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Using data to drive improvement in the quality and safety of care: a social science perspective

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Overview

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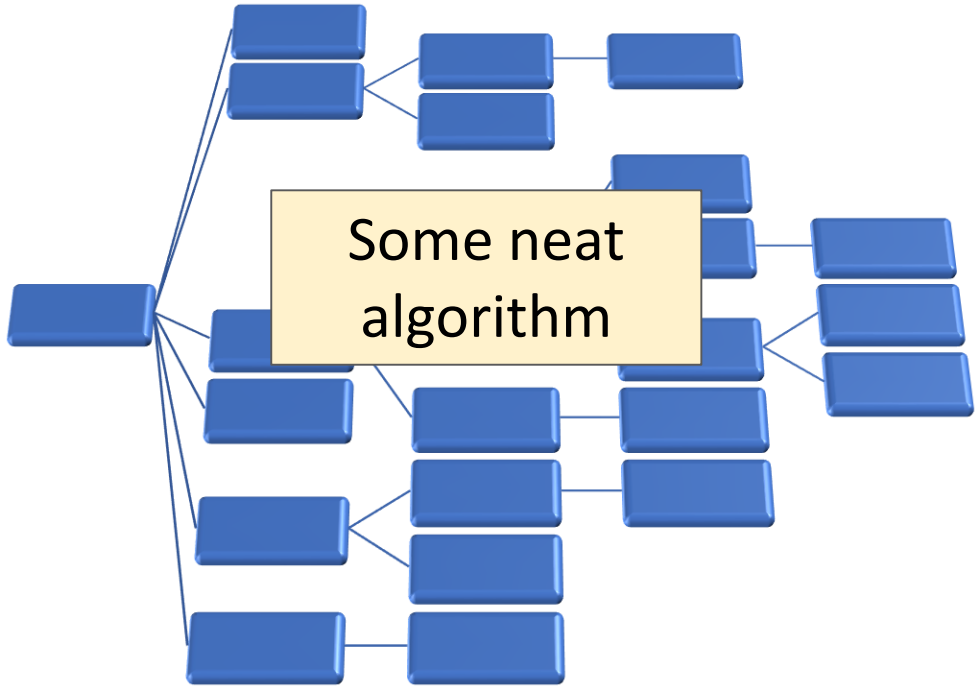
1. Introduction: why focus on use of data for quality improvement?
2. A framework for three research case studies
    - Case 1: Patient safety incident reporting
    - Case 2: Mortality alerts
    - Case 3: Quality in anaesthesia
3. Discussion: A generic model for data-driven improvement
4. Concluding thoughts

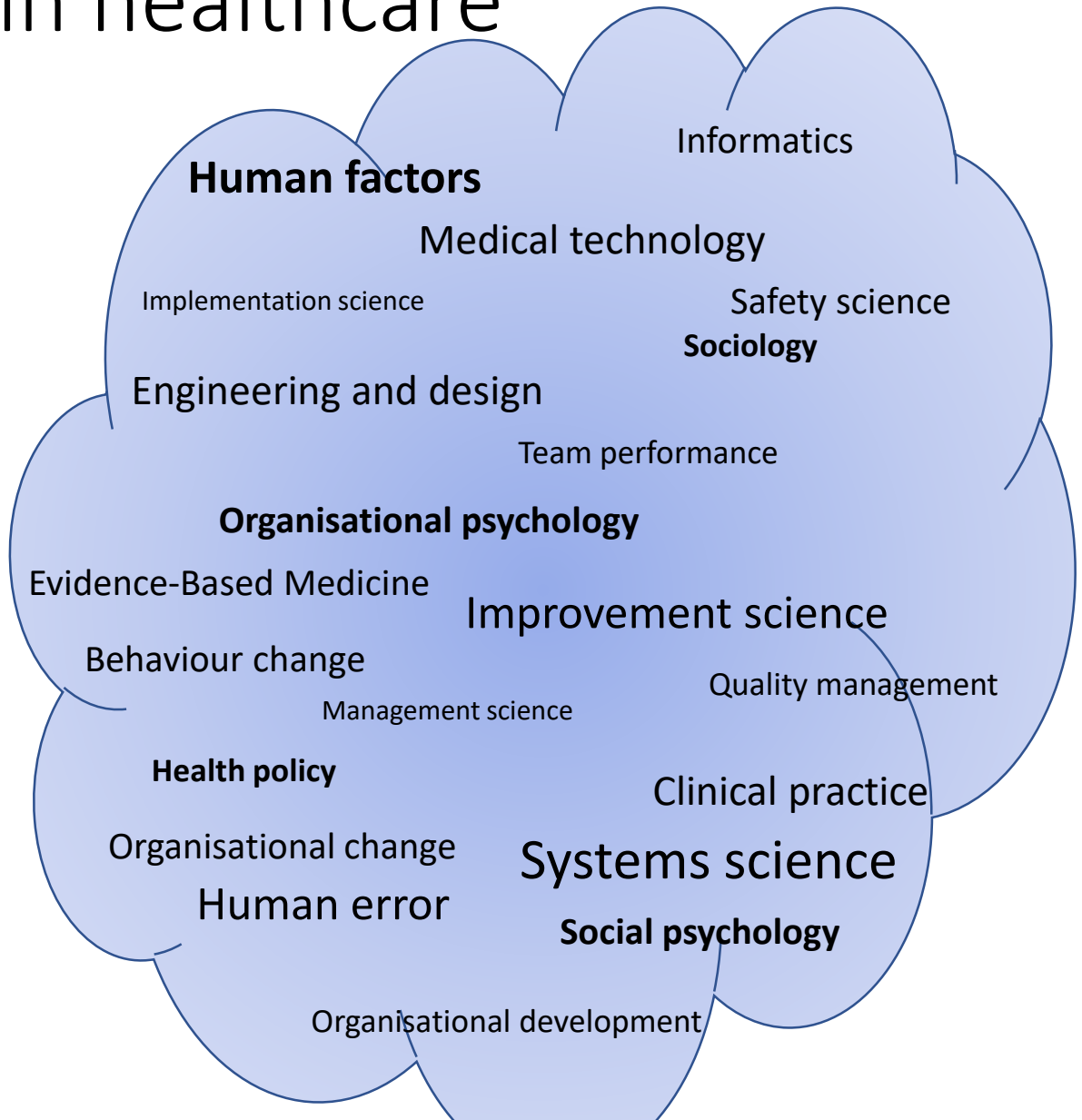
Understanding how to improve quality and safety in healthcare



The capacity to operate with consistent, effective, failure-free performance, whilst maintaining peak output, under variable task and situational conditions

(Adapted from the literature on HRO's e.g. Roberts et al., 1990)

Understanding how to improve quality and safety in healthcare



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The capacity to operate with consistent, effective, failure-free performance, whilst maintaining peak output, under variable task and situational conditions

(Adapted from the literature on HRO's e.g. Roberts et al., 1990)

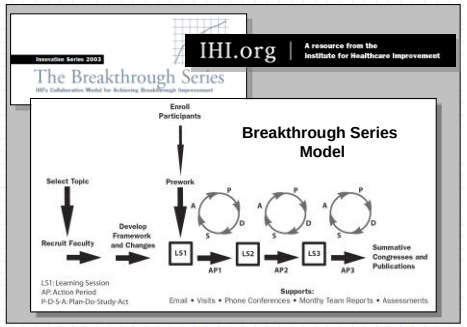
Why focus on use of data for improvement?

- Experience in the Safer Patients Initiative
- Reaction of clinicians and healthcare professionals to “new” models for measurement, evaluation and improvement.
- Capacity of UK healthcare trusts to implement industry-style process monitoring
- Advances in theory relating to measurement and monitoring for quality and safety

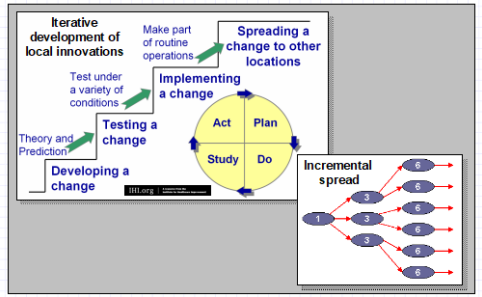
Safer Patients Initiative (SPI) 2004/2006

Expert support

Programme model



QI methodology

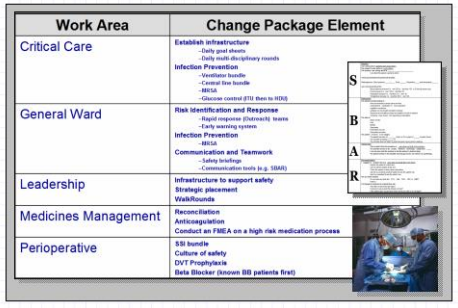


Safer Patients Initiative

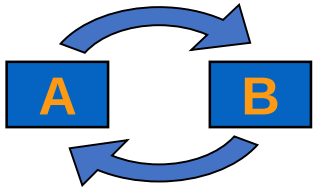
Participating hospital site

The Health Foundation

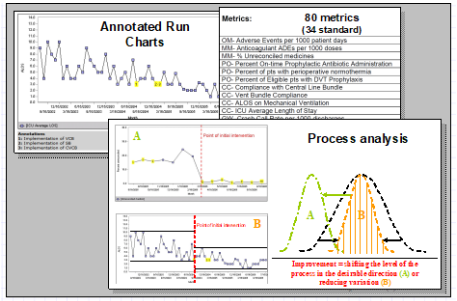
Change elements



Collaborative learning



Process measurement



The SPI programme required trusts to monitor and report on approximately 35 standard metrics

High level metrics
-OM- Actual percent monthly mortality (unadjusted)
-OM- Adverse Events per 1000 patient days
Medicines Management
-MM- Anticoagulant ADEs per 1000 days
-MM- Narcotic ADE Rate
-MM- Pilot population size: Anticoagulants
-MM- Pilot population size: Narcotics
-MM- Percent pts. Receiving anticoags with ADE
-MM- Percent of patients receiving Narcotic who experience an ADE
-MM- Fall Rate
-MM- % Unreconciled medicines
-MM- Risk Priority Number (RPN) from FMEA for a core medication process
Critical Care
-CC- CLC Bloodstream Infection Rate
-CC- Percent compliance with central line bundle
-CC- VAP rate
-CC- Percent compliance with central line bundle
-CC- Vent Bundle Compliance
-CC- ALOS on Mechanical Ventilation
-CC- Re-intubation Rate
-CC- Percent Compliance with Weaning Protocol
-CC- Multi-disciplinary Rounds and Daily Goals
-CC- ICU Average Length of Stay

General Ward
-GW- Monthly crash call rate per 1000 discharges
-GW- Crash Call Rate per 1000 discharges
-GW- Percent of Crash Calls Discharged Alive
-GW- Utilization of Rapid Response Team
-GW- MRSA Bloodstream Infection Rate
Perioperative Management
-PO- Percent of Eligible pts with DVT Prophylaxis
-PO- Percent of postoperative BB HR 80 or less
-PO- Percent of Eligible Patients with Beta Blockers
-PO- Surgical Site Infections (SSI)
-PO- Percent On-time Prophylactic Antibiotic Administration
-PO- Percent of pts with perioperative normothermia
-PO- Percent of Surgical Patients with Perioperative Glucose Control
Culture and Leadership
-CL- Culture support process: walkarounds

SPI: Review of pilot phase metrics

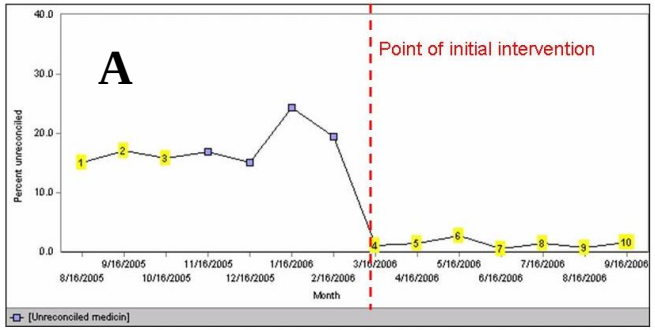
Number of individual metrics reported to SPI extranet site during SPI Phase 1:

Process measurement review item:	Trust A	Trust B	Trust C	Trust D
Total overall metrics monitored	43	38	24	61
Total standard project metrics monitored	29	28	21	28
Total custom metrics monitored	14	10	3	33
No. metrics with 15 or more data points	24	27	14	39
No. metrics with 20 or more data points	11	21	12	27

3 different approaches to measurement (source: IHI)

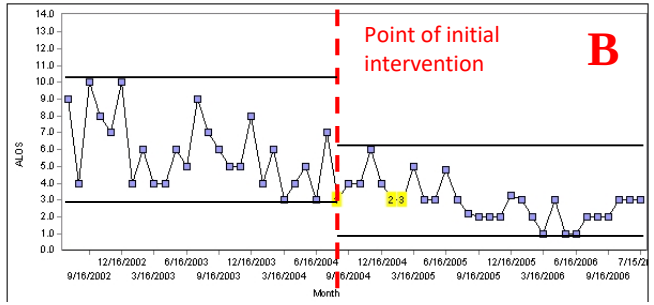
Aspect	Improvement	Accountability	Research
Aim	Improvement of care	Comparison, choice, reassurance, spur for change	New knowledge
Methods: • Test Observability	Test observable	No test, evaluate current performance	Test blinded or controlled
• Bias	Accept consistent bias	Measure and adjust to reduce bias	Design to eliminate bias
• Sample Size	"Just enough" data, small sequential samples	Obtain 100% of available, relevant data	"Just in case" data
• Flexibility of Hypothesis	Hypothesis flexible, changes as learning takes place	No hypothesis	Fixed hypothesis
• Testing Strategy	Sequential tests	No tests	One large test
• Determining if a change is an improvement	Run charts or Shewhart control charts	No change focus	Hypothesis, statistical tests (t-test, F-test, chi square), p-values
• Confidentiality of the data	Data used only by those involved with improvement	Data available for public consumption and review	Research subjects' identities protected

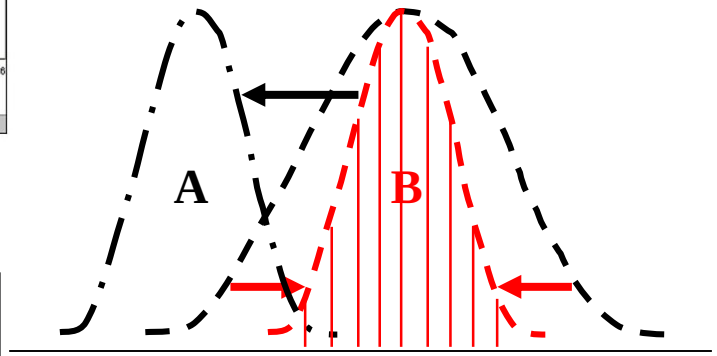
Statistical definition of improvement using principles of Statistical Process Control



