standard contract*
7. HQIP, 2014. *National Clinical Audit and Patient Outcomes (NCAPOP)*
8. Department of Health, 2014/15. *Quality Accounts*
9. HQIP, 2014. *Statutory and mandatory requirements for clinical audit*
10. HQIP, 2015. *Clinical audit: a guide for NHS boards and partners*

Patient input into service design is essential as only they have experience as service users. The involvement of patients in healthcare quality improvement can take many forms, for example:

- Patient representation at organisational quality committees
- Shadowing the patient journey to identify quality shortfalls
- Patient led assessment of the healthcare environment
- Completion of patient satisfaction surveys
- Review of patient information materials
- Patient networking to share self-care strategies
- Analysis of patient complaints, concerns and claims
- Patient involvement in quality improvement focus groups

Further information (full reading list on page 34):

- HQIP, patient and public involvement in clinical audit[i]
- HQIP, a guide to develop a patient panel in clinical audit[ii]
- NHS Institute for Innovation and Improvement, Patient perspectives tool[iii]
- Picker Institute Europe, Patient experience reviews[iv]
- NHS England, Patient-led assessments of the care environment (PLACE)[v]

Collaboration for quality improvement

Collaboration through regional clinical networks, clinical audit networks or other similar groups enables the sharing of experiences, techniques and learning for quality improvement. Networks provide a rich source of up to date knowledge and expertise and a useful sounding board for the discussion and development of innovative quality improvements proposed, or those under review.

Figure 4: Collaboration for quality improvement

Peers understand and appreciate the nuances and complexities of quality improvement in healthcare. Collaboration also supports progress, and reduces barriers to change, breaching historical boundaries. Quality improvement initiatives can be reviewed and piloted across regional and national networks for more robust testing than at local level.

Patient collaboration through networks deepens the knowledge pool around their conditions and how to manage them, ultimately improving the quality of care received. Self-care strategies shared first hand among those affected by conditions offers comfort and can reduce both the physical and emotional burden. Providers and clinicians involving patients in their collaborative networks are able to listen to their experiences, identify shortfalls in care and improve quality to meet their expressed needs.

Healthcare quality improvement strategies developed through collaborative networks are often shared and adopted at regional or national levels and therefore have a wider uptake than those developed locally, raising the standard of quality and consistency of care across a broader landscape.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, Stakeholder analysis tools[i]
- NHS Institute for Innovation and Improvement, Spread and adoption tool[ii]
- NHS Improving Quality, Patient safety collaboratives[iii]

Literature review for quality improvement

For best practice quality improvement, reviewing the latest literature is key. Research and development are ongoing, particularly in the field of quality improvement in healthcare, and new ideas are continually introduced and tested. Whilst time consuming, whether in advance of a system redesign, an environmental, staffing or key clinical process adjustment, reviewing the literature to ensure evidence-based quality improvement can save considerable time and resources in the long run.

The literature review process comprises a research question, searching relevant literature, managing and synthesizing search results and a written assessment of findings from which conclusions may be drawn.

A literature review identifies trends and predicted future developments, reveals known facts and questions unanswered, makes a case for further study and informs decisions taken through a firm evidence base, often tried and tested. Quality improvements based upon strong evidence of prior success are of course more likely to be effective.

Further information (full reading list on page 34):

- National Institute for Health and Care Excellence (NICE), Journals and databases[i]
- National Institute for Health and Care Excellence (NICE), Evidence search[ii]
- The Cochrane Evidence Library, The Cochrane Collaboration[iii]

Figure 5: The literature review journey[11]

11. Garson, D. and Lillvik, C., Harvard Graduate School of Education, 2012. Pictorial: *The Literature Review: a research journey*. Harvard

Quality improvement (QI) methods directory

This next section illustrates 12 quality improvement methods, each distinct in their own specific purpose and the directory below sets out when each method might be used.

This list is not exhaustive but we have highlighted those we think most useful within healthcare organisations.

QI Method	Use to	Page
Clinical audit	Check clinical care meets defined quality standards	10-11 >>
Plan do study act	Introduce and test potential quality improvements on a small scale	12-13 >>
Model for improvement	Decide upon, test and refine quality improvements	14-15 >>
Lean/Six sigma	Eliminate waste and redirect resources for quality and efficiency	16-17 >>
Performance benchmarking	Drive quality improvement through performance targets	18-19 >>
Healthcare failure modes and effects analysis	Systematically evaluate processes for quality improvement	20-21 >>
Process mapping	Map the patient journey for quality improvement opportunities	22-23 >>
Statistical process control	Measure and control process quality against predefined parameters	24-25 >>
Root cause analysis	Systematically uncover the causes of events affecting quality	26-27 >>
Communication tools	Improve quality of care through structured information exchange	28-29 >>
Technological innovations	Automate processes and systems for care quality improvement	30-31 >>
Decision trees	Improve the quality and consistency of processes in healthcare	32-33 >>

Clinical audit

Use to: Check clinical care meets defined quality standards and monitor improvements to address shortfalls identified.

Most effective: For ensuring compliance with specific clinical standards and driving clinical care improvement.

Prerequisites: Evidence based clinical standards drawn from best practice and an audit proforma comprised of measures derived from the standards. A clearly defined population of patients (or a sample from the population) whose care will be measured using the pro forma.

Overview: Clinical audit can be described as a quality improvement cycle that involves measurement of the effectiveness of healthcare against agreed and proven standards for high quality, and taking action to bring practice in line with these standards so as to improve the quality of care and health outcomes.[12]

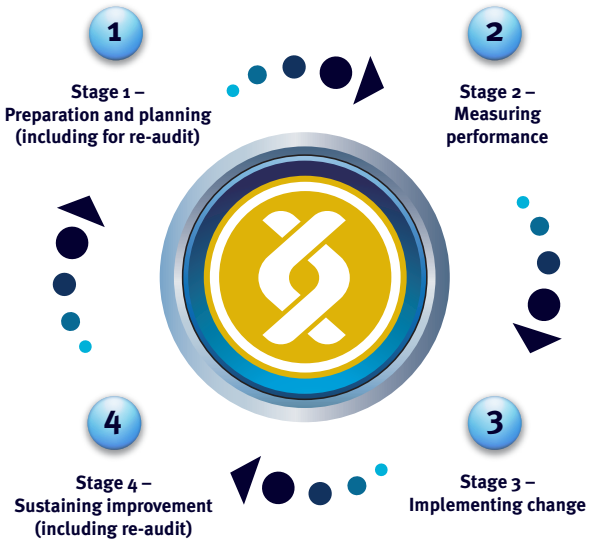
How to use it: To check clinical care provided against specific desired standards, clinical audit typically involves the design of a clinical audit pro forma comprising those standards, and the subsequent review of a defined sample of healthcare data, such as health records, using this pro forma, collecting data over a specified timeframe. Data is analysed and where shortfalls against the standards are identified, action planning follows, to drive improvement, with repeated cycles of data collection and analysis at appropriate intervals to monitor change. Each full audit cycle is not complete until there is evidence that changes made have been effective (see Fig.6). Clinical audits can be carried out retrospectively, though are increasingly prospective, with clinicians completing proformas during or immediately after care delivery, or through automated electronic healthcare record ongoing real time data collection. Where clinical audits are designed and carried out by clinicians, desired standards are embedded and awareness is raised amongst those delivering care. Findings and required actions for quality improvement should be shared with the entire relevant workforce to foster learning.

Governance: It is helpful for a central register of clinical audits to be held organisationally for monitoring purposes and for audit design and proformas to be approved using in-house expertise and if required, for example where the audit is part of a wider clinical research project, presentation to the Local Research Ethics Committee for ethical approval.[13] Clinical audit results require collation, analysis and open and transparent presentation of findings, in particular exception reports detailing shortfalls and the actions required for improvement, enabling review and scrutiny at provider meetings, ideally with patient and board member representation. Action plans to address any shortfalls in care identified should be presented, with clear target dates for remedial action completion and named responsible leads. Re-audits should be carried out to ensure corrective actions have been taken and quality has improved, these too should be reviewed and approved at provider meetings until there is evidence that changes made have been effective. Patients may request local clinical audit data around the treatments and procedures they are considering. Commissioners may wish to review clinical audit activity within provider organisations for their assurance and may request specific clinical audits to be undertaken after a serious untoward incident, to ensure required changes have been implemented to prevent recurrence.