A = A stable shift in the level of the process in a desirable direction

➡ **Improved "Capability"**



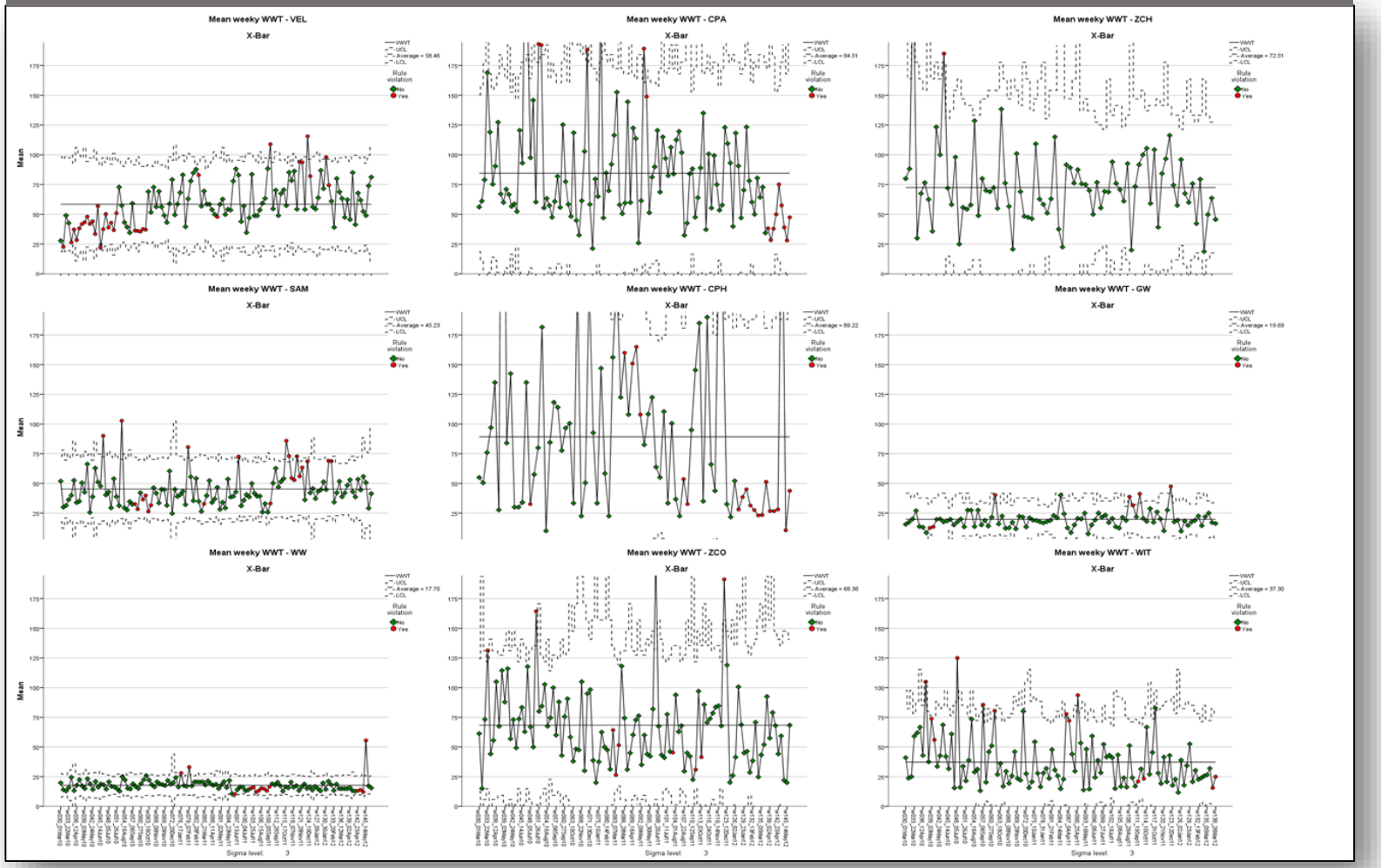


B = Reduction in degree of variation in consecutive data points over time

➡ **Improved "Reliability"**

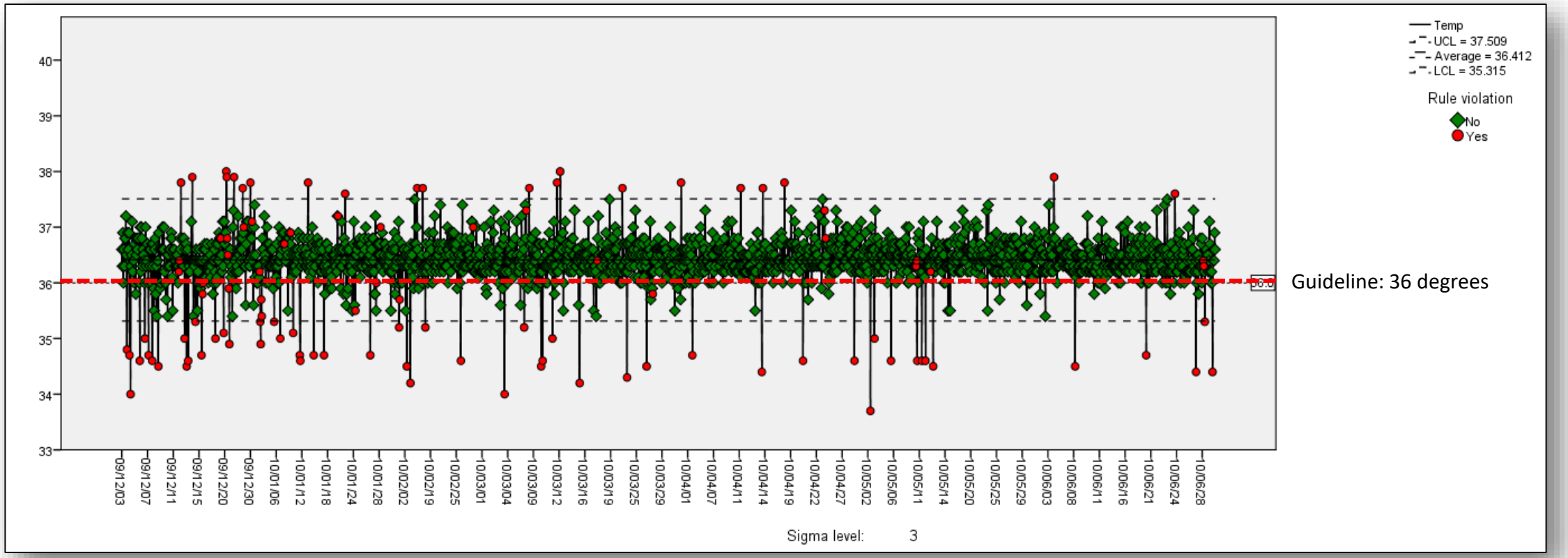
Data provides a window on variations in care

Ward-level variation in patient transfer time from recovery



Data provides a window on variations in care

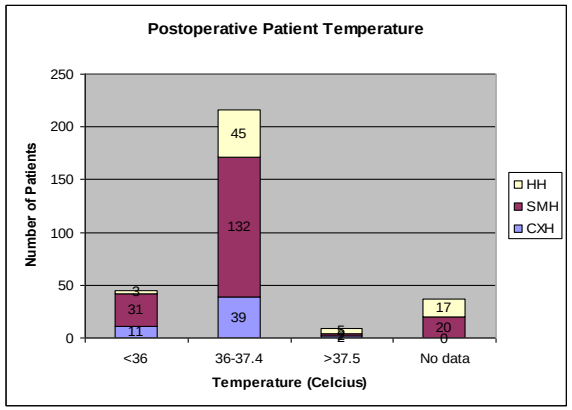
Variation in core temperature on arrival in recovery for 3200 consecutive surgical patients

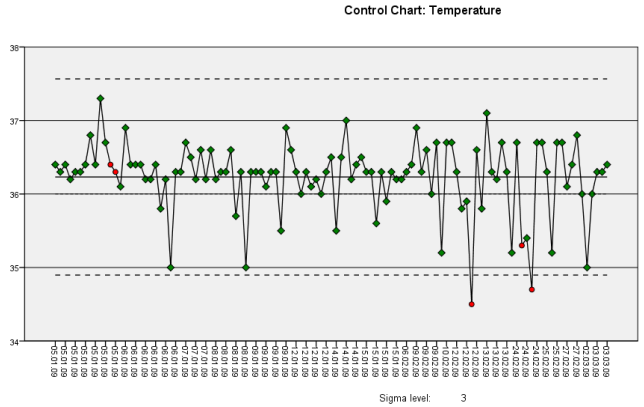


Guideline: 36 degrees

Periodic auditing & summary reports:

- Provides “Snapshot” summaries at specific time-points
- Masks natural process variation over time
- Supports periodic summative feedback that is retrospective in focus
- Supports summative pretest-posttest design but not iterative improvement work
- Is usually a “special project”





Continuous process monitoring:

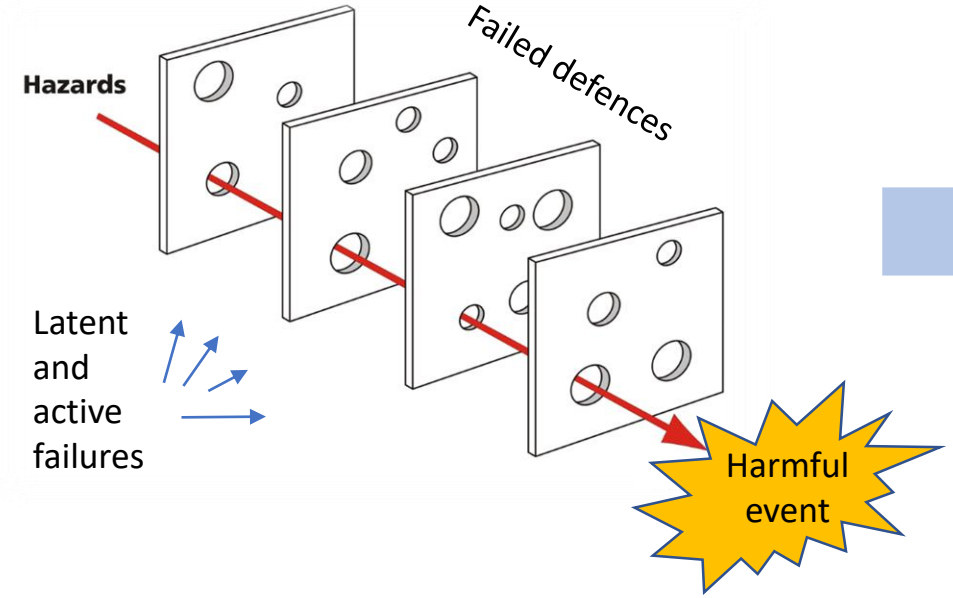
- Provides continuous signal of variation over time
- Can identify significant underlying process change against background noise
- Supports real-time continuous feedback that can detect harmful trends early
- Effects of interventions are observable over time and can be used to guide improvement work
- Must be integrated within routine operations

Qualitative perspectives on the value of measurement in SPI

Understanding cause and effect	"…if you start to measure then you start to see cause and effect more and one of the problems in healthcare is, it's very difficult to see cause and effect…So the measurement is absolutely fundamental and I think that's as big a cultural change as any." (Senior clinical manager)
Local ownership of data for improvement	"..I know at the senior charge nurse meetings, they all use the data now to discuss the improvement work, which before, there was no data really, or it was data that was given to them, it wasn't their own data and I think that's what makes the difference, it's their own data…" (SPI Coordinator)
Making current reliability visible	"What was new was the measurement…We were already using care bundles…what we weren't doing was measuring how effectively we did it, we were just doing it and it wasn't till we started measuring it that we realised we weren't doing it as effectively as we thought." (Senior clinical manager)

Advances in theory that inform how we generate “signals” for improvement

“Safety 1”
Complex linear model: interdependent causes



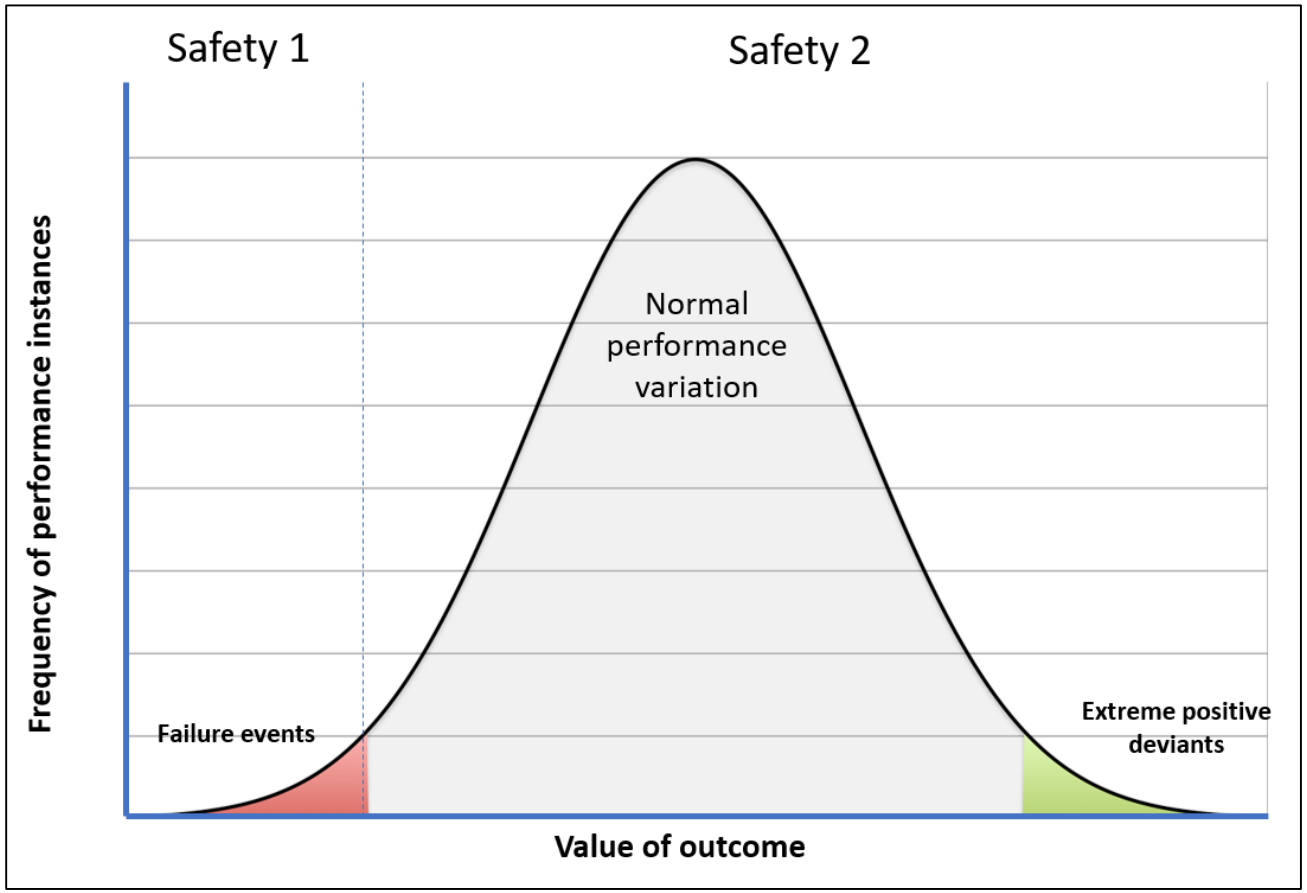
- Safety = the absence of harmful events
- Learning = reactive: understanding why the system failed

“Safety 2”
Non-linear model: tight-coupling and emergence

- Safety = the capacity to adapt to variable conditions
- Learning = proactive: understanding why things go right most of the time

Hollnagel E., Wears R.L. and Braithwaite J. (2015) From Safety-I to Safety-II: A White Paper. The Resilient Health Care Network.

Advances in theory that inform how we generate “signals” for improvement



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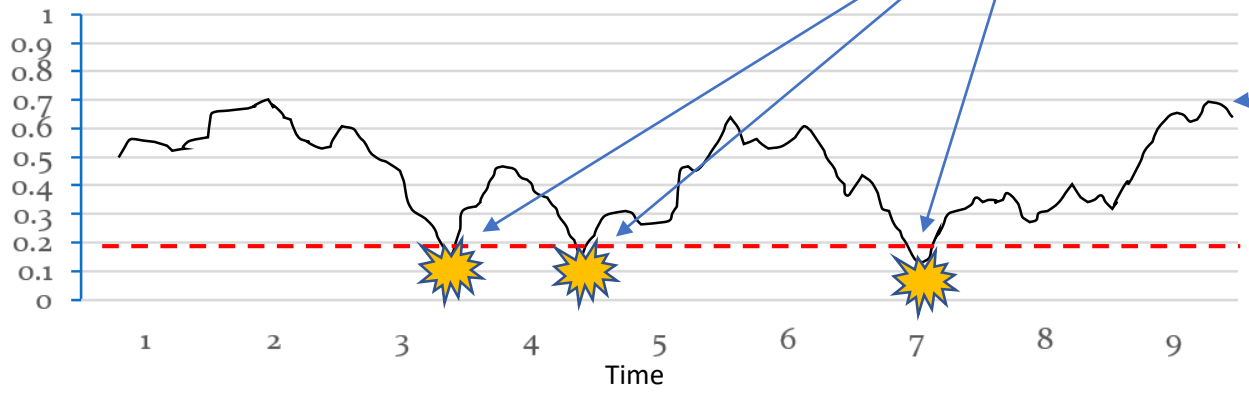
Increasing maturity in measurement and monitoring systems

Maturity level 1: Identifying and analysing negative events (and near misses)

Lagging indicators

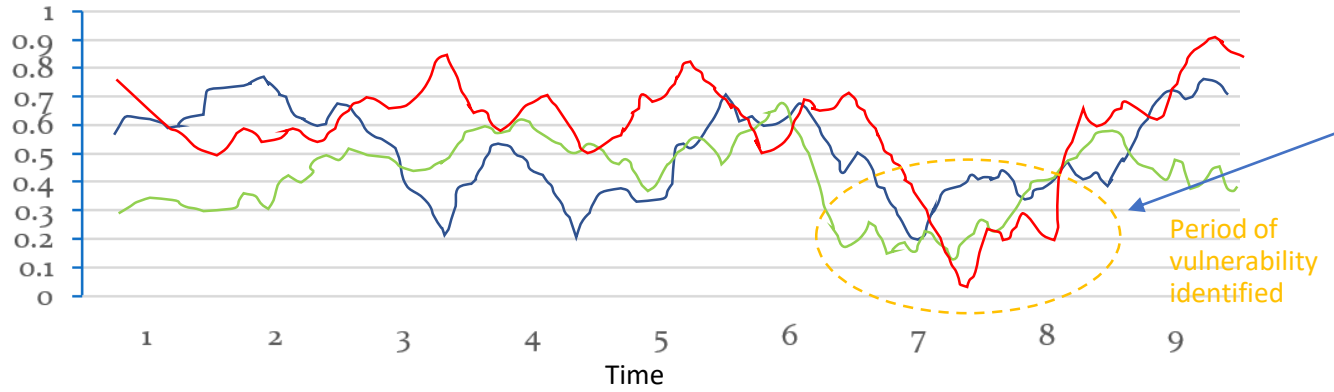
Known safety outcome



Maturity level 2: Continuous monitoring of routine variations in safety-related outcomes in order to understand drivers of full spectrum variation

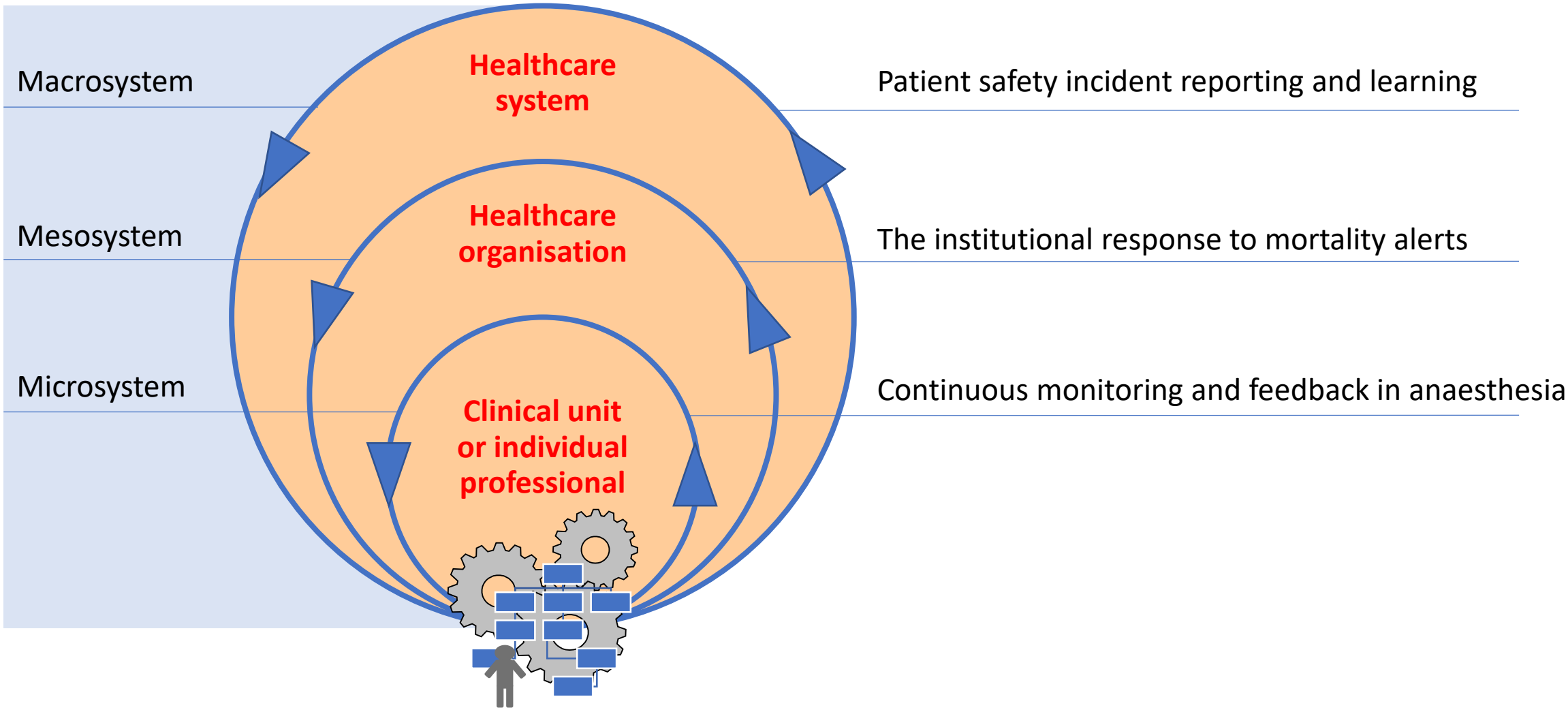
Leading indicators

System parameters that might influence safety in the future



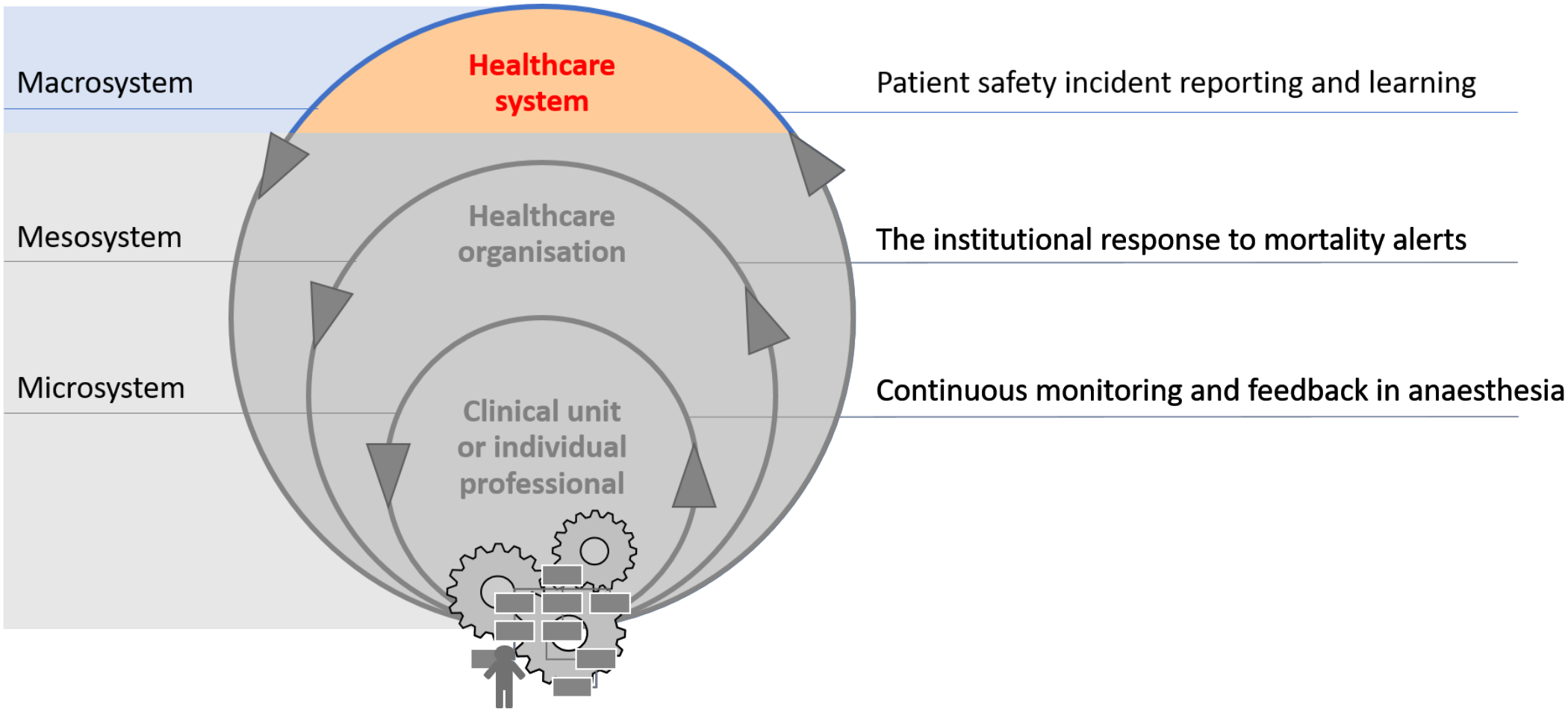
Maturity level 3: Understanding systemic behaviour and dynamic risk by monitoring multiple upstream factors

Three case studies in “feedback” for improvement



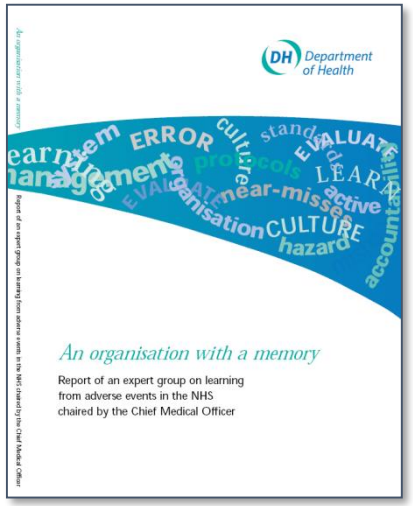
Generic model for data-driven improvement

Case 1

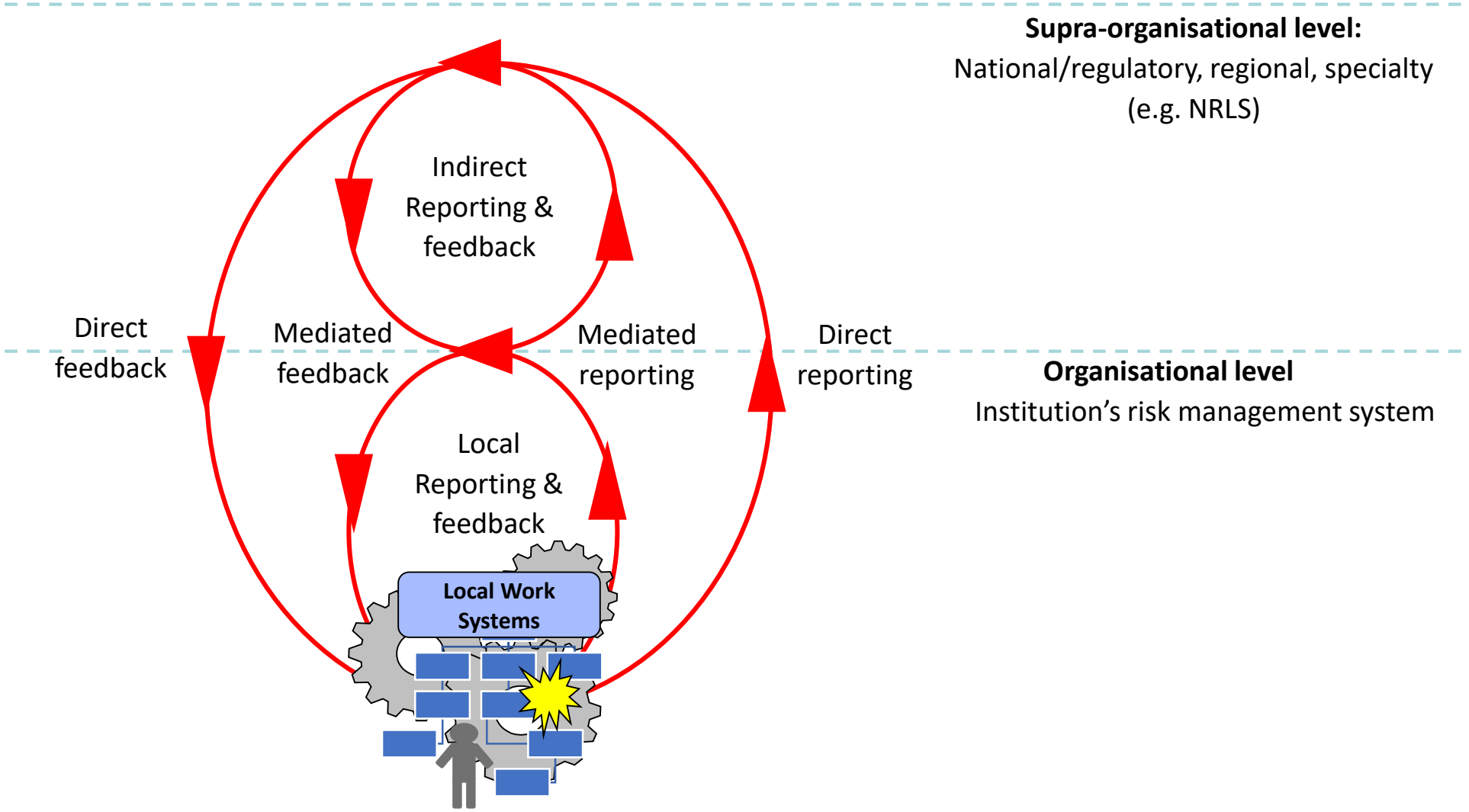

Macrosystem
Mesosystem
Microsystem
Healthcare system
Healthcare organisation
Clinical unit or individual professional
Patient safety incident reporting and learning
The institutional response to mortality alerts
Continuous monitoring and feedback in anaesthesia

The requirement to learn from failures in UK care systems

- UK Dept of Health report: *An Organisation with a Memory (2000):*
  - NHS does not actively learn from failures
  - Existing systems took a long time to analyse information and generate recommendations
  - There is little or no systematic follow-up of recommendations
- National Audit Office survey of NHS trusts *A Safer Place for Patients* (2005):
  - Lessons learnt on a local level are not widely disseminated either within or between trusts
  - There is a need to improve sharing of solutions by all organisations
  - Considerable complexity in reporting and channels currently exists (multiple agencies responsible for producing guidance)



Multilevel architecture of reporting and feedback: Local and national systems



National patient safety alerts and rapid responses

NHS
National Patient Safety Agency

PATIENT SAFETY **ALERT**

PROBLEM:

Research in UK and elsewhere has identified a risk to patients from errors occurring during intravenous administration of potassium solutions.

Potassium chloride concentrate solution can be fatal if given inappropriately.

ACTION FOR NHS BY 31 OCTOBER 2002:

This alert sets out action, including initial action in the following areas:

1. Storage and handling of potassium chloride concentrate and other strong potassium solutions
2. Preparation of dilute solutions containing potassium
3. Prescription of solutions containing potassium
4. Checking use of strong potassium solutions in clinical areas

For the attention of:

Chief Executives of NHS Trusts and Primary Care Trusts

For action by:

Chief Pharmacists and pharmaceutical advisers in NHS Trusts and Primary Care Trusts

For information to:

Regional Directors of Health and Social Care
Chief Executives of Strategic Health Authorities
Directors of Public Health: Regional, StHA, PCT
Medical Directors
Directors of Nursing
Risk Managers
Lead Consultants/Clinical Directors – critical care areas
Communications Leads
Patient Advice and Liaison Service (PALS)

Date: 23 July 2002

NHS
National Patient Safety Agency

Rapid Response Report

NPSA/2012/RRR001

From reporting to learning — 22 March 2012

Harm from flushing of nasogastric tubes before confirmation of placement

Issue

Misplaced nasogastric tubes leading to death or severe harm are 'never events.' The Patient Safety Alert *Reducing the harm caused by misplaced nasogastric feeding tubes in adults, children and infants* was issued by the NPSA on 10 March 2011 with an action complete date of 12 September 2011. Alongside other actions, this Alert requires all organisations to ensure that '*Nasogastric tubes are not flushed, nor any liquid/feed introduced through the tube following initial placement, until the tube tip is confirmed by pH testing or x-ray to be in the stomach.*' This advice is repeated in the National Nurses Nutrition Group *Good Practice Guideline: Safe Insertion of Nasogastric Feeding Tubes in Adults*.

The advice not to flush until after gastric placement is confirmed is important because:

- any flush could cause an aspiration pneumonia if the tube is misplaced in the lungs;
- pH testing for gastric placement relies on collecting aspirate via the tube; anything introduced down the tube will contaminate this aspirate, potentially leading to false positive pH readings.

Evidence of harm

The NPSA is aware of two patient deaths since 10 March 2011 where staff had flushed nasogastric tubes with water before initial placement had been confirmed. Staff then aspirated back the water they had flushed into the tube, including the lubricant within the tube that this water had activated. Because this mix of water and lubricant gave a pH reading below 5.5, they assumed that the nasogastric tube was correctly placed and went on to give medications and/or feed, although the tube was actually in the patient's lung. We are also aware of a similar incident which did not lead to harm to a patient.

The three organisations where the incidents occurred were aware of the NPSA Alert, but there appeared to be a widespread belief amongst their frontline staff that the 'never flush' rule did not apply where nasogastric tubes had a water-activated lubricant. This belief is incorrect, and the manufacturer's written guidance, enclosed with each new nasogastric tube, clearly states that gastric placement must be confirmed BEFORE the tube is flushed. The lubricant is not needed for placement, only to aid removal of the guidewire/ stylet from the tube **after gastric placement has been confirmed.**

FOR IMMEDIATE ACTION by all organisations in the NHS and independent sector where nasogastric feeding tubes are placed and used for feeding patients. The deadline for action complete is 21 September 2012.

1. Assign a named clinical lead to coordinate implementation of the actions in this Rapid Response Report (RRR) with any actions outstanding from the earlier Alert
2. Remind all staff responsible for checking initial placement of nasogastric tubes (including staff who support parents/carers who check initial placement of nasogastric tubes):
   a. NOTHING should be introduced down the tube before gastric placement has been confirmed;
   b. DO NOT FLUSH the tube before gastric placement has been confirmed;
   c. Internal guidewires/ stylets should NOT be lubricated before gastric placement has been confirmed.
3. This reminder should be given through:
   a. Distributing this RRR to all relevant staff;
   b. Providing warning notices and/ or overwraps with warning labels on all current and future stock of nasogastric tubes, until these are provided as standard by manufacturers;
   c. Reviewing and, if necessary, amending all local policy, protocol and training materials.

The NPSA has alerted device manufacturers of this risk and will promote the need for safer design and labelling. Any concerns related to manufacturers' instructions for use or labelling should be reported to the Medicines and Healthcare products Regulatory Agency.

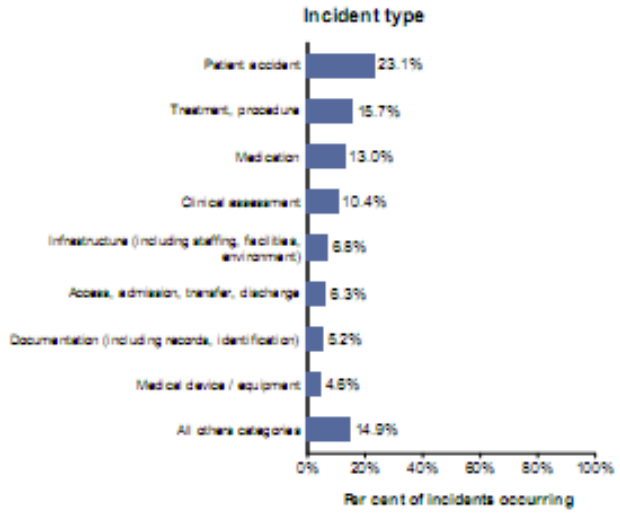
NHS Evidence accredited provider

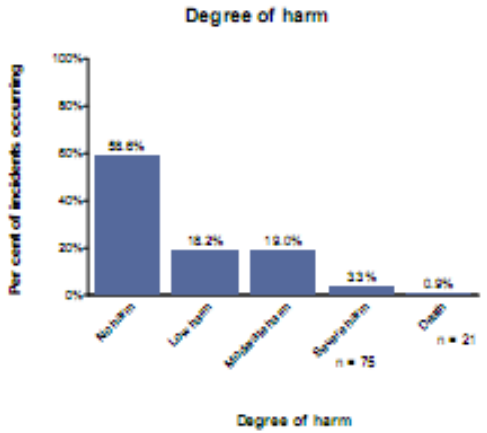
Further information: This RRR should be read in conjunction with the previous Alert *Reducing the harm caused by misplaced nasogastric feeding tubes in adults, children and infants*. This remains in force and should be referred to for all other issues, including repeat placement checks after initial gastric placement has been confirmed.
For further queries contact rrr@npsa.nhs.uk, Telephone 020 7927 9500.