See the section on **Regulation, accreditation and inspection** for statutory and mandatory requirements for clinical audit.

12. Burgess, R. (ed), 2011. *New Principles of Best Practice in Clinical Audit*. 2nd ed. Radcliffe Publishing Limited
13. HQIP 2009. *Review of ethics issues related to clinical audit and quality improvement activities*

Figure 6: The clinical audit cycle[14]



Implementation

The clinical audit was prospective and GPs evaluated their own management of diabetes in 20 consecutive consenting patients with T2D, using proformas comprised of standards for the development of care plans and clinical measurement targets. GPs evaluated their management of T2D patients at two time points, six months apart. Following the initial audit, GPs received feedback around the use of annual cycle of care plans and a decision support tool, to address the shortfalls identified.

Impact on quality

On re-audit, GP performance had improved across all measures, with the greatest gains being in the use of care plans (increased by 12%) and meeting clinical measurement targets. The clinical audit provided annual cycle of care plans, decision support tools and also diabetes patient registers, which improved the quality of care for patients with T2D.

Case example:

Healthcare quality issue

Type 2 diabetes (T2D) was responsible for 5.8% of the total disease burden in Australia in 2010, and despite advances in clinical management, many patients were found to have suboptimal glycaemic control.[15] Within general practitioner (GP) practices, development of care plans and meeting clinical measurement targets were known to be inadequate.

Method selection

In order to identify and manage the shortfalls in clinical care against expected standards in GP practices and to drive improvement in glycaemic control, a Type 2 care clinical audit programme was developed.

Further information (full reading list on page 34):

- HQIP, A guide for clinical audit, research and service review[i]
- HQIP, Guide to using quality improvement tools to drive clinical audit[ii]
- HQIP, Template clinical audit strategy, policy and audit report[iii]
- HQIP, An information governance guide for clinical audit[iv]
- HQIP, Ethics and clinical audit and quality improvement[v]
- HQIP, Clinical audit: a guide for NHS boards and partners[vi]
- HQIP, Good governance handbook[vii]
- HQIP, Template for cinical audit policy[viii]
- National Institute for Health and Care Excellence (NICE), Clinical audit tools[ix]

14. HQIP 2009. *Criteria and indicators of best practice in clinical audit*
15. Barlow, J. and Krassas, G. (2013). *Improving management of type 2 diabetes - findings of the Type 2 care clinical audit.* Australian Family Physician

Plan do study act

Use to: Introduce and test potential quality improvements and refine them on a small scale, prior to wholesale implementation.

Most effective: When a procedure, process or system needs changing, or a new procedure, process or system is to be introduced.

Prerequisites: A procedure, process or system which needs changing, or a new procedure, process or system to be introduced and a small cohort of associated stakeholders.

Overview: Plan, do, study, act (PDSA) cycles test changes to assess their impact, ensuring new ideas improve quality before implementation on a wider scale. Making changes to processes can give unexpected results, so it is safer and more efficient to test quality improvements on a small scale before wholesale implementation, allowing a sample of stakeholders involved to assess the proposed changes in action. Such small scale change introduction also enables interactions with other systems to be tested without causing large scale disruption to service quality, for example, completing a new patient assessment proforma with a limited group of patients before using the proforma for all patients.

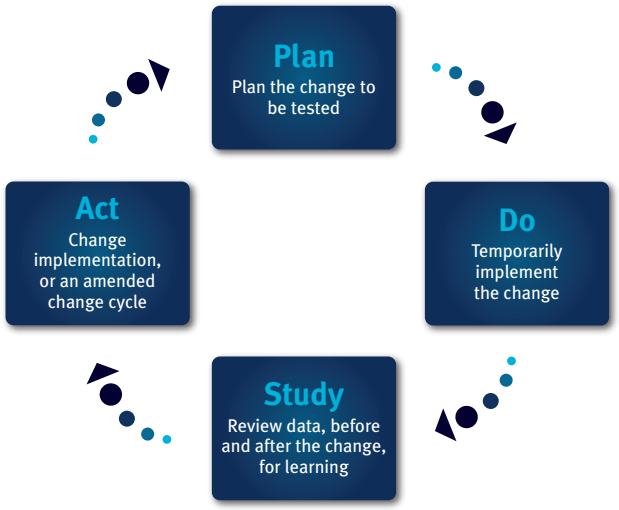
How to use it: A procedure, process or system which needs changing, or a new procedure, process or system to be introduced is developed (plan), implemented for a specific timeframe on a small scale with a minimal cohort of stakeholders (do), evaluated (study) and adjusted (act), with repeated PDSA cycles, until it is fit for purpose and wholesale implementation. Involving stakeholders in all four stages of the PDSA cycle fosters engagement with changes proposed and enables input for adjustment where potential users are aware of barriers to change (see fig.7).

Governance: Usually an ad-hoc review involving staff associated with the healthcare system or pathway under scrutiny.

Providers may wish to hold reviews on record as evidence of due diligence, particularly where significant changes are made to healthcare systems, such as environmental, staffing or key clinical process adjustment.

May be requested from providers by commissioners where quality failures are identified and improvements are required.

Figure 7: The four stages of the plan, do, study, act quality improvement cycle



Case example:

Healthcare quality issue

A multidisciplinary team from an infectious diseases unit were keen to introduce care bundles for central venous catheters to their hospital, in the light of the international success of care bundles in reducing catheter-related bloodstream infection.[16]

Method selection

PDSA cycles were chosen in order to introduce changes to central venous catheter care on a small scale, and to evaluate these changes before further adjustment and PDSA cycles, until fit for wide scale implementation.

Implementation

A care bundle for peripheral venous catheters (PVCs) based on drafts developed nationally was introduced to an intensive care ward. A senior medical student collected care bundle percentage compliance data weekly for each patient. Data consisted of measures to assess clinical performance for insertion (recording date, indication and location) and maintenance (daily review of necessity, clinical appearance of site, duration less than 72 hours and timely removal). The medical student carried out monthly PDSA cycles, evaluating and adjusting the PVC care bundle design where shortfalls in compliance were identified, and displaying and sharing the results and required changes on the ward until percentage compliance rates were satisfactory. Weekly evaluation and feedback was shared, with monthly patient safety meetings to discuss issues with compliance. Significant improvement in PVC management within this single hospital ward was demonstrated and in order to improve the quality of PVC management organisation-wide the PVC care bundle was implemented throughout the hospital.

Impact on quality

The initial care bundle compliance rate of 54% gradually improved to 82% on the intensive care ward through a series of PDSA cycles. This was attributed to multiple quality improvement interventions including daily assessment of PVC necessity, weekly evaluation and feedback, monthly patient safety meetings to discuss issues with compliance, the introduction of new PVC dressings and the promotion of new PVC care plans, subsequently implemented across the organisation.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, Plan do study act[i]
- University of North Carolina School of Medicine, Plan do study act worksheet template[ii]
- Institute for Healthcare Improvement, Plan do study act work sheet[iii]

16. Boyd, S., and Aggarwal, I., et al., 2011. *Peripheral intravenous catheters: the road to quality improvement and safer patient care.* Journal of Hospital Infection

Model for improvement

Use to: Decide upon measurable quality improvements required and test and refine them on a small scale, prior to wholesale implementation.

Most effective: When a procedure, process or system needs changing, or a new procedure, process or system is to be introduced, for measurable quality improvement.

Prerequisites: A procedure, process or system which needs changing, or a new procedure, process or system to be introduced for measurable quality improvement and a small cohort of associated stakeholders.

Overview: The model for improvement accelerates improvements in the quality of healthcare processes and outcomes, via two phases:

1. Three fundamental questions, asked and addressed in any order, to define required changes and measures of improvement
2. The plan, do, study, act (PDSA) cycle (see previous entry) to test changes in live settings and determine improvements

How to use it: With an understanding of the current situation, where problems lie in a process, and what needs to change, quality improvements are designed, tested, measured and refined. For successful quality improvement it is vital that an appropriate stakeholder team is formed as ideas for change arise from the insight of those who work in the system.