Tailored feedback reports for individual trusts (2012)

Incident summary for the period April 2008 to September 2008

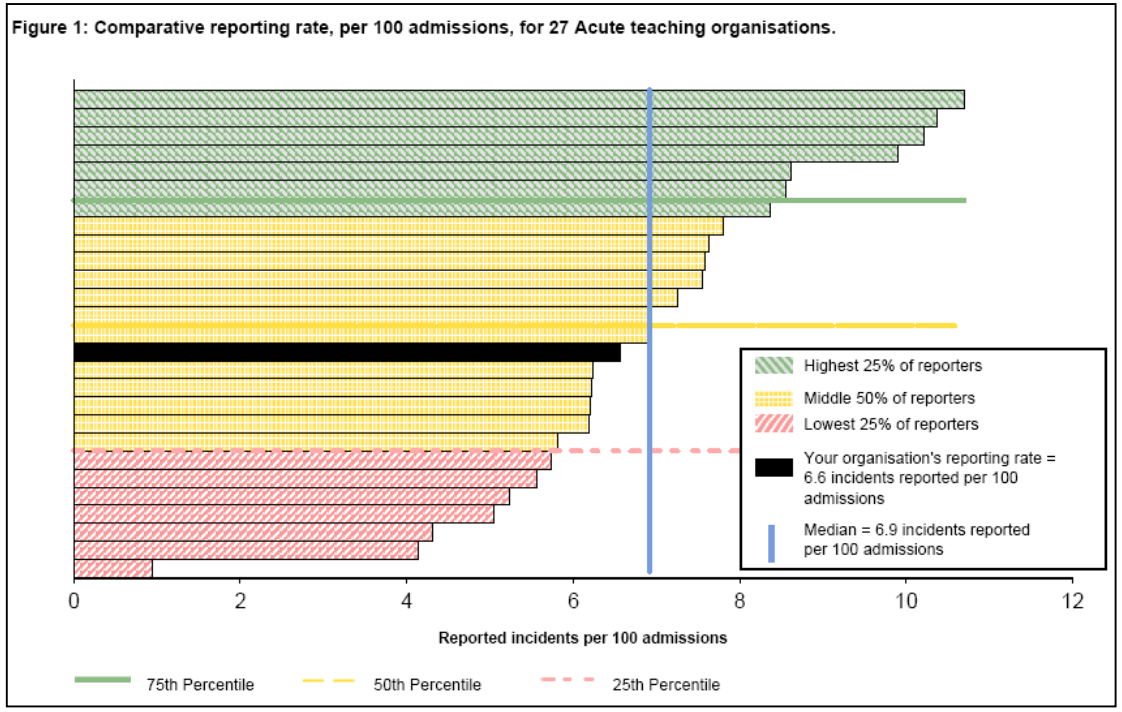
There were 2,269 incidents during the 6 month period between April 2008 to September 2008 submitted to the Reporting and Learning System (RLS) by the end of November 2008.





The graph above shows the degree of harm of incidents as reported by this organisation. Nationally, 66 per cent of incidents are reported as no harm, and

The graph above shows the type of incidents reported from comparable national breakdown is available at http://www.npsa.nhs.uk/datareports/



Reports submitted by month

The graph above shows the number of incidents submitted in each of the last 12 months. Consistent or increasing numbers of reports each month indicate that an organisation has a robust process for submitting data. Organisations should submit incidents to the RLS at least monthly, to allow timely national action to be taken. The median days between an incident occurring and being submitted to the RLS for the period April 2008 to September 2008 is 57 days: the time lag for this organisation over the same period was 59 days.

Includes:
- Breakdown by type
- Degree of harm
- Tracks reporting rates by month
- Benchmarks against other trusts

Characteristics of effective reporting and learning systems (Leape, 2002)

- **Nonpunitive**: Reporters are free of fear of retaliation or punishment from others as a result of reporting.
- **Confidential**: The identities of the patient, reporter, and institution are never revealed to a third party.
- **Independent**: The program is independent of any authority with power to punish the reporter or organization.
- **Expert analysis**: Reports are evaluated by experts who understand the clinical circumstances and who are trained to recognize underlying systems causes.
- **Timely**: Reports are analyzed promptly, and recommendations are rapidly disseminated to those who need to know, especially when serious hazards are identified.
- **Systems-oriented**: Recommendations focus on changes in systems, processes, or products, rather than on individual performance.
- **Responsive**: The agency that receives reports is capable of disseminating recommendations, and participating organizations agree to implementing recommendations when possible.

Factors that impact upon reporting in health care

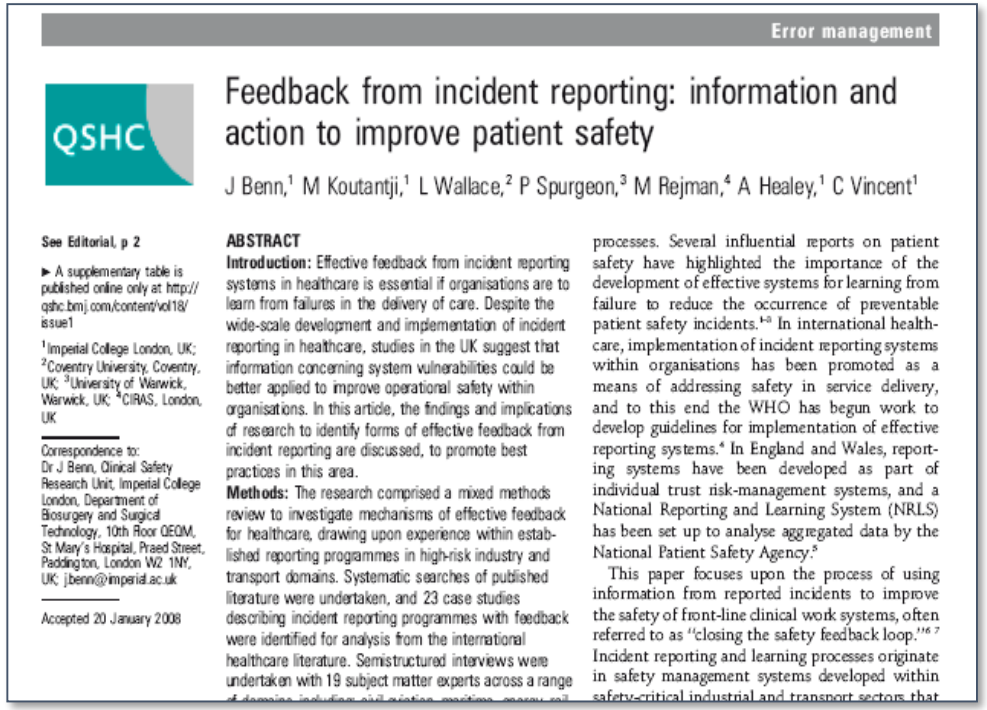
- Practical constraints: time pressure
- Variations in reporting behaviour between professional groups
- Unclear as to what should be reported
- Fear of blame/repercussions
- Perception of lack of feedback/follow-up of reported issues

Stanhope et al. (1999), Firth-Cozens (2004), Lawton & Parker, (2002)

Systematic scoping study of effective feedback mechanisms for reporting systems

- Scoping review of literature:
  - 2000 records screened for relevance; 190 articles reviewed
  - 23 best case examples of health care reporting systems identified from the published literature, with explicit feedback mechanisms identified
- Consultation with expert panel on reporting and feedback (N=19)
  - Expert panel comprised safety and reporting systems experts from a range of high risk industries and international healthcare.
- Synthesis of qualitative findings into requirements for effective feedback systems and candidate mechanisms/channels
- Expert Review workshop with UK healthcare professionals, NHS risk managers and industry experts to develop consensus on emerging model

Output from scoping review



Error management

QSHC

Feedback from incident reporting: information and action to improve patient safety

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See Editorial, p 2

► A supplementary table is published online only at http://qshc.bmj.com/content/vol18/issue1

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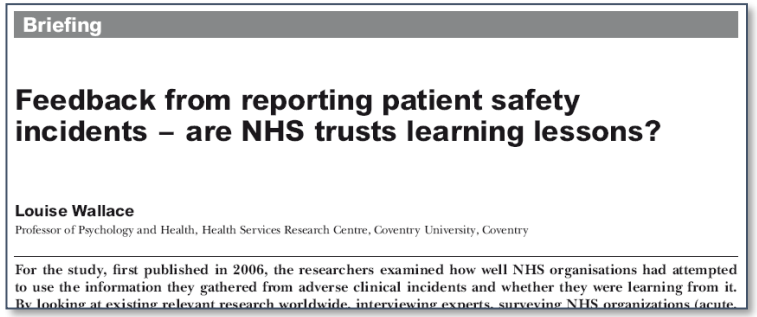
Accepted 20 January 2008

ABSTRACT

Introduction: Effective feedback from incident reporting systems in healthcare is essential if organisations are to learn from failures in the delivery of care. Despite the wide-scale development and implementation of incident reporting in healthcare, studies in the UK suggest that information concerning system vulnerabilities could be better applied to improve operational safety within organisations. In this article, the findings and implications of research to identify forms of effective feedback from incident reporting are discussed, to promote best practices in this area.

Methods: The research comprised a mixed methods review to investigate mechanisms of effective feedback for healthcare, drawing upon experience within established reporting programmes in high-risk industry and transport domains. Systematic searches of published literature were undertaken, and 23 case studies describing incident reporting programmes with feedback were identified for analysis from the international healthcare literature. Semistructured interviews were undertaken with 19 subject matter experts across a range of domains including civil aviation, maritime, energy, rail processes. Several influential reports on patient safety have highlighted the importance of the development of effective systems for learning from failure to reduce the occurrence of preventable patient safety incidents.[1–3] In international healthcare, implementation of incident reporting systems within organisations has been promoted as a means of addressing safety in service delivery, and to this end the WHO has begun work to develop guidelines for implementation of effective reporting systems.[4] In England and Wales, reporting systems have been developed as part of individual trust risk-management systems, and a National Reporting and Learning System (NRLS) has been set up to analyse aggregated data by the National Patient Safety Agency.[5]

This paper focuses upon the process of using information from reported incidents to improve the safety of front-line clinical work systems, often referred to as "closing the safety feedback loop."[6 7] Incident reporting and learning processes originate in safety management systems developed within safety-critical industrial and transport sectors that



Briefing

Feedback from reporting patient safety incidents – are NHS trusts learning lessons?

Louise Wallace
Professor of Psychology and Health, Health Services Research Centre, Coventry University, Coventry

For the study, first published in 2006, the researchers examined how well NHS organisations had attempted to use the information they gathered from adverse clinical incidents and whether they were learning from it. By looking at existing relevant research worldwide, interviewing experts, surveying NHS organizations (acute,

PAPERS

Improving patient safety incident reporting systems by focusing upon feedback – lessons from English and Welsh trusts

Louise M Wallace*, Peter Spurgeon†, Jonathan Benn‡, Maria Koutantji‡ and Charles Vincent‡

*Applied Research Centre Health and Lifestyles Interventions, Coventry University; †Institute for Clinical Leadership, University of Warwick, Coventry, UK; ‡Centre for Patient Safety and Service Quality, Imperial College London, London, UK
E-mail: hsx201@coventry.ac.uk

Summary

This paper describes practical implications and learning from a multi-method study of feedback from patient safety incident reporting systems. The study was performed using the Safety Action and Information Feedback from Incident Reporting model, a model of the requirements of the feedback

Benn, J., Koutantji, M., Wallace, L., Spurgeon, P., Rejman, M., Healey, A., et al. (2009). Feedback from incident reporting: information and action to improve patient safety. *Qual Saf Health Care, 18(1), 11-21.*

Wallace, L. M., Spurgeon, P., Benn, J., Koutantji, M., & Vincent, C. (2009). Improving patient safety incident reporting systems by focusing upon feedback - lessons from English and Welsh trusts. *Health Serv Manage Res, 22(3), 129-135.*

Wallace, L. (2010). Feedback from reporting patient safety incidents - are NHS trusts learning lessons? *Journal of Health Services & Research Policy, 15(suppl_1), 75-78.*

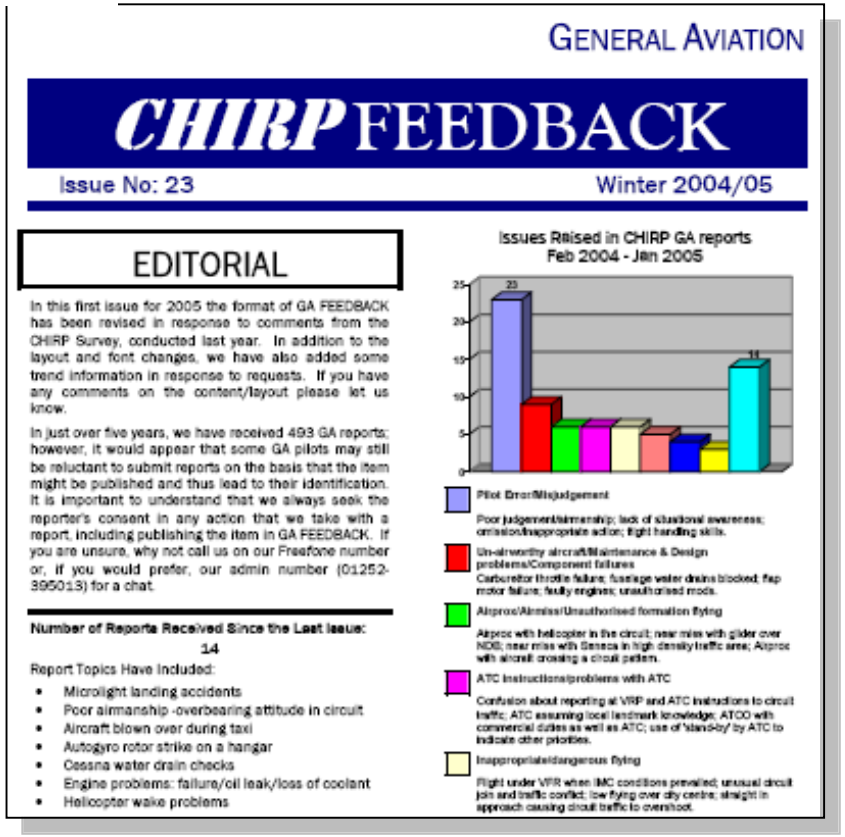
International models for reporting systems in multiple domains

System	Domain
High risk industry and transport sectors:	
Aviation Safety Reporting System (ASRS)	US Aviation
Confidential Human Factors Incident Reporting Programme (CHIRP)	UK Civil Aviation
Confidential Hazardous Incident Reporting Programme (CHIRP)	UK Maritime
British Airways Safety Information System (BASIS)	UK Civil Aviation
Corrective Action Programme (CAP)	UK Energy
Confidential Incident Reporting and Analysis System (CIRAS)	UK Rail
Health care:	
Intensive Care Unit Safety Reporting System (ICUSRS)	US Health Care
Patient Safety Reporting System (PSRS)	US Health Care
NPSA National Reporting and Learning System (NRLS)	UK Health Care
Australian Incident Monitoring Study (AIMS)	AUS Health Care

CHIRP

Aviation and Maritime Confidential Incident Reporting

- CHIRP has been running since 1982 in the UK and provides an independent confidential reporting system for the aviation community
- CHIRP produces FEEDBACK - a periodic safety newsletter
- Simple, summary statistics, presented graphically - cumulative incidence according to type per period
- Published examples of specific incidents
- Editorial commentary to highlight best practices/lessons learnt and draw attention to specific safety issues



GENERAL AVIATION

CHIRP FEEDBACK

Issue No: 23 Winter 2004/05

EDITORIAL

In this first issue for 2005 the format of GA FEEDBACK has been revised in response to comments from the CHIRP Survey, conducted last year. In addition to the layout and font changes, we have also added some trend information in response to requests. If you have any comments on the content/layout please let us know.

In just over five years, we have received 493 GA reports; however, it would appear that some GA pilots may still be reluctant to submit reports on the basis that the item might be published and thus lead to their identification. It is important to understand that we always seek the reporter's consent in any action that we take with a report, including publishing the item in GA FEEDBACK. If you are unsure, why not call us on our Freefone number or, if you would prefer, our admin number (01252-395013) for a chat.

Number of Reports Received Since the Last Issue:

14

Report Topics Have Included:

- Microlight landing accidents
- Poor airmanship -overbearing attitude in circuit
- Aircraft blown over during taxi
- Autogyro rotor strike on a hangar
- Cessna water drain checks
- Engine problems: failure/oil leak/loss of coolant
- Helicopter wake problems

Issues Raised in CHIRP GA reports
Feb 2004 - Jan 2005

Pilot Error/Misjudgement

Poor judgement/airmanship; lack of situational awareness; omission/inappropriate action; flight handling skills.

Un-airworthy aircraft/Maintenance & Design problems/Component failures

Carburettor throttle failure; fuselage water drains blocked; flap motor failure; faulty engines; unauthorised mods.

Airprox/Airmiss/Unauthorised formation flying

Airprox with helicopter in the circuit; near miss with glider over NDB; near miss with Seneca in high density traffic area; Airprox with aircraft crossing a circuit pattern.