Three fundamental questions are answered by the team (see fig.8):

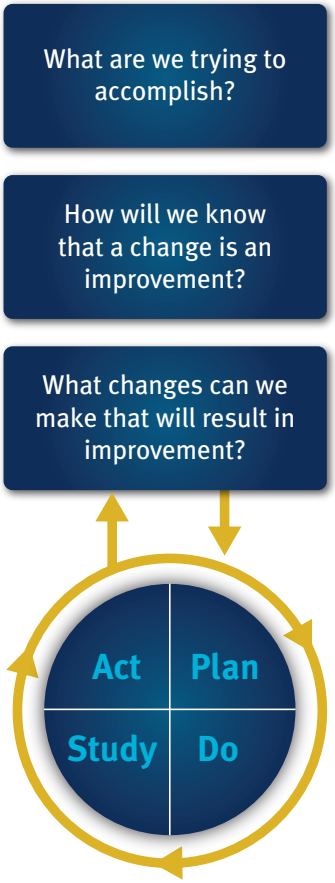
1. **What are we trying to accomplish?** The required quality improvements and specific group of patients that will be affected are defined
2. **How will we know that a change is an improvement?** Time-specific, measurable improvement aims are set
3. **What changes can we make that will result in improvement?** For each change to be tested, specific quantitative measures are established to determine whether or not the changes lead to improvement

Changes are tested using a PDSA cycle on a small scale, in the live setting: planning the change, testing it out, evaluating and acting upon results. After testing, learning and refining through several PDSA cycles, the change is implemented on a wider scale, for example, for an entire pilot population or hospital.

Governance: Usually an ad-hoc review involving staff associated with the healthcare system or pathway under scrutiny. Providers may wish to hold reviews on record as evidence of due diligence, particularly where significant changes are made to healthcare systems, such as environmental, staffing or key clinical process adjustment.

May be requested from providers by commissioners where quality failures are identified and improvements are required.

Figure 8: The Model for Improvement[17]



Case example:

Healthcare quality issue

A hospital wished to introduce a quality improvement programme to reduce preventable harm, using high-reliability practices and microsystem-based multidisciplinary teams.[18]

Method selection

The model for improvement was chosen in order to introduce high-reliability practices and microsystem-based multidisciplinary teams, to reduce preventable harm and to evaluate and measure the changes introduced through PDSA cycles.

Implementation

Change packages were devised by a group of stakeholders using the model for improvement, answering the three fundamental questions to: define the required quality improvements (reduction in preventable harm events), the group of patients to be affected (hospital-wide), set time-specific, measurable improvement aims (preventable harm events to decrease year on year), and for each change to be tested, to establish specific quantitative measures to determine whether or not the changes led to improvement (decrease in serious safety event rate and hospital mortality rate). Extensive error prevention training was provided for employees in using high-reliability practices in microsystem-based multidisciplinary teams. The impact of the change packages was evaluated through PDSA cycles, coupled with specific quantitative measures defined to establish whether changes implemented had led to improvement.

Impact on quality

Preventable harm events decreased by 53%, from a quarterly peak of 150 in the first quarter of 2010, to 71 in the fourth quarter of 2012. Further substantial reductions in serious safety event rate and hospital mortality rate were seen after wide scale implementation of the change packages.

Further information (full reading list on page 34):

- Institute for Healthcare Improvement, Model for improvement[i]
- Institute for Healthcare Improvement, Science of improvement: how to improve[ii]
- NHS Scotland Quality Improvement Hub, Aims tool[iii]

17. Institute for Healthcare Improvement, 2012. *Model for Improvement*
18. Brilli, R.J., and McClead, R.E.Jr., et al., 2013. *A comprehensive patient safety program can significantly reduce preventable harm, associated costs, and hospital mortality.* Journal of Pediatrics

Lean/Six sigma

Use to: Analyse healthcare systems to eliminate waste and redirect resources towards a more efficient, improved and consistent quality of care.

Most effective: When healthcare systems are inefficient, wasteful and inconsistent in quality of care.

Prerequisites: A procedure, process or system which needs changing to become more efficient and consistent and associated stakeholders.

Overview: Lean seeks to improve flow in the value stream and eliminate waste. Six sigma uses the framework Define, measure, analyse, improve and control (DMAIC), with statistical tools, to uncover and understand root causes of variation and reduce them. Repeatability and reduced variation in healthcare services helps ensure a consistently high quality experience for patients, whilst waste reduction enables resources to be used where they are most effective. A combination of Lean and Six sigma provides a structured approach to quality improvement with effective problem-solving tools. Rapid transformational improvement results, with cost savings.

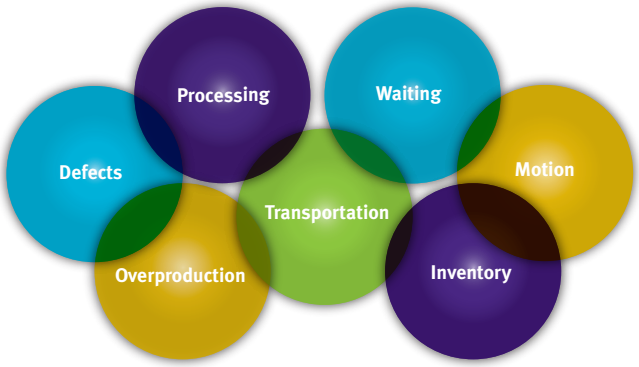
How to use it: Lean uses **process mapping** with associated stakeholders to identify inefficiencies affecting the quality of care, enabling action planning for improvement (see fig.9). Process mapping with Lean adjustment eliminates activity carried out 'just-in-case' or in a batch, holding excess inventory, waiting patients, excess transportation, defects, unnecessary staff movement, and unnecessary processing. In Six sigma, DMAIC and control charts are used to study adjusted processes over time. DMAIC is comprised of:

- **Define:** state the problem, specify the patient group, identify goals and outline the target process
- **Measure:** decide the parameters to be quantified and the best way to measure them, collect the necessary baseline data and measure after changes have been made
- **Analyse**: identify gaps between actual performance and goals, determine the causes of those gaps, determine how process inputs affect outputs, and rank improvement opportunities
- **Improve:** devise potential solutions, identify solutions that are easiest to implement, test hypothetical solutions and implement required improvements
- **Control:** share a detailed solution monitoring plan, observe implemented improvements for success, update on a regular basis and maintain a training routine

Statistical process control charts are combined with DMAIC, whereby data are plotted chronologically, with a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit, determined from historical data. By comparing current data with these lines after adjusted processes, conclusions are drawn about process variation. Such studies identify areas for improvement to ensure consistency of quality in health care, ultimately improving the patient experience.

Governance: Usually an ad-hoc review involving staff associated with the healthcare system or pathway under scrutiny. May be requested from providers by commissioners where waste and inconsistencies in quality are identified.

Figure 9: Lean elimination of waste



Case example:

Healthcare quality issue

Surgical disruption was known to prolong session times, affect quality of patient care, increase waiting lists, cause surgical error and found to be costly.[19]

Method selection

Lean process mapping was chosen to eliminate waste and redirect resources towards a more efficient, improved and consistent quality of care.

Implementation

A study was carried out using Lean process mapping principles to identify the sources of preventable disruption affecting perioperative process time and to effectively reduce it. Events inside and outside operating rooms that disturbed the operative time were recorded for 31 elective surgeries over a period of five months. Disruption events were classified and the findings were reviewed by surgical teams.

Impact on quality

Preventable disruption had caused an increase in surgical time of approximately 25% and Lean process mapping revealed poor information flow, failure to follow concepts of a methods study, lack of communication, lack of coordination, and failure to follow the principles of motion economy. The study enabled remedial action to reduce operative time considerably for patients, ease the pressure of emergency cases, reduce waiting lists for elective surgery, increase operating room utilisation and reduce medical errors.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, Lean[i]
- NHS Institute for Innovation and Improvement, Lean seven wastes[ii]
- NHS Institute for Innovation and Improvement, Lean Six sigma[iii]
- American Society for Quality, Costs and Savings of Six sigma programs[iv]
- American Society for Quality, Control chart template[v]

19. Al-Hakim, L. and Gong, X.Y., 2012. *On the day of surgery: how long does preventable disruption prolong the patient journey?* International Journal of Health Care Quality Assurance

Performance benchmarking

Use to:

Drive quality improvement by raising awareness of local and national performance targets, and finding and sharing best practice.