ATC Instructions/problems with ATC

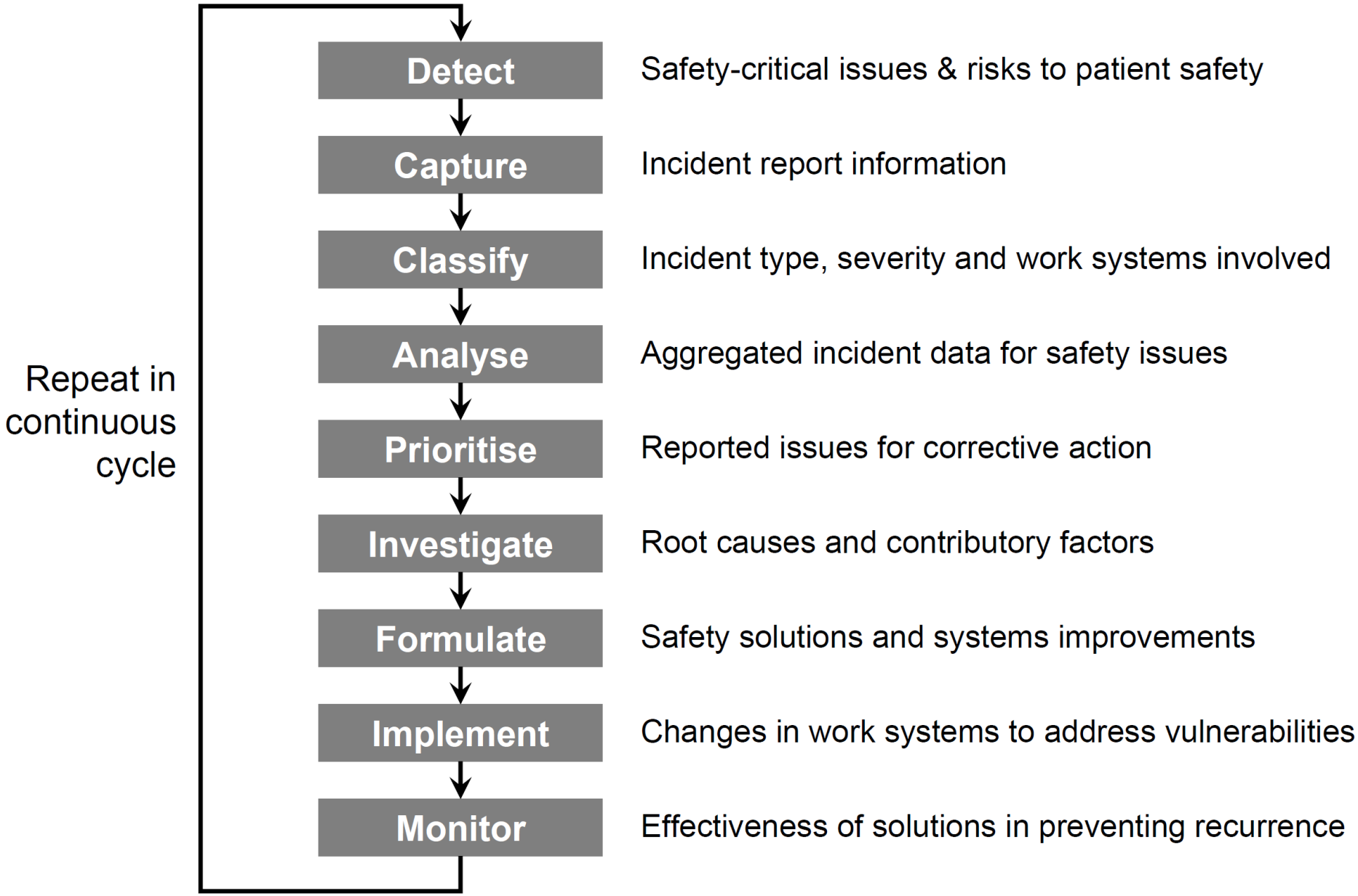
Confusion about reporting at VRP and ATC instructions to circuit traffic; ATC assuming local landmark knowledge; ATCO with commercial duties as well as ATC; use of 'standby' by ATC to indicate other priorities.

Inappropriate/dangerous flying

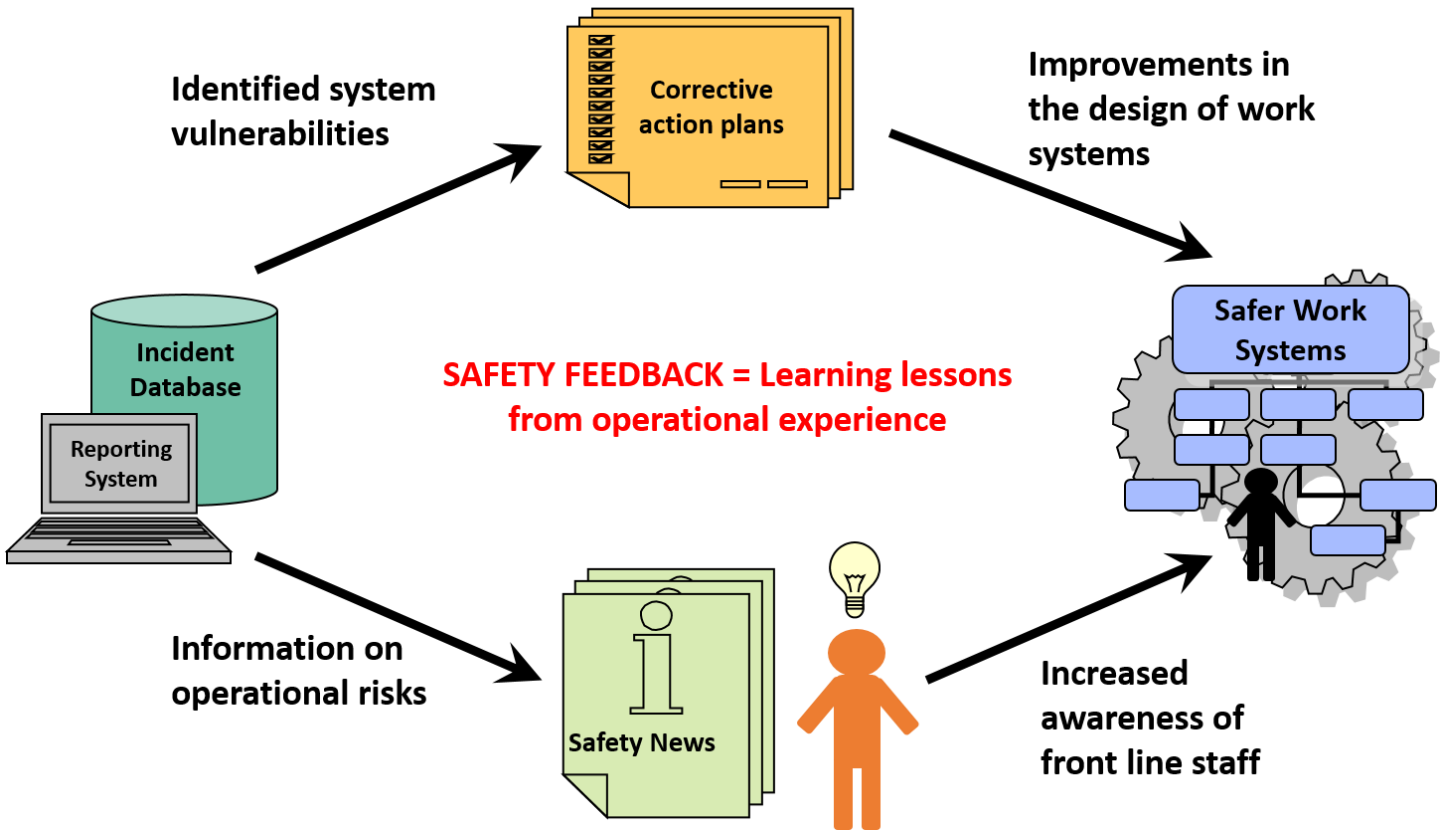
Flight under VFR when IMC conditions prevailed; unusual circuit join and traffic conflict; low flying over city centre; straight in approach causing circuit traffic to overshoot.

Source: "Feedback" – General Aviation Safety Newsletter from the Confidential Human Factors Incident Reporting Programme (CHIRP).

Feedback = “Closing the loop”



Defining feedback as both Information and Action



- *Feedback* publicises safety issues raised and actions taken to the original reporters and all levels of staff.
- *Follow-up* involves prioritising safety actions, assigning responsibility and accountability and implementing the action plan.

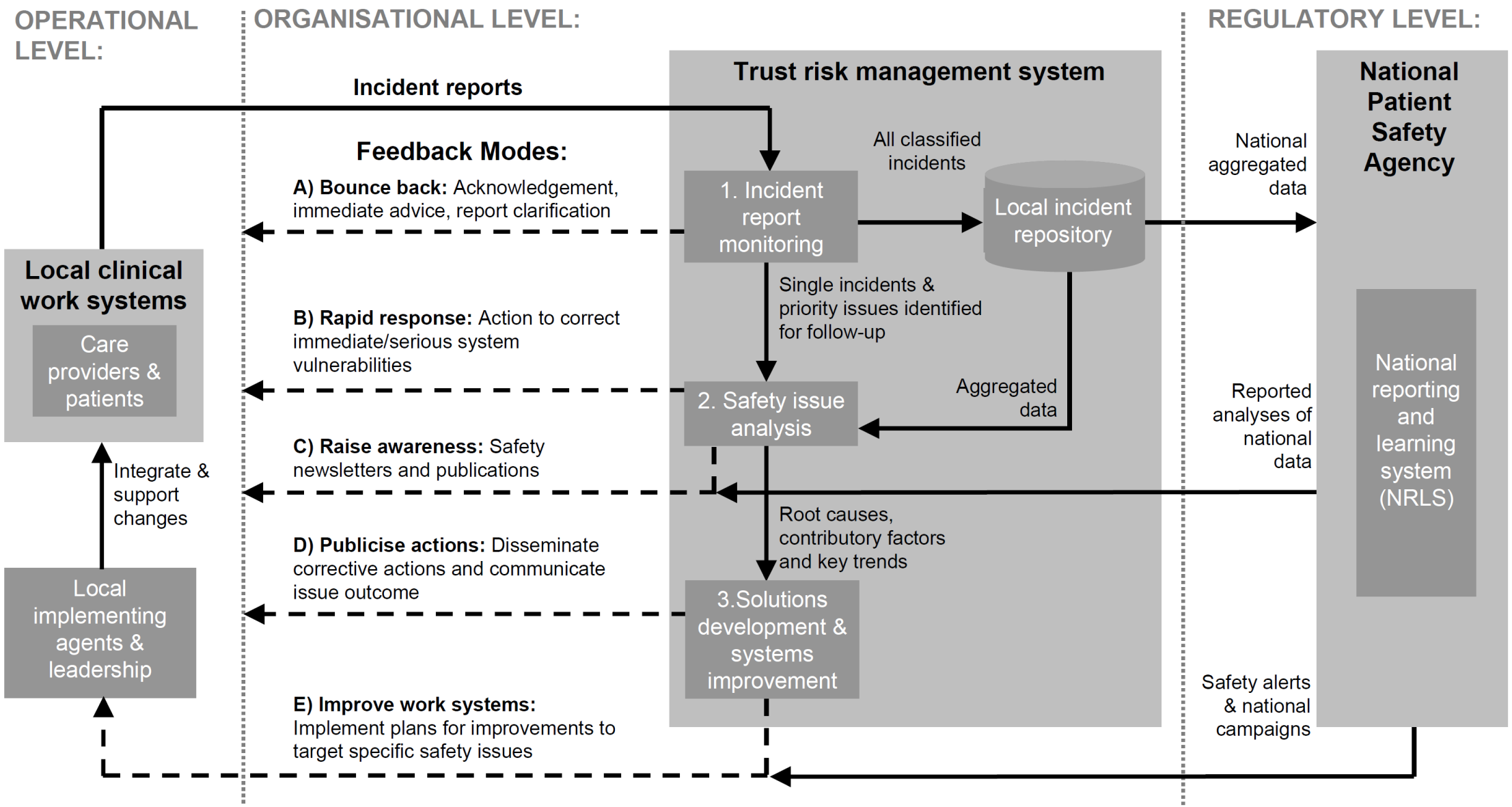
(Ghandi et al. 2005)

Local feedback mechanisms

from review of 23 “best case” health care reporting systems

- Implementation of urgent improvement actions for high risk issues within a set timescale (Nakajima et al., 2005)
- Patient safety seminars and cascade (Nakajima et al., 2005)
- Feedback notes for medical devices (Amoore & Ingram, 2002)
- Automated feedback of individual performance data to the reporting physician (Bolsin, 2005; Bolsin et al., 2005)
- Email distribution to all front line staff of summary of improvements made (Gandhi et al., 2005)
- Staff bulletin board postings with safety issues raised and actions taken (Holzmueller et al., 2005; Lubomski et al., 2004)
- Targeted staff training programmes (Takeda et al., 2003)
- Development of manuals on error prevention (Wilf-Miron et al., 2003)
- One-to-one telephone debriefings with reporters (Wilf-Miron et al., 2003)
- Departmental presentations and quality meetings (Parke, 2003)

Feedback to front line clinical work systems in health care

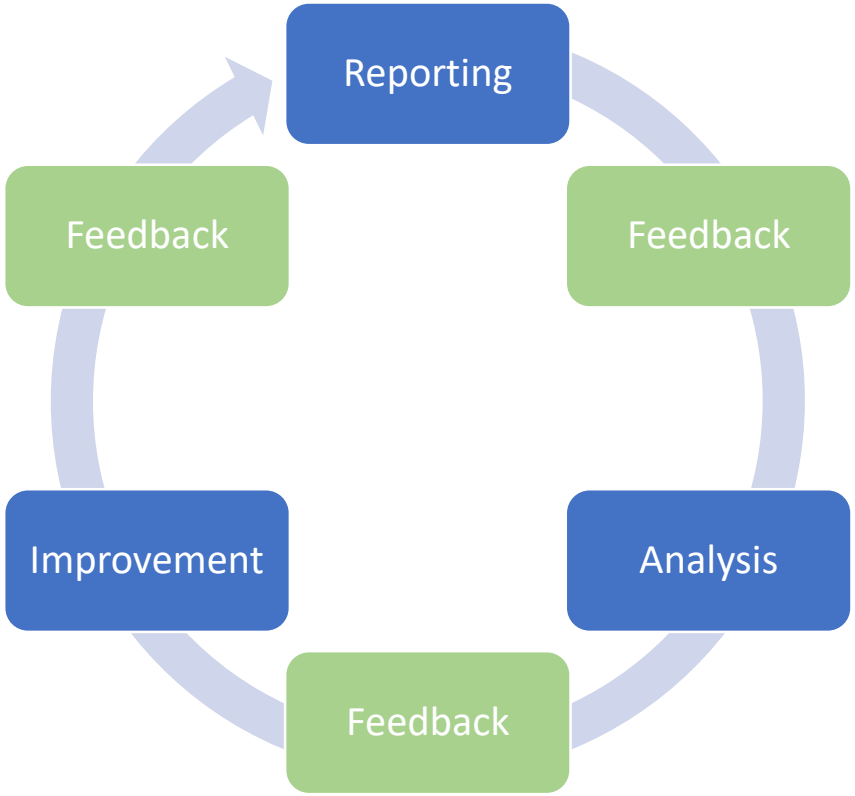


Evidence of feedback from incident reporting

Feedback	Type	Content & Examples	Implemented
A: Bounce back	Information to reporter	• Acknowledge report filed (automated) • Debrief reporter (by telephone) • Provide advice from safety experts (feedback on issue type) • Outline issue process (and decision to escalate)	39% of best case systems reviewed
B: Rapid response	Action within local work systems	• Measures taken against immediate threats to safety or serious issues that have been marked for fast-tracking • Temporary fixes/workarounds until in-depth investigation process can complete (withdraw equipment; monitor procedure; alert staff)	70% of best case systems reviewed
C: Raise awareness	Information to all front line personnel	• Safety awareness publications (posted/online bulletins and alerts on specific issues; periodic newsletters with example cases and summary statistics)	91% of best case systems reviewed
D: Publicise actions	Information to reporter and wider reporting community	• Report back to reporter on issue progress and actions resulting from their report • Widely publicise corrective actions taken to resolve safety issue to encourage reporting (e.g. using visible leadership support)	52% of best case systems reviewed
E: Improve work systems	Action within local work systems	• Specific actions and implementation plans for permanent improvements to work systems to address contributory factors evident within reported incidents. • Changes to tools/equipment/working environment, standard working procedures, training programs, etc. • Evaluate/monitor effectiveness of solutions and iterate.	100% of best case systems reviewed (selection criteria)

Requirements for effective feedback based upon industry safety expertise

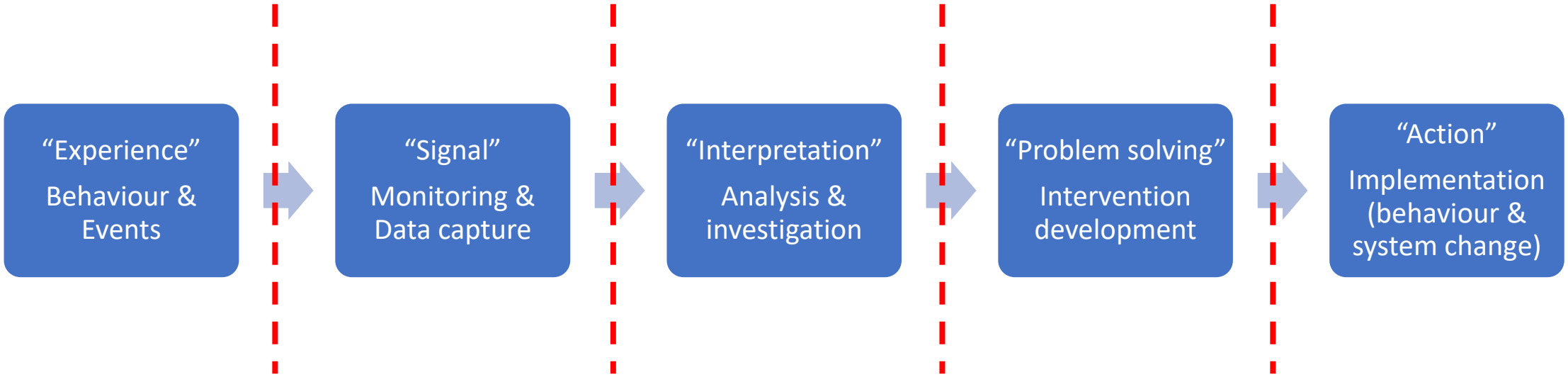
- Visible sponsorship from local leadership
- Preserves anonymity without compromising learning
- Rewards reporters and reinforces reporting
- Supports prioritisation of resources for improvement
- Involves and engages frontline staff in the safety improvement process
- Tailored to be specific and relevant to its audience
- Occurs at multiple points in the alerting and response process
- Facilitates dialogue between relevant stakeholders



Conclusions from the review (2009)

- Further attention is needed to address how information from incident reporting should actually be used to improve safety
- Lack of evaluative evidence concerning effective models of feedback for incident reporting
- There is wide variation in trusts' practice in terms of information and action feedback to front line work systems
- Little evidence of capacity for rapid action in Trust systems
- Little evaluation of impact of actions upon operational safety
- Safety actions should be monitored and their effectiveness evaluated in order to build an evidence base for responses to safety issues
- Feedback should be timely and targeted to the recipient

Challenges for incident reporting



Acting on intelligence from incident reporting

"…in translating incident reporting into healthcare from aviation, what was largely missed was that, in airlines and other industries, the rapid detection and resolution of safety issues depend on a deeply embedded and widely distributed social infrastructure of inquiry, investigation and improvement"

Macrae C (2016) The problem with incident reporting. *BMJ Qual Saf* **25:**71-75.