Most effective:

When local and national performance targets are established and given organisational importance as drivers for quality improvement.

Prerequisites:

Local and national performance targets, and data collection routines for monitoring and sharing systems and processes.

Overview:

Performance indicators are used as part of a benchmarking process to raise awareness of required standards and act as drivers for quality improvement. Healthcare organisations and their departments strive to meet standards imposed, and those performing well demonstrate models of best practice which can be shared, becoming the benchmark against which performance is compared.

How to use it:

Performance may be monitored through provision of data, or evidence of compliance with standards, to an external agency publishing league tables, which can also drive quality improvement as organisations aim for lead positions. Performance indicators should be carefully devised and are most powerful if they are active, for example, focused upon quality improvement initiatives met through evidence of positive outcomes achieved. The communication of organisational performance against national benchmarks for context raises awareness of shortfalls and stimulates further subsequent quality improvement.

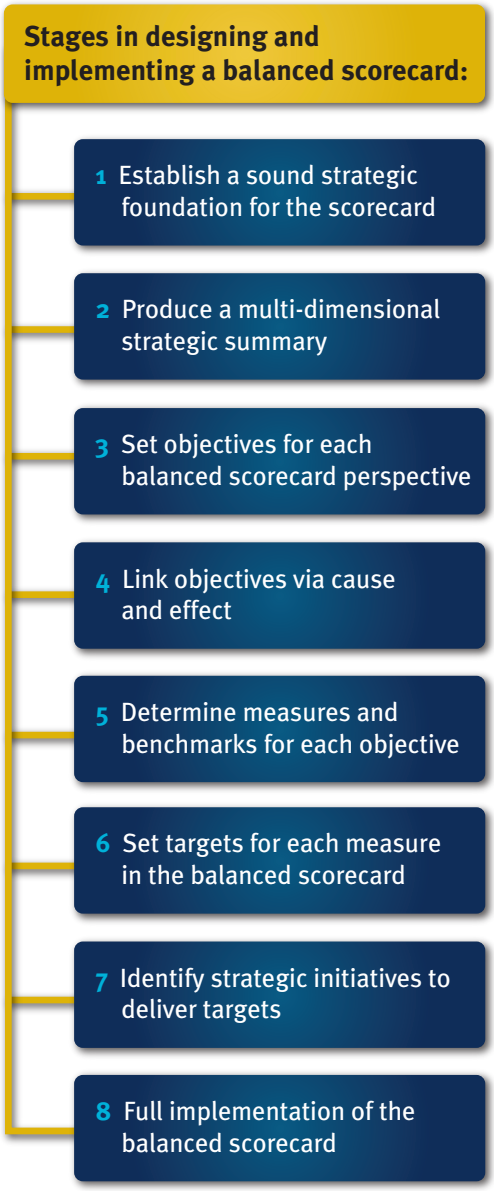
Key performance indicators (KPIs) and benchmarking are also used within healthcare organisations to compare activity across different departments or units, unearthing and sharing best practice locally to drive quality improvement. Formal, routine and regular systems of data collection and review help define quality improvement targets, provide a clear picture of progress towards goals and indicate trends, including emerging quality issues requiring resolution. Balanced scorecards are useful to translate organisational vision and strategy into tangible objective measures to help create KPIs, enabling measurement of progress towards defined targets, such as length of stay parameters, and mortality and readmission rates and may ultimately take any shape or form (see fig.10).

Governance:

A central record of both external and internal performance monitoring and benchmarking data should be held organisationally for monitoring purposes, to ensure follow up and closure of required remedial actions for quality improvement. Open and transparent presentation of both external and internal performance monitoring and benchmarking data is essential, with review and scrutiny of exception reports at provider meetings, ideally with patient and board member representation. Action plans to address any shortfalls identified should be presented, with clear target dates for action completion and named responsible leads. Evidence of corrective actions taken should be shared for approval at provider meetings.

Commissioners may wish to review quality improvement plans within provider organisations for assurance purposes and may also set and monitor local key performance indicators as quality improvement initiatives. Patients may compare the external performance monitoring and benchmarking data of organisations offering treatments and procedures they are considering.

Figure 10: Producing a balanced scorecard



Case example:

Healthcare quality issue

The German Cystic Fibrosis (CF) Quality assurance project required goals for the management of CF patients, to drive care quality improvement.[20]

Method selection

Benchmarking was chosen to highlight healthcare programs with the most favourable outcomes within registry data, and to identify and spread effective strategies for delivery of care.

Implementation

Clinical goals were developed for participating programmes through benchmarks derived from registry data.
Quality indicators were selected: airway cultures free of pseudomonas aeruginosa, nutritional measures, lung function measures and lack of serious complications. During two annual conferences, the highest-ranking programmes for these quality indicators presented their treatment strategies, and the ensuing discussions led to the identification of clinical practices that other programmes would aspire to adopt.

Impact on quality

Benchmarking improved the quality of CF care and whilst certain goals were accomplished through focus on data analysis, benchmarking programmes supplemented these data analyses with exploratory interactions and discussions to better understand successful approaches to care and encourage their spread throughout the care network. Benchmarking facilitated the discovery and sharing of effective approaches to improve the quality of CF care, and provided insights into the relative effectiveness of different therapeutic methods.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, Performance management[i]
- NHS Institute for Innovation and Improvement, Performance measures sheet[ii]
- NHS Institute for Innovation and Improvement, Balanced scorecard[iii]

20. Schechter, M.S., 2012. *Benchmarking to improve the quality of cystic fibrosis care*. Current Opinion in Pulmonary Medicine

Healthcare failure modes and effects analysis (HFMEA)

Use to: Systematically and proactively evaluate processes for quality improvement opportunities.

Most effective: When a critical process requires careful and systematic review and improvement to prevent failure.

Prerequisites: A critical process, and stakeholders.

Overview: Healthcare failure modes and effects analysis (HFMEA) is a systematic, proactive quality improvement method for process evaluation, used to identify where and how a process might fail and to assess the relative impact of different failures, for identification of the process elements in most need of change. HFMEA includes review of the following:[21]

- Steps in the process
- Failure modes (what could go wrong?)
- Failure causes (why would the failure happen?)
- Failure effects (what would be the consequences of each failure?)

How to use it: Healthcare teams collaborate to use HFMEA to prevent failures, reviewing and correcting processes proactively rather than reacting to adverse events after failures have occurred. This emphasis on prevention reduces the risk of harm to both patients and staff. HFMEA is particularly useful in new critical process evaluation prior to implementation, or assessing the impact of a proposed change to an existing critical process. The seven steps are shown in Figure 11.

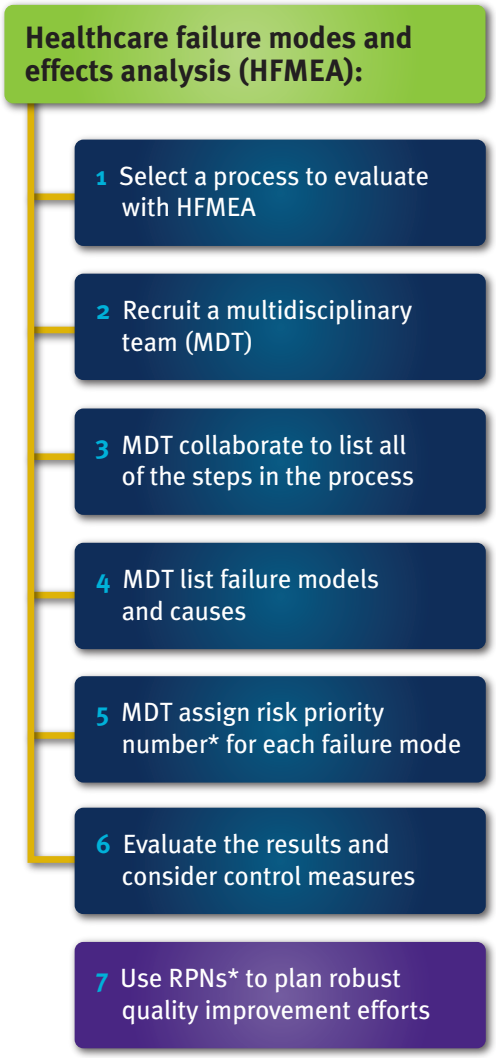
Failure modes include anything that could go wrong that would prevent a process step from being carried out. Each failure mode might have multiple causes. Failure mode causes are prioritised by risk grading for attention and eliminated, controlled or accepted.