THE PROBLEM WITH...

The problem with incident reporting

Carl Macrae

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Accepted 19 August 2015
Published Online First
7 September 2015

'The Problem with…' series covers controversial topics related to efforts to improve healthcare quality, including widely recommended, but deceptively difficult strategies for improvement and pervasive problems that seem to resist solution. The series is overseen by Ken Catchpole (Guest Editor) and Kaveh Shojania (Editor-in-Chief).

Seminal reports that launched the modern field of patient safety highlighted the importance of learning from critical incidents.[1 2] Since then, incident reporting systems have become one of the most widespread safety improvement strategies in healthcare, both within individual organisations and across entire healthcare systems.[3]

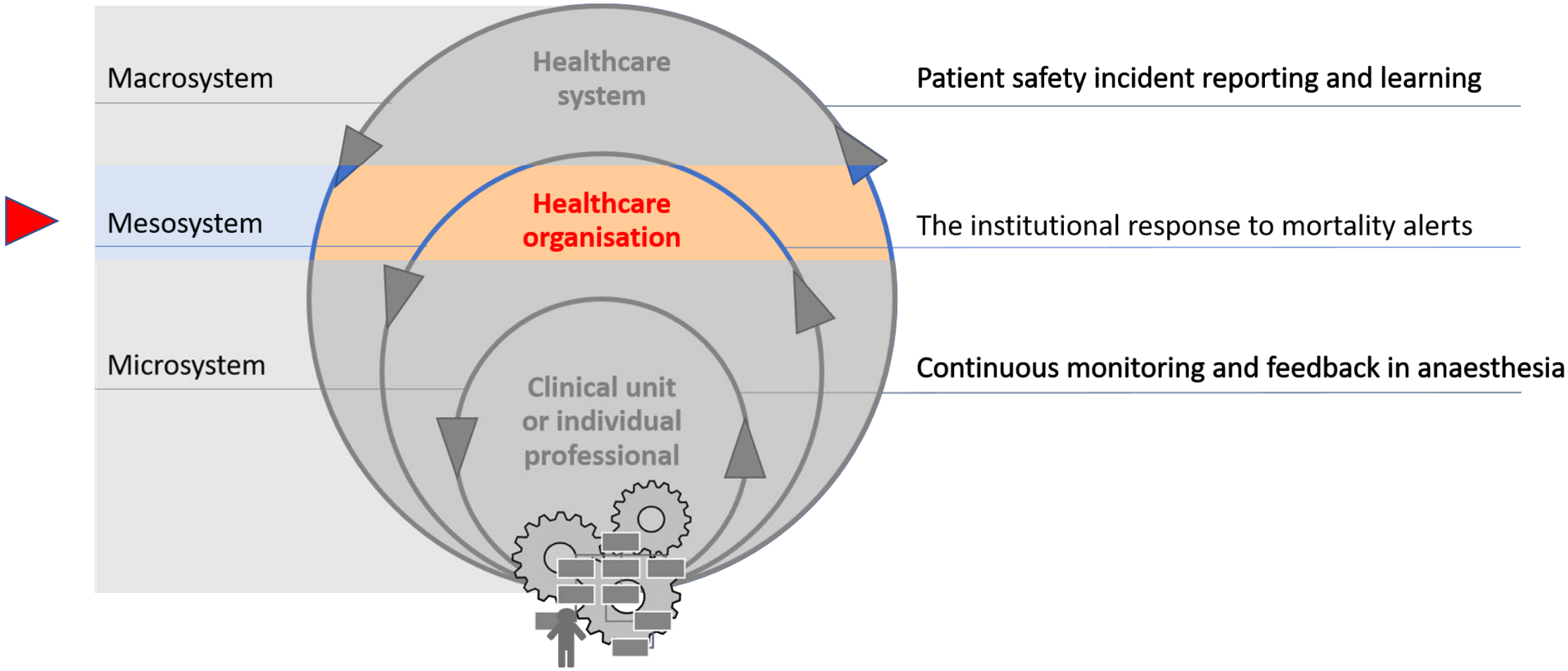
There are some strong examples of learning and improvement following serious patient safety incidents.[4 5] But major disasters have also revealed widespread failures to understand and respond to reported safety incidents.[6 7] Between these two extremes exists a range of frustrations and confusions regarding the purpose and practice of incident reporting.[8–10] These problems can be traced to what was lost in translation when incident reporting was adapted from aviation and other safety-critical industries,[11] with fundamental aspects of successful incident reporting systems misunderstood, misapplied or entirely missed in healthcare. This mistranslation of incident reporting from other industries has left us with confused and contradictory approaches to reporting and

system-wide learning in the same way that the discovery of a defective 'orange wire' in a particular aircraft type might cause rapid and systematic action across the entire aviation industry.[13] But, in translating incident reporting into healthcare from aviation, what was largely missed was that, in airlines and other industries, the rapid detection and resolution of safety issues depend on a deeply embedded and widely distributed social infrastructure of inquiry, investigation and improvement.

Incident reports provide brief—and usually ambiguous and sometimes mundane—triggers for collective inquiry and coordinated action. The incident reports themselves do not matter nearly as much as the practical work of investigating and understanding a particular aspect of an organisational system and then working collaboratively to improve it.[14] In aviation, incident reporting systems grew out of a decades-long history of conducting routine, structured, systematic investigations into the most serious aviation incidents and accidents.

Healthcare has nothing like this history of systematic investigation. Instead, inci-

Case 2


Macrosystem
Mesosystem
Microsystem
Healthcare system
Healthcare organisation
Clinical unit or individual professional
Patient safety incident reporting and learning
The institutional response to mortality alerts
Continuous monitoring and feedback in anaesthesia

Mortality surveillance

Imperial College London

CONFIDENTIAL

[redacted]

MORTALITY OUTLIERS

We are writing to share with you in confidence an analysis of mortality data which indicates higher than average mortality rates for Aortic, peripheral, and visceral artery aneurysms, Peritonitis and intestinal abscess within your hospital trust (Appendix 1).

The Dr Foster Unit at Imperial College (DFU) routinely analyses Hospital Episode Statistics (HES) and Secondary Uses Service (SUS) data for a wide range of diagnoses and procedures, computing risk-adjusted mortality rates for hospitals. In the course of this work we have come across examples of mortality rates in various trusts significantly in excess of what would be expected, given the risk profile of the relevant patients.

There are a number of possible reasons for these results, including random variation, poor data quality or coding problems, and case-mix issues, and we draw no conclusions as to what lies behind the figures. However, as clinicians we believe we have a duty under the GMC Good Medical Practice code to alert trusts to this analysis since there is a possibility that it indicates areas where patients may be at risk.

We therefore piloted a system of mortality alerts to trusts earlier this year and received very valuable feedback. As a result of the pilot we have made a number of changes for the roll-out of the alert system. First, we have limited the procedures and diagnoses we monitor for the purposes of this alert system, as we wish to restrict alerts to areas where there is most likely to be a clinical issue. Second, we have increased the amount of information supplied with the alerts. The short briefing note at Appendix 2 explains our methodology and alert process in more detail, including the criteria we have used for alerting trusts.

Third, we have decided to share alerts routinely with the Healthcare Commission. The general view of the trusts we consulted in our pilot was that it was appropriate for the Commission to receive this information as part of the wide range of data they receive about individual trusts, although several trusts did request clarity as to how the Commission would deal with such alerts, and what action would expect trusts to take. We have discussed the alert system with the Commission who have assured us that a single alert would not normally trigger any kind of intervention; the Commission already conducts regular analyses of data from a wide range of sources and this data would be considered in the light of other information held by the Healthcare Commission about the trust. Commission would wish to ensure that any perceived problems have been recognised by the and that, where necessary, appropriate steps are being taken using the clinical governance ments already in place at the trust.

Imperial College London

CONFIDENTIAL

Aortic, peripheral, and visceral artery aneurysms

Appendix 1

I71,I72,I79

This chart indicates that on at least one occasion in March 2007, risk-adjusted mortality of double the expected rate was recorded at this trust for this diagnosis or procedure.

Superspells: 43 (41/2)
First / Last: Apr-06/May-07
Deaths: 11 (25.6%)
Expected: 5.8 (13.5%)
Observed minus expected: 5.2 (12.1%)
Relative Risk: 189.1 (94.3—338.4)
C-Statistic: 0.87 (High)
Alerts (X): 1 (Mar-07)

The probability of a false alarm for this trust in a twelve month period: 0.4%

HEALTH SERVICES AND DELIVERY RESEARCH

VOLUME 6 ISSUE 7 FEBRUARY 2018
ISSN 2050-4349

Evaluation of a national surveillance system for mortality alerts: a mixed-methods study

Paul Aylin, Alex Bottle, Susan Burnett, Elizabeth Cecil, Kathryn L Charles, Paul Dawson, Danielle D'Lima, Aneez Esmail, Charles Vincent, Samantha Wilkinson and Jonathan Benn

NHS
National Institute for Health Research

Research aims

Institutional case study research:

- To understand the factors that influence institutional capacity to respond to signals in mortality data, from a realist evaluative perspective:
  - Explore interactions between the design of the alerts, local context, institutional behaviour and outcomes

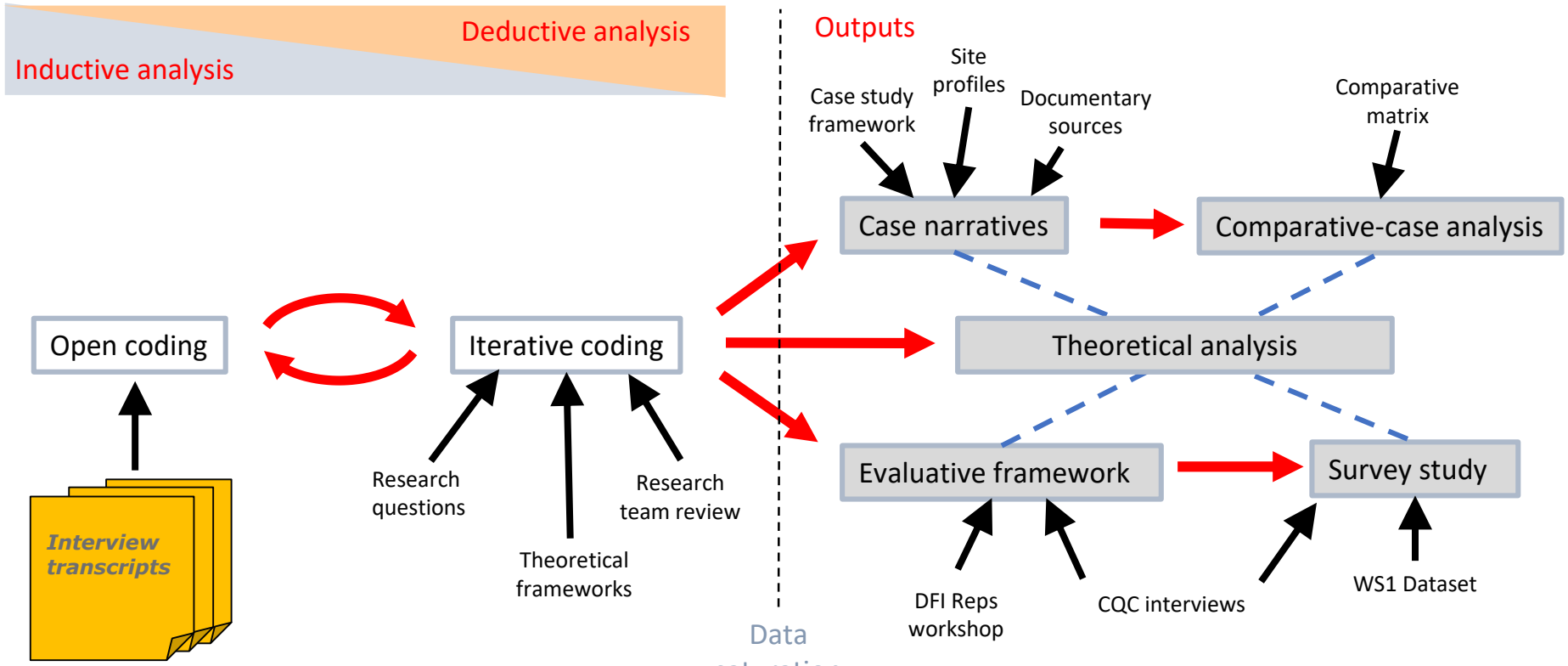
National survey of alerted trusts:

- Describe variance in organisational structures and processes for mortality governance and local capacity to respond to signals in mortality data
- Evaluate the current mortality surveillance and alerting system based upon respondents' perceptions

Mixed-methods design

- **Research design:** Theoretically-informed qualitative analysis of 11 institutional case studies followed by cross-sectional national survey study.
- **Qualitative research sampling:** Case sites received an alert letter for either Sepsis or AMI between 2010 and 2014.
  - 4 AMI sites (3 multiple and 1 single alert site)
  - 7 Sepsis sites (5 multiple and 2 single alert sites)
- **Respondents:** 65 qualitative interviews were conducted during the case studies over 2 years, including: mortality leads, medical directors, informatics/coding specialists, CEOs, and clinical leads for mortality and Sepsis/AMI.
- **Analysis:** Theoretically-informed qualitative analysis, undertaken by a multidisciplinary research team, following principles of grounded theory and framework analysis. Case-based analysis followed by cross-case comparative analysis to identify institutional dimensions which were later implemented within a national cross-sectional survey measure.