Control measures should be included at the earliest feasible point in the process. Multiple control measures can control a single hazard and each control measure can be used more than once in the process. Input from process owners should be solicited if they are not represented on the team and any recommended process change requires simulation for test purposes before facility-wide implementation.[22]

Governance: Usually an ad-hoc review involving staff associated with the process under scrutiny. Providers may wish to hold reviews on record as evidence of due diligence, particularly where significant changes are made to healthcare processes, such as environmental, staffing or key clinical system adjustment. May be requested from providers by commissioners where quality failures are identified and improvements are required.

21. Institute for Healthcare Improvement, 2004. *Failure modes and effects analysis*
22. VA National Centre for Patient Safety, 2014. *The basics of healthcare failure mode and effect analysis*

Figure 11: The seven steps to healthcare failure modes and effects analysis



Case example:

Healthcare quality issue

Research showed that 51.4% of adverse events in hospitals occurred in surgery and that 3-22% of surgical patients experienced adverse events, with higher risks when turnover is high and when patients are children, as is often the case in ear, nose and throat surgery.[23]

Method selection

The HFMEA method was used to evaluate the process flow for ear, nose and throat patients and to redesign the process to enhance patient safety.

Implementation

In two one day sessions, the process flow for ear, nose and throat patients was analysed by multidisciplinary teams using the HFMEA method. Process stages were listed and potential failure modes were identified, eliminated, controlled or accepted, then prioritised by risk grade for attention. Major failure modes were caused by the absence of a surgical safety checklist and the absence of an active identity check throughout the process.

Impact on quality

The process was redesigned, implementing a surgical safety checklist and an active identity check protocol. The systematic HFMEA approach by a multidisciplinary team was found to be useful in detecting failure modes requiring immediate safety responses, throughout the entire process. The involvement of all disciplines and an open safety culture during the HFMEA exercise were felt to be the most important conditions for success. HFMEA was useful in detecting the failure modes in this care process.

Further information (full reading list on page 34):

- Institute for Healthcare Improvement, Failure modes and effects analysis tool[i]
- VA National Centre for Patient Safety, Basics of HFMEA[ii]
- VA National Centre for Patient Safety, HFMEA worksheets[iii]

23. Marquet, K. and Claes, N. et al., 2013. *ENT one day surgery: critical analysis with the HFMEA method*

Process mapping

Use to: Map the patient journey to identify quality improvement opportunities.

Most effective: When the patient journey is complex with associated inefficiencies.

Prerequisites: A patient journey and stakeholders.

Overview: Reviewing and mapping the whole patient journey or diagnostic pathway with all parties involved enables the identification of inefficiencies and opportunities for improvement. It illustrates unnecessary steps, duplication, discrepancies, and variation and stimulates ideas for quality improvement to help create failsafe systems (see fig.12).

How to use it: Starting with a high level process map, the scope of the process and significant issues are set out, step by step, to create a more detailed map. The exercise offers all those taking part a broader insight into the process under review and sets out exactly what happens in practice, as opposed to what those involved think happens.

By placing the patient and their needs central to the journey and involving patient representatives in the exercise, barriers to safe, effective care are identified and process changes can be discussed, agreed and designed out of the system.

Process mapping promotes staff ownership of each stage of the process and enables all stakeholders to input to avoid the ripple effect, whereby a change to one stage of a process adversely affects another stage. Mapping should cross team and department boundaries, revealing the whole process from start to finish, ensuring quality improvements which flow across teams and departments.

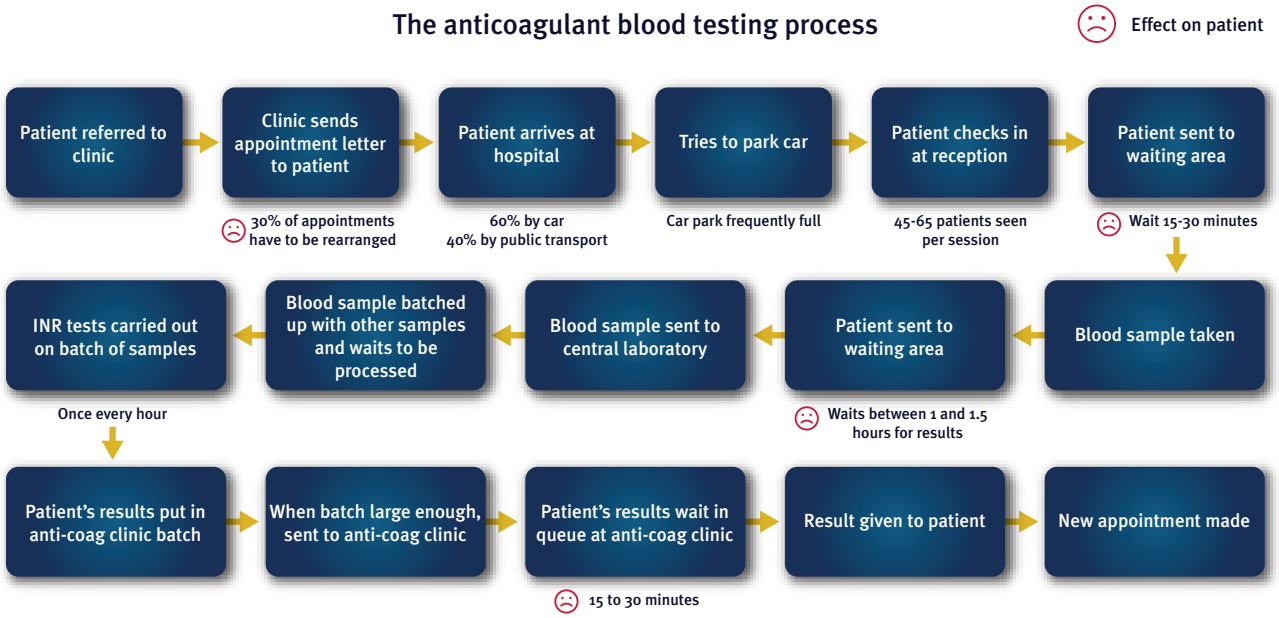
Governance: Usually an ad-hoc review involving staff associated with the healthcare system or pathway under scrutiny.

To be most effective, process mapping should be carried out involving staff associated with the clinical process or pathway under development, along with patients for service user insight.

Providers may wish to hold evidence of such developments on record to demonstrate due diligence, particularly where significant changes are made to healthcare processes, such as environmental, staffing or key clinical system adjustment.

May be requested from providers by commissioners where quality failures are identified and improvements are required.

Figure 12: Process mapping[24]



Case example:

Healthcare quality issue

Evidence suggested that primary care physicians were not satisfied with communication at transition points between inpatient and ambulatory care and that information was often not provided in a timely manner, omitted essential information or contained ambiguities that put patients at risk.[25]

Method selection

Safe patient transitions depend upon effective and co-ordinated processes and the patient journey was therefore reviewed using process mapping.

Implementation

Process mapping illustrated handover practices in place between ambulatory and inpatient care settings, identifying existing barriers and effective transitions of care and highlighting potential areas for quality improvement. Focus group interviews were conducted to facilitate a process mapping exercise with clinical teams in six academic health centres in the USA, Poland, Sweden, Italy, Spain and the Netherlands. High level processes for patient admission to hospital through the emergency department, inpatient care and discharge back in the community were found to be comparable across sites.

Impact on quality

The process mapping exercise highlighted barriers to providing information to primary care physicians, inaccurate or incomplete information on referral and discharge, a lack of time and priority to collaborate with counterpart colleagues, and a lack of feedback to clinicians involved in handovers. Process mapping was effective in bringing together key stakeholders to make explicit current and required processes, exploring the barriers to and changes necessary for safe and reliable patient transitions, for quality improvement, through process revision.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, A conventional model of process mapping[i]
- NHS Institute for Innovation and Improvement, Process mapping, alternative conventional methods[ii]

24. NHS Institute for Innovation and Improvement, 2008. *A conventional model of process mapping*
25. Johnson, J.K., and Farnan, J.M., et al., 2012. *Searching for the missing pieces between the hospital and primary care: mapping the patient process during care transitions.* British Medical Journal Quality & Safety

Statistical process control

Use to: Measure and control process quality against predefined parameters.

Most effective: When a process requires monitoring and control to maximise its full potential for optimum quality of care.

Prerequisites: A process requiring monitoring and control, and stakeholders.

Overview:

Statistical process control (SPC) is a method of quality improvement using statistics to monitor and control a process, ensuring that it operates at its full potential. At full potential, required quality is maintained and waste is minimised. SPC can be applied to any process within which outputs can be measured. SPC involves:

- Control charts
- A focus on continuous improvement
- The design of experiments

SPC highlights the degree of variation from required outputs and enables the measurement of the impact of any experimental process change made for improvement.

How to use it:

An upper control limit and a lower control limit are set using standard deviations from historical mean or baseline measurements and outputs are charted for variation in quality (see fig.13).

Data may be unavailable and require special arrangements for collection for charting. For statistical rigour, the number and frequency of measurements are important: the more measurements that are charted, the more robust the overview of variation in outputs.

Analysis of variation enables the identification of shortfalls against the baseline and highlights opportunities for quality improvement. Such shortfalls require targeted investigation, process adjustment, and continued monitoring to check whether or not the changes made have reduced variation, or indeed, caused further variation, which may appear at another point within the process.

SPC is used throughout the life cycle of a process quality improvement project, at initial project identification, setting a baseline, checking progress, checking whether the project made a difference, whether changes are sustainable and in evaluating the worth of the project.

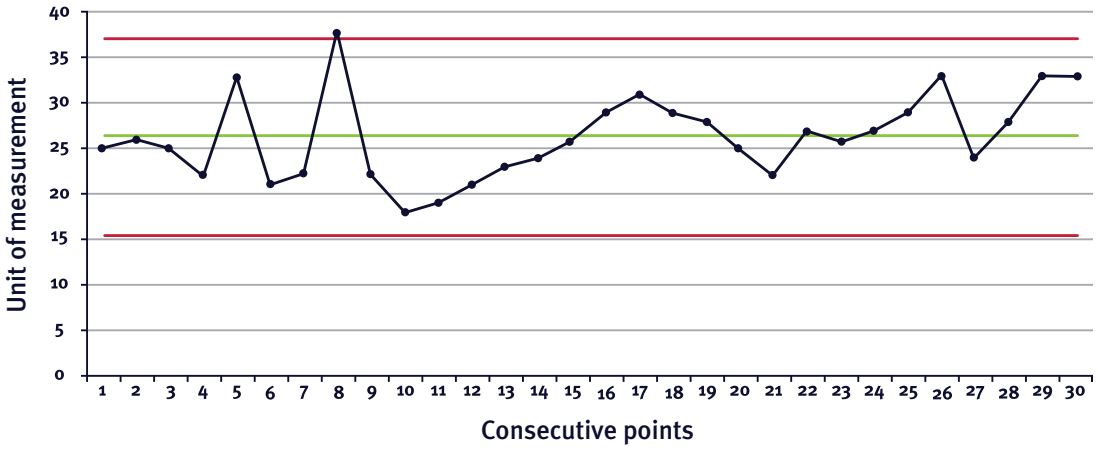
Governance:

Usually an ad-hoc review involving staff associated with the healthcare system or pathway under scrutiny.

Providers may wish to hold evidence of such developments on record to demonstrate due diligence, particularly where significant changes are made to healthcare processes, such as environmental, staffing or key clinical system adjustment.

May be requested from providers by commissioners where quality failures are identified and measurable improvements are required, perhaps across a range of providers for comparison.

Figure 13: Statistical process control chart[26]



Case example:

Healthcare quality issue

Variation in improvement among practices participating in the Saskatchewan chronic disease management collaborative (CDMC), which set out to improve the quality of care through clinical processes for patients living with diabetes and coronary artery disease.[27]

Method selection

Statistical process control was applied to monitor the variation in improvement among practices participating in the CDMC and to explore the variation to identify remedial actions required.

Implementation

Study participants were primary care practices from across the province, involving more than 25% of Saskatchewan family physicians, all 13 regional health authorities and more than 15,000 patients with diabetes and coronary artery disease. SPC charts were used to record variation in CDMC process compliance between practices over time. The SPC charts set out to query whether all practices improved against the CDMC measures and if not, whether there were groups of practices that appeared to have different levels or rates of improvement and then to explore why.

Impact on quality

Once the variation in process compliance was charted it informed a further qualitative study to better understand why any differences occurred, exploring additional data on factors such as context (culture, team efficiency, leadership) and facilitation (collaborative facilitator roles and skills), to shed more light upon why differences between practices (and groups of practices) occurred and enable remedial action plans.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, Statistical process control[i]
- SAASoft Systems Thinking Improvement Science, BaseLine tool[ii]

26. NHS Institute for Innovation and Improvement, 2008. *Statistical process control*
27. Timmerman, T. and Verrall, T. et al, 2010. *Taking a closer look: using statistical process control to identify patterns of improvement in a quality-improvement collaborative.* Quality and Safety in Health Care

Root cause analysis

Use to: Uncover the physical, human and latent causes of events affecting quality.

Most effective: When events affecting quality, are noted and analysis is required to identify the root causes of events, for improvement.

Prerequisites: Events affecting quality and stakeholders.

Overview: Root cause analysis (RCA) is a structured process, often used as a reactive method, to identify causes after an adverse event has occurred, or as an investigative tool to identify causes after clinical audit findings demonstrate shortfalls in the quality of care (HQIP is producing separate guidance around RCA, which will be available in 2015). However, RCA also affords insights which make it useful as a pro-active method to forecast or predict possible events before they occur, at system or process design or review stage. RCA enables the source of an issue or problem to be identified, so that resources for quality improvement can be appropriately directed towards the true cause of the issue or problem, rather than towards the symptoms. Patient safety RCA investigations should be conducted at a level appropriate and proportionate to the adverse event under review, and should involve all associated stakeholders by way of relevant multidisciplinary team involvement, with remedial action planning and associated audit and re-audit to prevent adverse event recurrence. Where adverse events are significant, affected patients/carers should be invited to take part for their valuable perspective and insight, as appropriate.

How to use it: A tool often used in RCA is the fishbone cause and effect diagram. The fishbone diagram helps identify a broad range of possible causes behind an issue or problem and the associated effects, known as care/service delivery problems (C/SDPs). It can be used to structure a creative thinking session around potential cause categories, placing sticky notes with contributory factors along the spines of the diagram, identifying clusters. With each line of enquiry identified it is helpful to ask 'Why does this happen?' five times, known as 'The Five Whys Technique', to explore causes and remedial actions (see fig.14).

Governance: It is useful for a central register of root cause analysis investigations underway and undertaken to be held organisationally for monitoring purposes and for investigation design to be approved using in-house expertise with consideration of ethical issues, particularly where patients are involved.[28] RCA findings require collation, open and transparent presentation and exception reports detailing shortfalls and the required actions for improvement, enabling review and scrutiny at provider meetings, ideally with patient and board member representation. Action plans to address any shortfalls in care identified should be presented with clear target dates for remedial action completion and named responsible leads. Audits and subsequent re-audits should be carried out to ensure corrective actions have been taken to improve quality, and these too should be reviewed and approved at provider meetings until there is evidence that changes made have been effective.

Patients may request copies of RCA investigation reports where they have been affected by adverse events and providers should ensure transparency through the Duty of candour.[29] Commissioners may wish to review RCA activity within provider organisations for their assurance, and may request specific RCA investigations to be undertaken after a serious untoward incident to ensure actions have been taken to prevent recurrence.