Analytic process and outputs



11 institutional case studies (single and multiple alerters; sepsis and AMI)

- 71 informants
- 65 interviews

Case studies: "Response" characteristics of repeated sepsis-alerting trusts

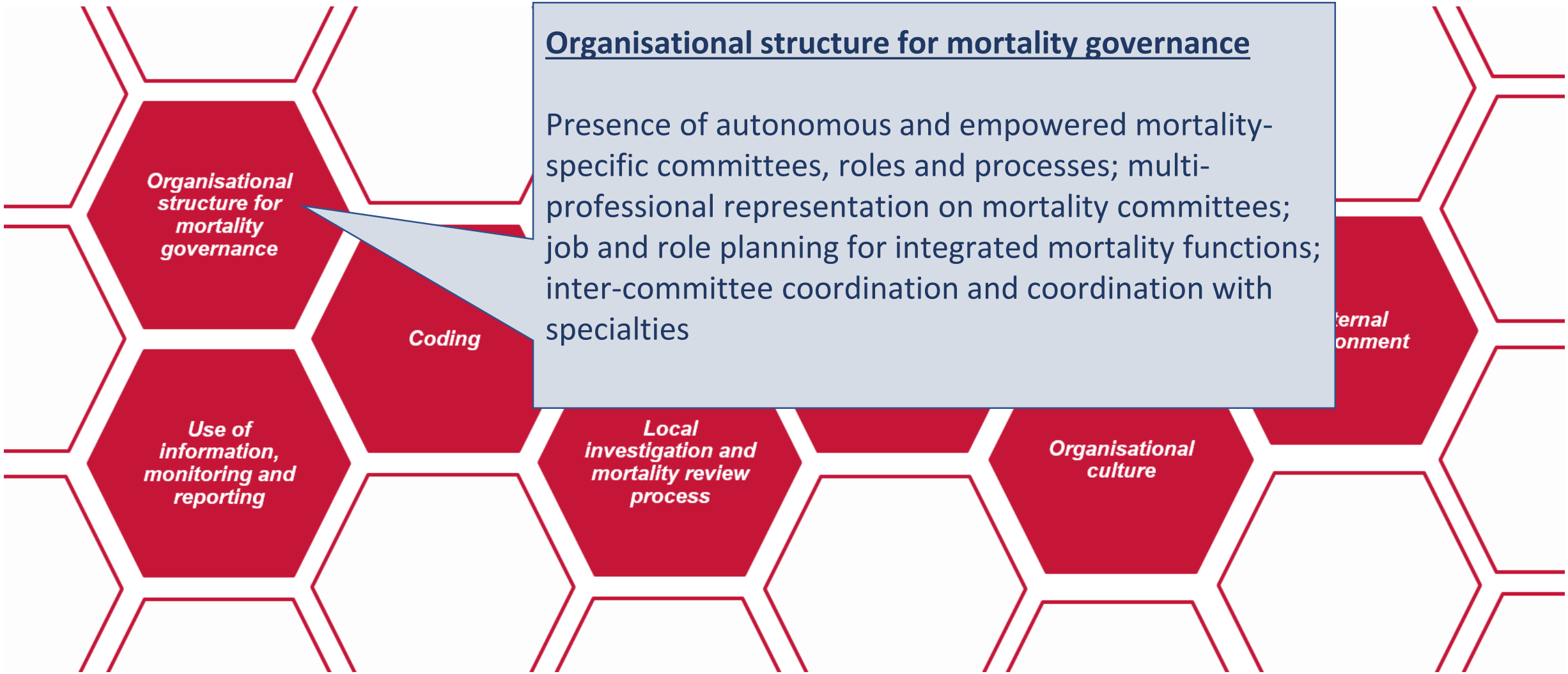
- **First alert responses characterised as:**
  - Focus of analysis: validating the alert
  - Handled as an administrative process – focus on coding issues
  - Clinician involvement fragmented – mainly at corporate senior level - reliance on Clinicians to volunteer
  - Sense of urgency and a prompt for action
  - Senior leadership oversight
- **Second and subsequent alert responses**
  - Comprehensive forensic approach – coding, staffing, patient pathways, service design
  - Accessing support/resources/from external sources – QI Collaboratives; Dr Foster engagement
  - More clinical engagement (and formalised) across services and levels
  - Integrated in governance processes and QI action programmes – alert feeds into action
  - Long term commitment to using and understanding data
  - Senior leadership invest time and involvement
  - Resourcing processes at all levels and investing in organisational learning – IT, Learning Cafes, Newsletters
  - A Universal approach – look at all deaths
  - Implementation of actions – Junior Doctors writing up case notes – training set up

"Now if we hadn't had mortality alerts would we have a sepsis group now in the Trust is an interesting question… I think what we've understood or what we're beginning to understand about sepsis is it's phenomenally complicated and why the patient dies having had a slightly arbitrary diagnosis of sepsis attached to them when they came in the front door."

Medical Director (Sepsis Repeat Alerting Trust)

Institutional capability for effective responses to signals in mortality data

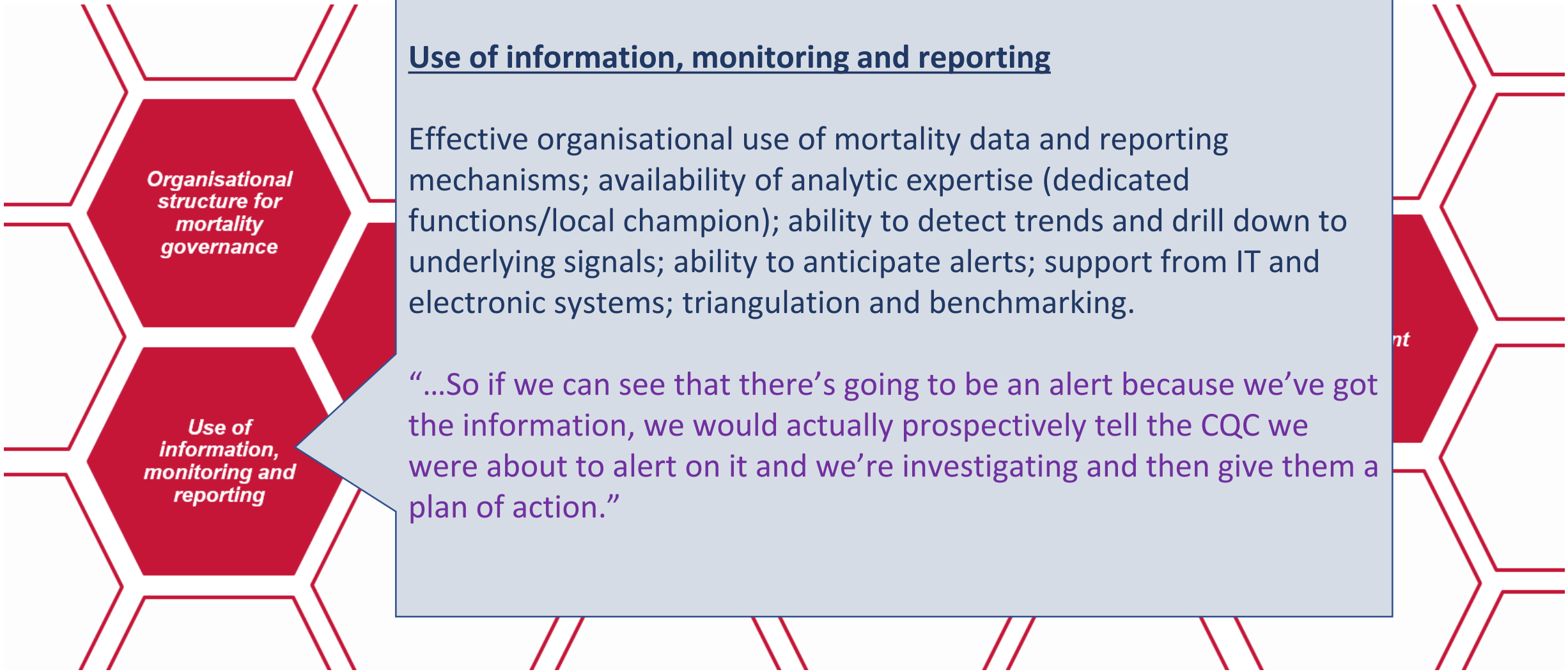
Institutional capability for effective responses to signals in mortality data



Organisational structure for mortality governance

Presence of autonomous and empowered mortality-specific committees, roles and processes; multi-professional representation on mortality committees; job and role planning for integrated mortality functions; inter-committee coordination and coordination with specialties

Institutional capability for effective responses to signals in mortality data



Use of information, monitoring and reporting

Effective organisational use of mortality data and reporting mechanisms; availability of analytic expertise (dedicated functions/local champion); ability to detect trends and drill down to underlying signals; ability to anticipate alerts; support from IT and electronic systems; triangulation and benchmarking.

"…So if we can see that there's going to be an alert because we've got the information, we would actually prospectively tell the CQC we were about to alert on it and we're investigating and then give them a plan of action."

Institutional capability for effective responses to signals in mortality data

Local improvement mechanisms

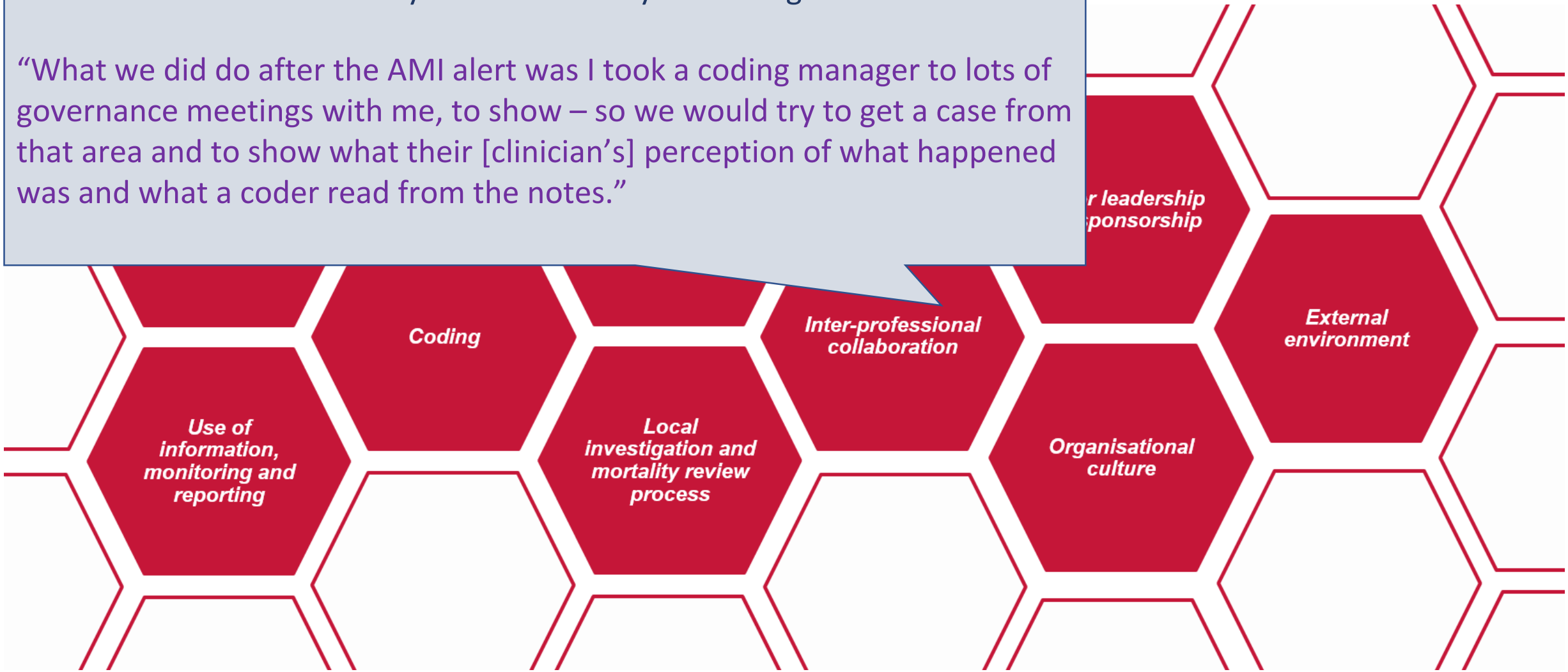
Capacity to translate learning from alerts into implementable actions; use of appropriate QI methodology; authority to make agents accountable for actions; ability to resolve data quality issues; project reporting and oversight; follow-up and evaluation of actions

als in mortality data

Inter-professional collaboration

Clinical engagement in coding, mortality review and action process; multi-professional representation in mortality groups; dissemination of mortality-related information vertically and horizontally within organisation

"What we did do after the AMI alert was I took a coding manager to lots of governance meetings with me, to show – so we would try to get a case from that area and to show what their [clinician's] perception of what happened was and what a coder read from the notes."

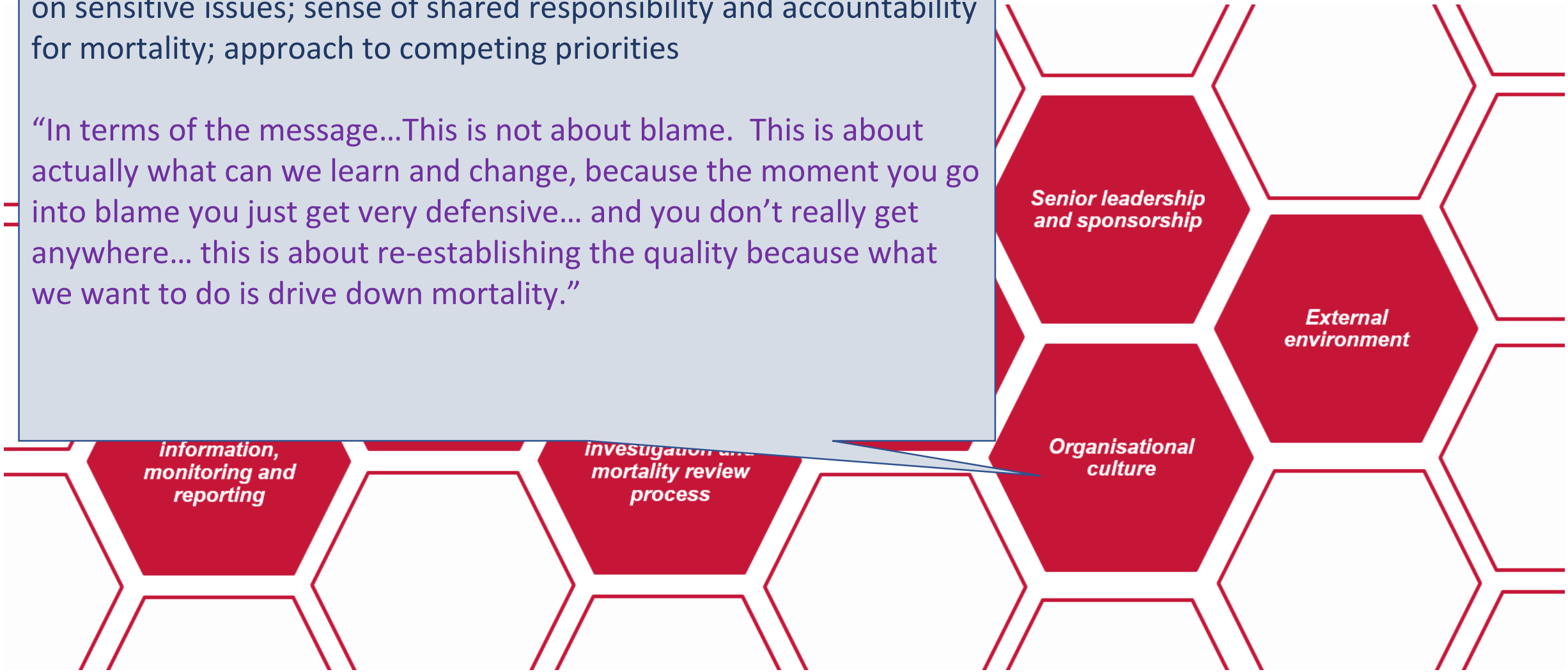


Organisational culture

Presence of a learning culture; attitude towards validity and value of alerts (signal or noise); degree of open discussion and collaboration on sensitive issues; sense of shared responsibility and accountability for mortality; approach to competing priorities

"In terms of the message…This is not about blame. This is about actually what can we learn and change, because the moment you go into blame you just get very defensive… and you don't really get anywhere… this is about re-establishing the quality because what we want to do is drive down mortality."

signals in mortality data



Survey: Data collection

- Survey development:
  - Based upon evaluative framework derived from qualitative analysis of case study data.
  - Stakeholder input (CQC and Dr Foster validation workshop).
  - Multiple rounds of piloting
- Target respondent: Trust mortality lead or medical director.
- Data collection: 11th May - 10th June 2016.
- Personalised contact letter and paper-based distribution.
- Multiple personalised email follow-ups (with electronic distribution)
- Observed sample: 78 responses received (65% response rate).

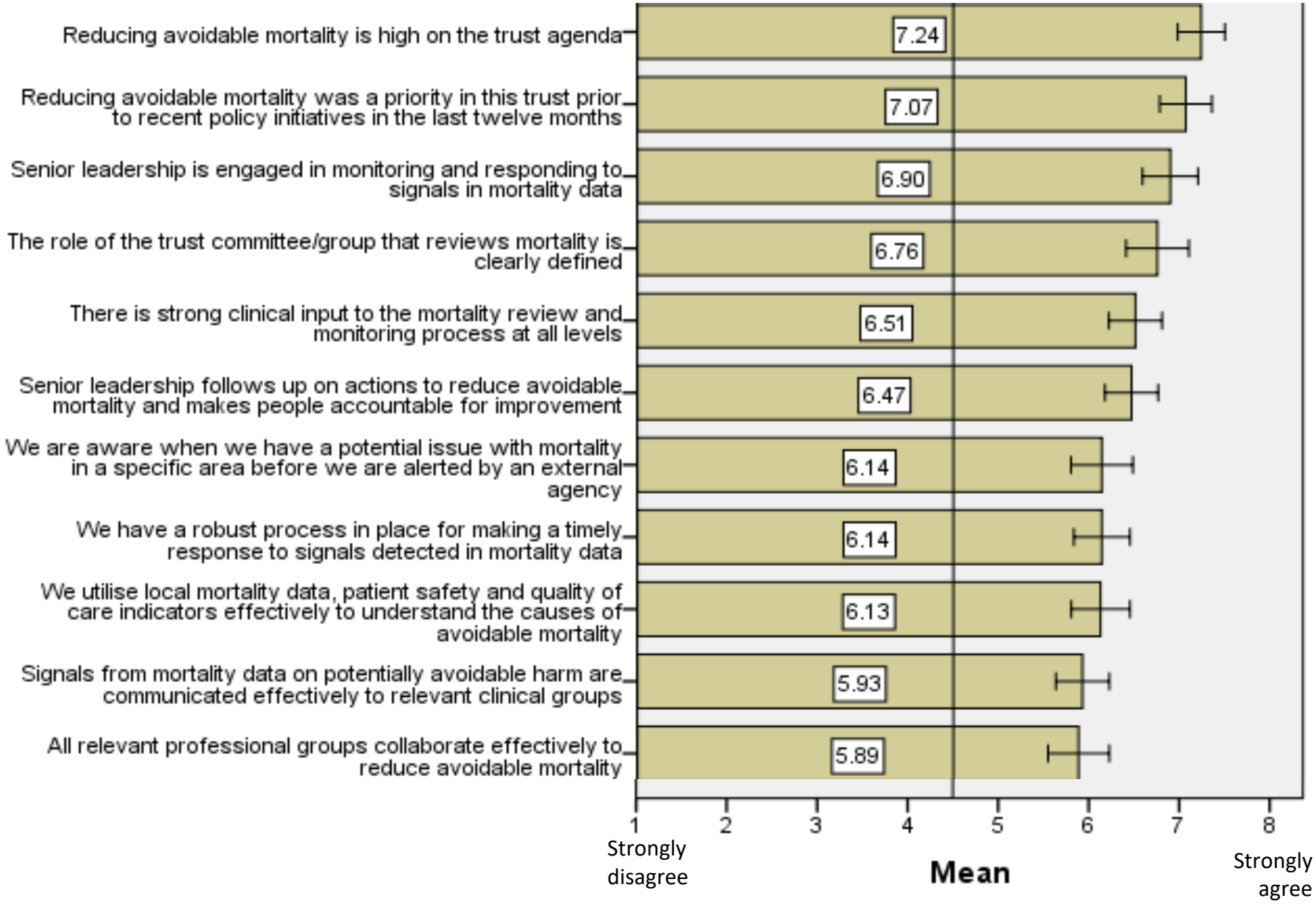
Institutional arrangements for mortality