28. HQIP, 2009. *Review of ethics issues related to clinical audit and quality improvement activities*
29. Health and Social Care Act, 2008 (Regulated Activities) *Regulations, 2014: regulation 20, Duty of candour*

Figure 14: Fishbone cause and effect diagram[30]

Case example:

Healthcare quality issue

Fluctuation in overdue medication dose rates in an acute teaching hospital.[31]

Method selection

Root cause analysis meetings were an essential component of a wider review to identify and investigate the causes of changes in overdue medication dose rates.

Implementation

To investigate the changes in overdue medication dose rates over a four year period in an acute teaching hospital, retrospective time-series analysis of weekly dose administration data was reviewed. Prescription data was extracted from the locally developed electronic prescribing and administration system, with an audit database containing details on every drug prescription and dose administration. Four interventions were implemented at the hospital: (1) the ability for doctors to pause medication doses; (2) clinical dashboards; (3) visual indicators for overdue doses and (4) executive-led overdue doses RCA meetings, at which findings were evaluated for cause and effect, and plans for remedial action were drawn up.

Impact on quality

Missed medication doses decreased significantly upon the introduction of these interventions coupled with overdue doses RCA meetings to drive improvement.

Further information (full reading list on page 34):

- American Society for Quality, Fishbone cause and effect tool[i]
- NHS Institute for Innovation and Improvement, Root cause analysis[ii]
- NHS England, Root cause analysis resource centre[iii]

30. American Society for Quality, 2014. *Fishbone cause and effect tool*
31. Coleman, J.J. and Hodson, J. et al., 2013. *Missed medication doses in hospitalised patients: a descriptive account of quality improvement measures and time series analysis.* International Journal of Quality in Health Care

Communication tools

Use to: Improve the quality of care through the structured exchange of essential information.

Most effective: When essential information requires rapid transfer.

Prerequisites: Essential information data set and stakeholders.

Overview: Clear communication in healthcare is essential and carefully designed tools can help ensure comprehensive, complete and consistent communication to improve the quality of care.

How to use it: Structured communication tools improve the consistency of exchange of essential information between clinicians, and between clinicians and patients and their relatives and carers.

Communication tools are numerous and include patient healthcare records, patient information leaflets and guidance, structured patient consultations, active listening techniques and prompts to encourage patients to ask questions about their care.

One such communication aid is the Situation, background, assessment, recommendation (SBAR) tool, which can be used to shape communication at any stage of the patient's journey, from the content of a GP's referral letter, consultant to consultant referrals, ward to ward transfers, handover of care at shift change, or communicating discharge back to a GP.

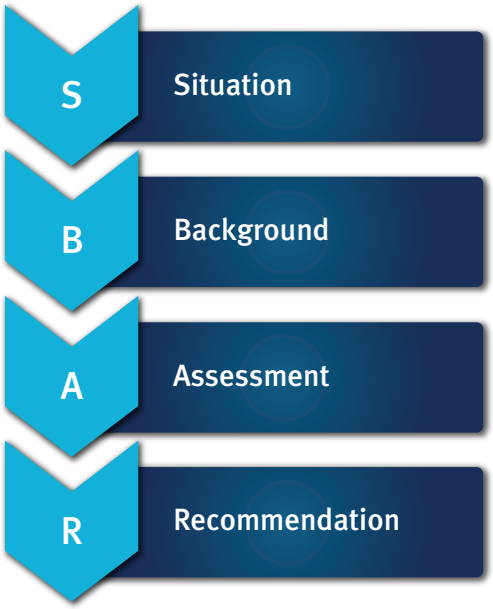
The tool enables staff in a clinical setting to make recommendations based upon the current situation, the patient's medical background and an assessment of the current situation (see fig.15).

Governance: Communication tools should be designed with representatives from relevant user groups, and patient information should be developed with patient input.

Tools should be routinely reviewed and revised, particularly where a system or process change has arisen, and updated versions of tools should be shared, with associated training for staff.

Careful housekeeping is essential to ensure only the latest versions of tools are available, applying version numbers and withdrawing and archiving copies of superceded tools, to safely and effectively use communication tools for quality improvement.

Figure 15: Situation, background, assessment, recommendation (SBAR)



Case example:

Healthcare quality issue

A group of Macmillan Cancer Support General Practitioner (GP) advisers had been receiving multiple forms of patient status communication from colleagues in secondary care, lacking a cancer diagnosis, treatment summary and ongoing management plan.[32]

Method selection

Effective communication is a key element of quality of care for patients with advanced and serious illness, and to improve the situation, a Treatment summary template was designed by the National cancer survivorship initiative (NCSI), incorporating all the information deemed necessary by stakeholders.

Implementation

The treatment summary was introduced, completed by secondary cancer care professionals at conclusion of treatment, and sent to the patient's GP. It provided important information for GPs, including patient's cancer diagnosis, treatment, an ongoing management plan, possible treatment toxicities, information about side effects and/or consequences of treatment, and signs and symptoms of a recurrence. It also informed GPs of any actions they needed to take and who to contact with any questions or concerns. The patient also received a copy to improve understanding of their condition and to share with other professionals and agents of their choice, e.g. for travel insurance purposes.

Impact on quality

The treatment summary was positively received in both primary and secondary care; 80% of GPs found the summary 'useful' or 'very useful', more than 50% felt it would make a difference to the way they managed patients, and 90% wanted to continue using it. The majority of hospital clinicians recognised the value of recording what could be months of treatment and holistic care into a concise summary.

Further information (full reading list on page 34):

- NHS Institute for Innovation and Improvement, SBAR[i]
- NHS Institute for Innovation and Improvement, SBAR cards and pads[ii]
- NHS Institute for Innovation and Improvement, Listening: importance of this skill[iii]
- NHS Brand guidelines, communicating with different patient groups[iv]

32. Macmillan Cancer Support, 2010. *Treatment summary: a tool to improve communication between cancer services and primary care*

Technological innovations

Use to: Automate processes and systems to increase reliability, reduce human error and variation in care, for quality improvement.

Most effective: When processes and systems require automation for reliability, ultimately saving resources.

Prerequisites: Processes and systems which require reliability and reduced variation, stakeholders such as clinicians, information governance and IT specialists.

Overview: Technological innovations automate processes and systems, offer reliability, reduce human error, and variation in care, and thus drive quality improvement. Life expectancy has increased and the healthcare system faces future crises with elderly care provision, a predicted rise in dementia diagnoses, obesity and associated conditions such as diabetes and cardiovascular disease and the need for wise use of limited resources. Efficiencies through technology are therefore vital to the sustainability of high quality healthcare provision.

How to use it: Growth in the telehealth, telemedicine and telecare sectors, whereby technologies and related services concerned with health and wellbeing are accessed by people remotely, or provided for them at a distance, reduces time absorbed through routine appointments. It also enables patients to move from a state of dependency towards more flexible and empowered self-care arrangements, improving quality of life and healthcare experience.[33] Technological innovations can incorporate alarms and early warning alerts where deterioration in patient health occurs, preventing serious decline.

Technological innovations and interventions have the power to improve and streamline the quality of care for patients of all ages and demographics, affording convenience and accessibility, and enabling patients to normalise and prevent medical conditions.

The move towards integrated electronic healthcare records affords shared real time data retrieval, active safety warnings and mandatory searchable fields, and sets the platform for further technological innovations to efficiently and effectively improve the quality of healthcare (see fig.16).

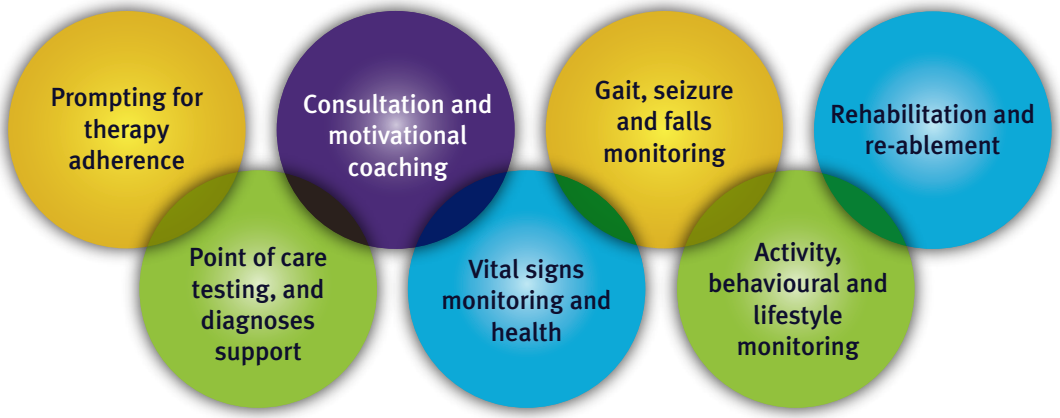
Governance: Implementation of healthcare technologies for quality improvement requires specialist input, in terms of technical appraisal, reliability, networking and interoperability, clinical application, information governance, security and data protection, with satisfactory testing and staff training prior to system go live.

For effective systems, provider organisations require input from patients and relevant stakeholders when selecting, integrating and implementing healthcare technologies, and provider committees are established to offer scrutiny of proposals and plans, with patient and board member representation and clinical and technical staff involvement.

Commissioners may wish to use data extraction tools as part of real time provider monitoring arrangements.

33. TeleSCoPE, 2014. *Telehealth services code of practice for europe*

Figure 16: Remote technologies for healthcare quality improvement



Case example:

Healthcare quality issue

The quality, timeliness and cost of outpatient surgical processes in hospitals were found to be adversely affected by problems in locating supplies and equipment and by post-operative infections.[34]

Method selection

Radio Frequency Identification (RFID) technology, the wireless use of electromagnetic fields to track data and equipment, automates identification systems to increase reliability and reduce human error and variation in care, for quality, timeliness and cost improvement.

Implementation

A study was designed to research the benefits of implementing RFID, limiting scope to outpatient surgical processes in hospitals. The study used the Define, measure, analyse, improve, control (DMAIC) approach (see previous Lean/Six sigma entry), work flow diagrams, value stream mapping and discrete event simulation, to examine the impact of implementing RFID equipment tracking on improving the effectiveness (quality and timeliness) and efficiency (cost reduction), of outpatient surgical processes.

Impact on quality

The study analysis showed significant estimated annual cost and time savings in carrying out surgical procedures with RFID technology implementation, largely due to the elimination of non-value added activities: locating supplies and equipment, and the elimination of the "return" loop created by preventable post-operative infections. Several fail-safes developed using RFID technology improved patient safety, the cost effectiveness of operations and the success of outpatient surgical procedures. Many stakeholders in the hospital environment were positively affected by the use of RFID technology, including patients, physicians, nurses, technicians and administrators. Computations of costs and savings helped decision makers understand the benefits of the technology.

Further information (full reading list on page 34):

- Telehealth Services Code of Practice for Europe[i]
- NHS Institute for Innovation and Improvement, technology[ii]
- Map of Medicine, pathway to improved care[iii]
- Health and Social Care Information Centre, NHS interoperability toolkit[iv]

34. Southard, P.B. and Chandra, C. et al., 2012. *RFID in healthcare: a Six sigma DMAIC and simulation case study. International journal of health care quality assurance*

Decision trees

Use to: Improve the quality and consistency of processes in healthcare.

Most effective: When decisions around healthcare options require consistency of approach.

Prerequisites: A healthcare pathway and stakeholders.

Overview: A decision tree is a flowchart whereby each intersection represents a test and each branch represents the outcome of the test, designed by stakeholders of a multidisciplinary team to improve quality and consistency of decisions taken throughout a process.

How to use it: Decision trees can be applied in healthcare when choices for treatment are uncertain, providing clear choices such as diagnostics, referrals, medication and next steps, involving established algorithms and healthcare criteria.

Decision trees allow clinicians and patients alike to identify the most favourable treatment options, and may also include the risks and benefits of each treatment and the potential sequence of events where risks are realised, improving the quality of care.

As tools to support quality improvement in healthcare, decision trees are clear and intuitive and can usefully feature in patient information materials.

Care pathways may be structured using decision trees, helpful in ensuring patients with similar clinical pictures undergo the same journey. Healthcare records may also be designed using the decision tree approach and electronic healthcare records can automate clinical pathways, supporting consistency of quality of care.

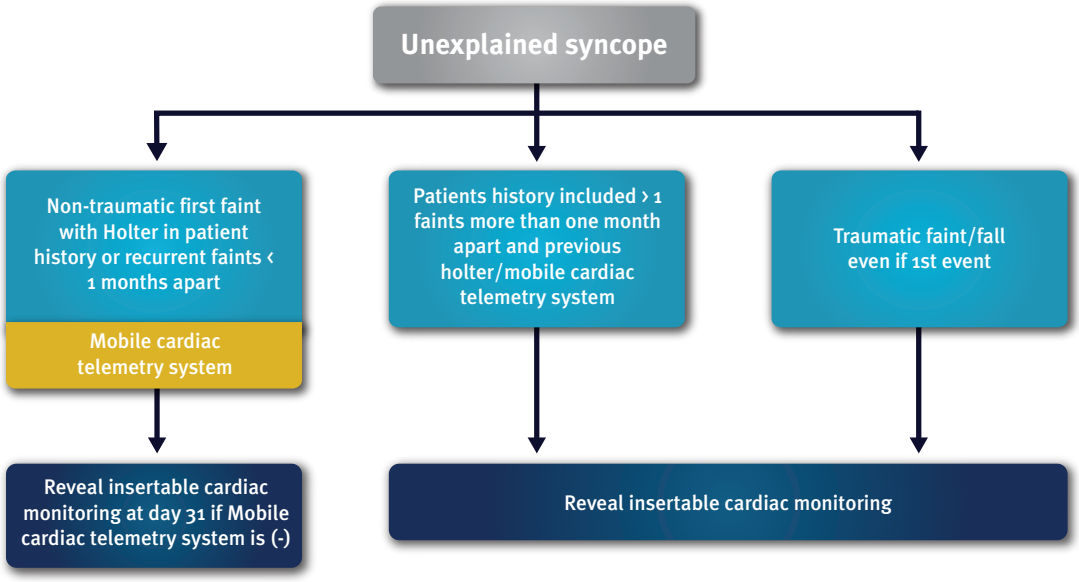
Decision tree design requires input from relevant stakeholders to be effective, along with patients for service user insight and when mapped out electronically with corresponding outcomes, values and probabilities, after rigorous testing decision trees become powerful tools in supporting the best healthcare choices for patients (see fig.17).

Governance: Decision trees which are informative and useful to patients may be shared widely, for example, via the organisational website.

Providers may wish to hold evidence of such developments on record to demonstrate due diligence, particularly where significant changes are made to healthcare processes, such as environmental, staffing or key clinical system adjustment.

May be requested from providers by commissioners where failures in consistency are identified and improvements are required.

Figure 17: Decision tree[35]



Case example:

Healthcare quality issue

It was noted that among patients who were discharged from a hospital emergency department (ED), about 3% returned within 30 days.[36]

Method selection

A decision tree was chosen to guide decisions around healthcare options on discharge, with consistency of approach.

Implementation

A decision tree based model with electronic medical record features was developed and validated, estimating the ED 30-day revisit risk for all patients approaching discharge from ED. A retrospective cohort of 293,461 ED encounters was assembled, with the associated patients' demographic information and one-year clinical histories as the inputs. To validate, a prospective cohort of 193,886 encounters was constructed. Cluster analysis of high-risk patients identified discrete sub-populations with distinctive demographic, clinical and resource utilisation patterns, which were incorporated into the ED discharge decision tree.

Impact on quality

Revisits were found to relate to the nature of the disease, medical errors, and/or inadequate diagnoses and treatment during the patient initial ED visit. Identification of high-risk patients using the decision tree enabled new strategies for improved ED care with reduced ED resource utilisation. The ED 30-day revisit decision tree model was incorporated into the electronic health record, and uncovered opportunities for targeted care intervention to reduce resource burden, and most importantly to improve the quality of care and patient health outcomes.

Further information (full reading list on page 34):

- Health Knowledge, Decision analysis[i]
- Centre for the study of complex systems, decision trees[ii]

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