- Dedicated trust-level lead for mortality in post in 87% of surveyed trusts.
- Trust-level mortality group or committee in place in 92% of surveyed trusts.
- Committee meets to review mortality on a monthly basis in 87% of surveyed trusts (and quarterly in 10%).
- 37% of surveyed trusts reported specialty-level mortality data to the board

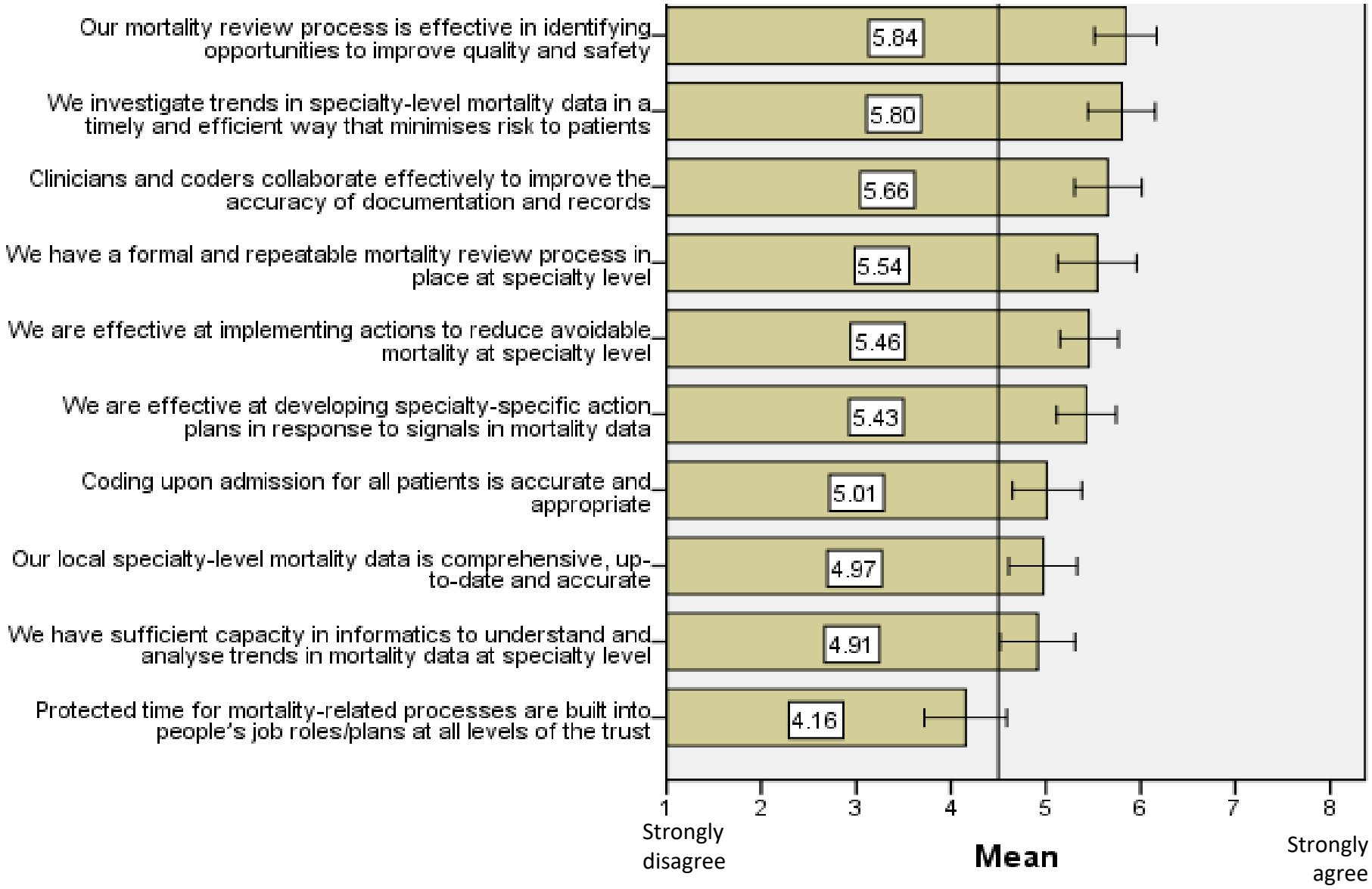
Local mortality review processes

- 75 out of 76 responding trusts reported having a systematic mortality review process in place
- 29% of surveyed trusts review less than 50% of deaths (based upon respondent estimates).
- 23% review more than 80% of deaths (based upon respondent estimates).
- 29% of surveyed trusts reviewed deaths only in response to alerts (internal or external)
- 84% of surveyed trusts used independent case note review (i.e. by someone not directly responsible for care of the patient)

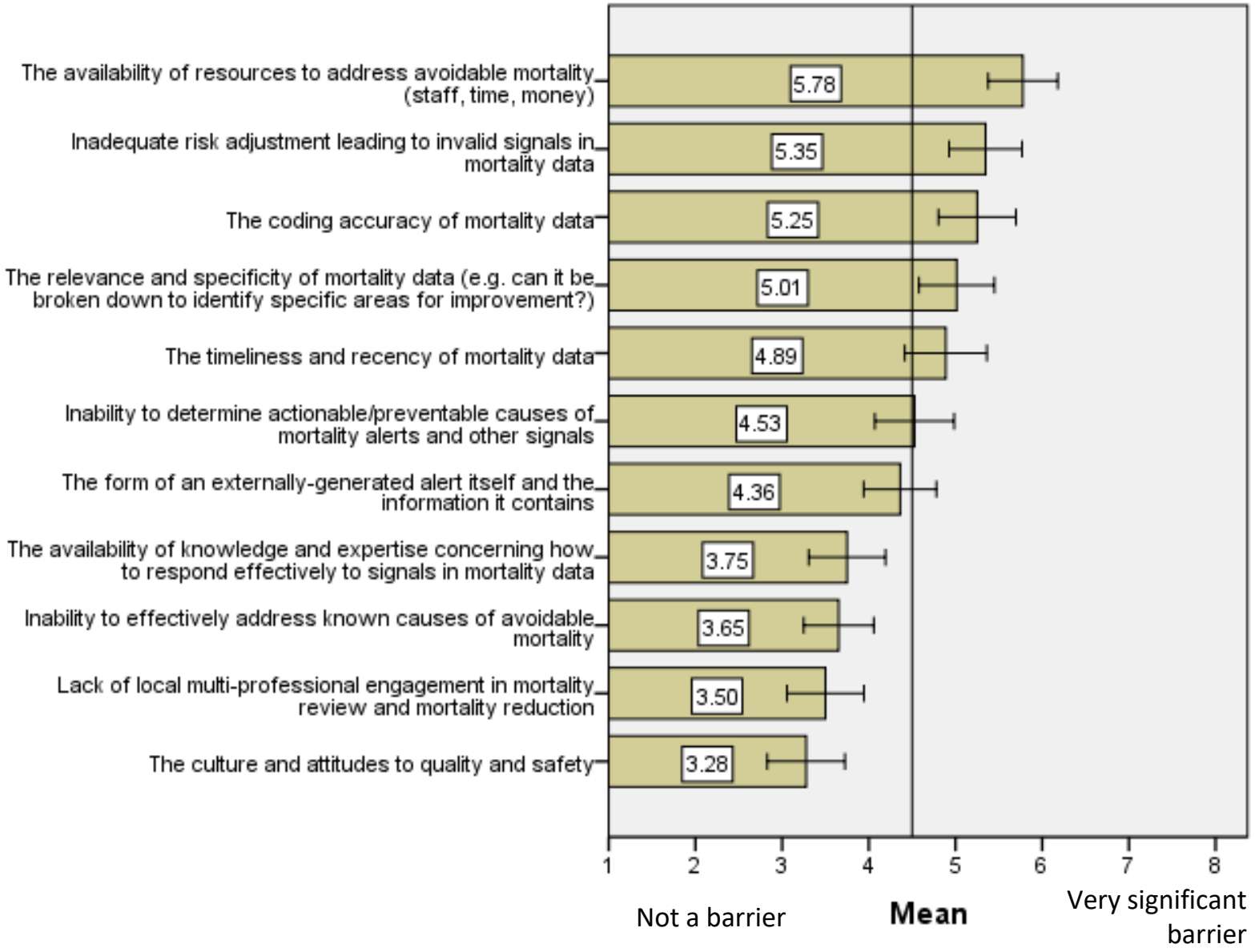
Institutional capacity to respond to signals in mortality data 1



Institutional capacity to respond to signals in mortality data 2

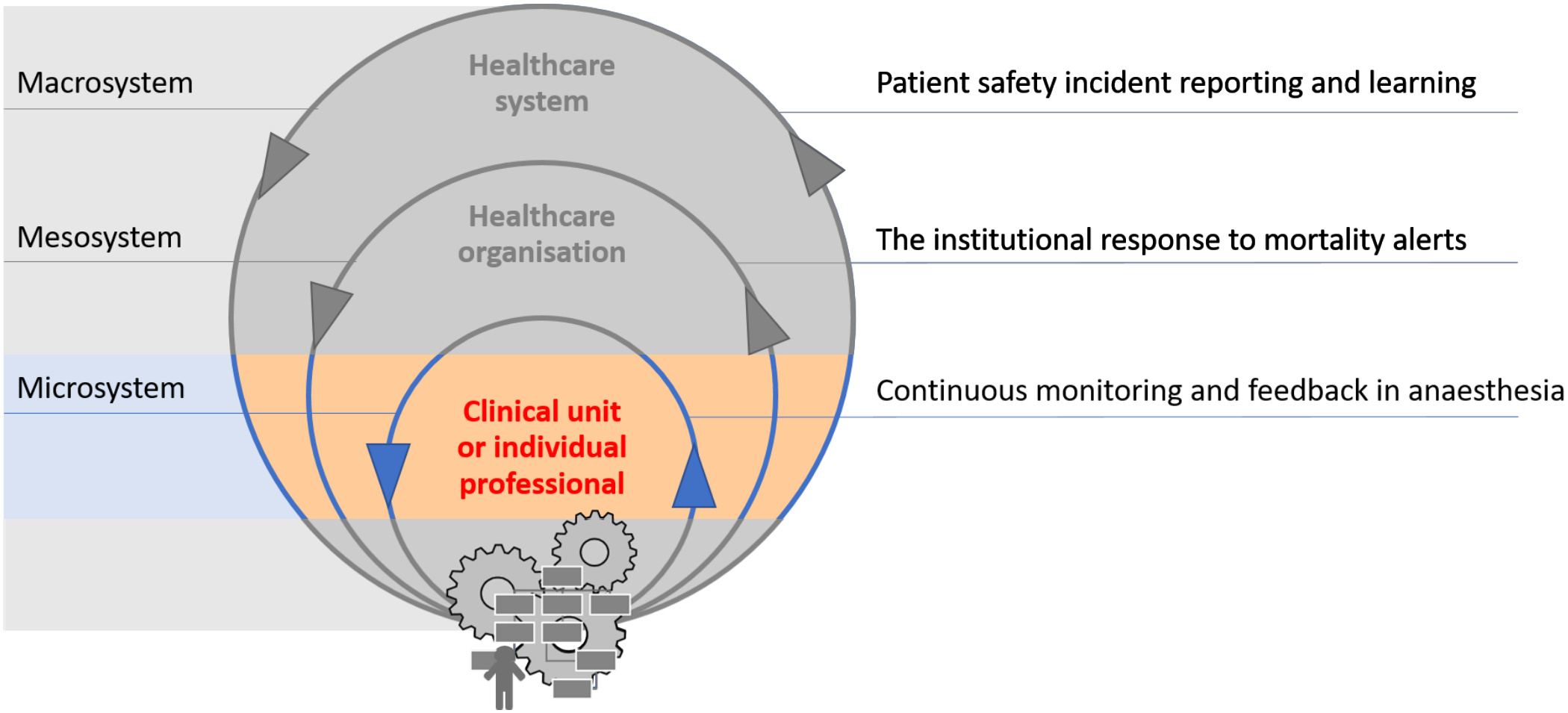


Perceived barriers to reduction in avoidable mortality

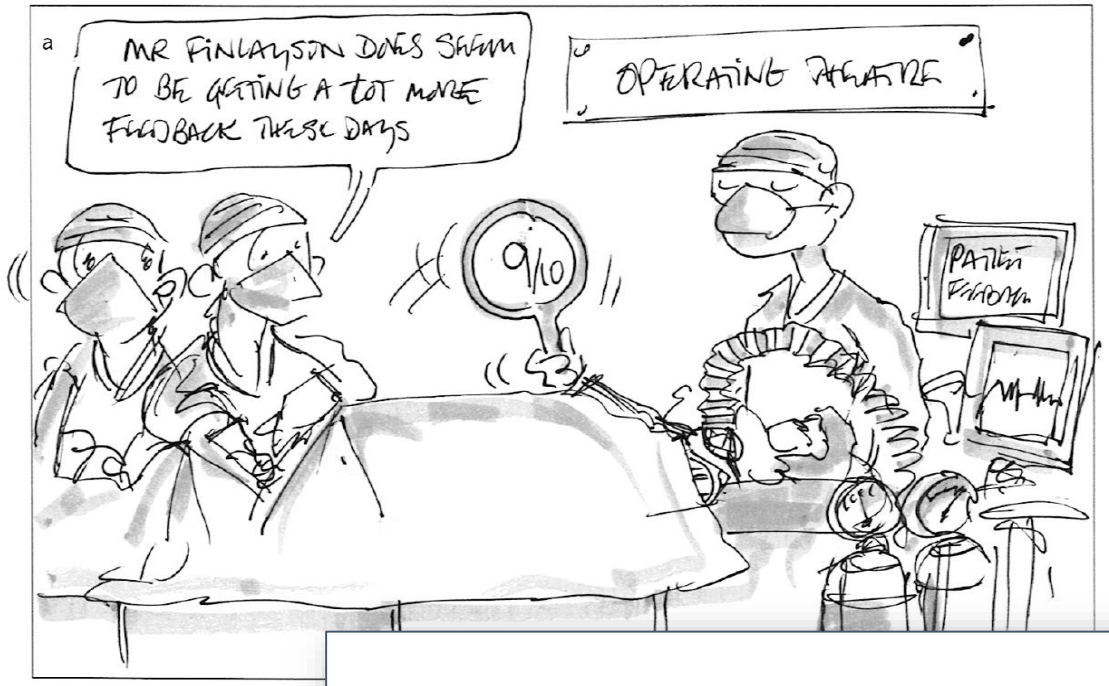


Challenges for mortality surveillance

Case 3


Macrosystem
Mesosystem
Microsystem
Healthcare system
Healthcare organisation
Clinical unit or individual professional
Patient safety incident reporting and learning
The institutional response to mortality alerts
Continuous monitoring and feedback in anaesthesia

Use of feedback to change professional behaviour: a case study in anaesthesia



Anesthesiology 2009; 110:1158–75

Quality and Safety Indicators in Anesthesia

A Systematic Review

Guy Haller, M.D., M.Sc., Ph.D., Johannes Stoelwinder, M.B.B.S., M.D., F.R.C.A.M.A., F.A.C.H.S.E., F.F.P.H.M.,† Paul S. Myles, M.B.B.S., M.P.H., M.D., F.C.A.R.C.S.I., F.A.N.Z.C.A.,‡ John McNeil, M.B.B.S., Ph.D., F.R.A.C.P.§*

Clinical indicators are increasingly developed and promoted by professional organizations, governmental agencies, and quality initiatives as measures of quality and performance. To clarify the number, characteristics, and validity of indicators available for anesthesia care, the authors performed a systematic review. They identified 108 anesthetic clinical indicators, of which 53 related also to surgical or postoperative ward care. Most were process (42%) or outcome (57%) measures assessing the safety and effectiveness

sensitivity and specificity for quality and safety issues. Patient perioperative mortality and morbidity are not always related to anesthesia. Incidents largely rely on the willingness of staff members to report them. As a consequence, a number of additional measurement tools are increasingly promoted, particularly clinical indicators.[5]

Indicators are primarily measures of a nonquantifiable

- Anaesthetists do not routinely learn about their patients' experience during post-operative recovery, unless there's a problem
- Haller et al. (2009)
  - Perioperative morbidity and mortality data is not sensitive or specific enough to serve as indicators of quality of anaesthetic care
  - Few validated indicators exist that incorporate the patient's perspective on quality of anaesthetic care

Aims

- Develop a continuous monitoring and feedback programme for quality of recovery indicators
  - Must support individual professional development, as well as group learning
  - Must be acceptable and useful for anaesthetists

- Conduct a systematic evaluation of the impact of the programme on quality of recovery
  - Formative evaluation to understand mechanisms of effect
  - Robust quasi-experimental component
  - Longitudinal and mixed methods approach

A continuous monitoring and feedback intervention for quality of recovery, drawing upon industrial process monitoring

British Journal of Anaesthesia **109** (1): 80–91 (2012)
Advance Access publication 1 June 2012 · doi:10.1093/bja/aes173

BJA

Using quality indicators in anaesthesia: feeding back data to improve care

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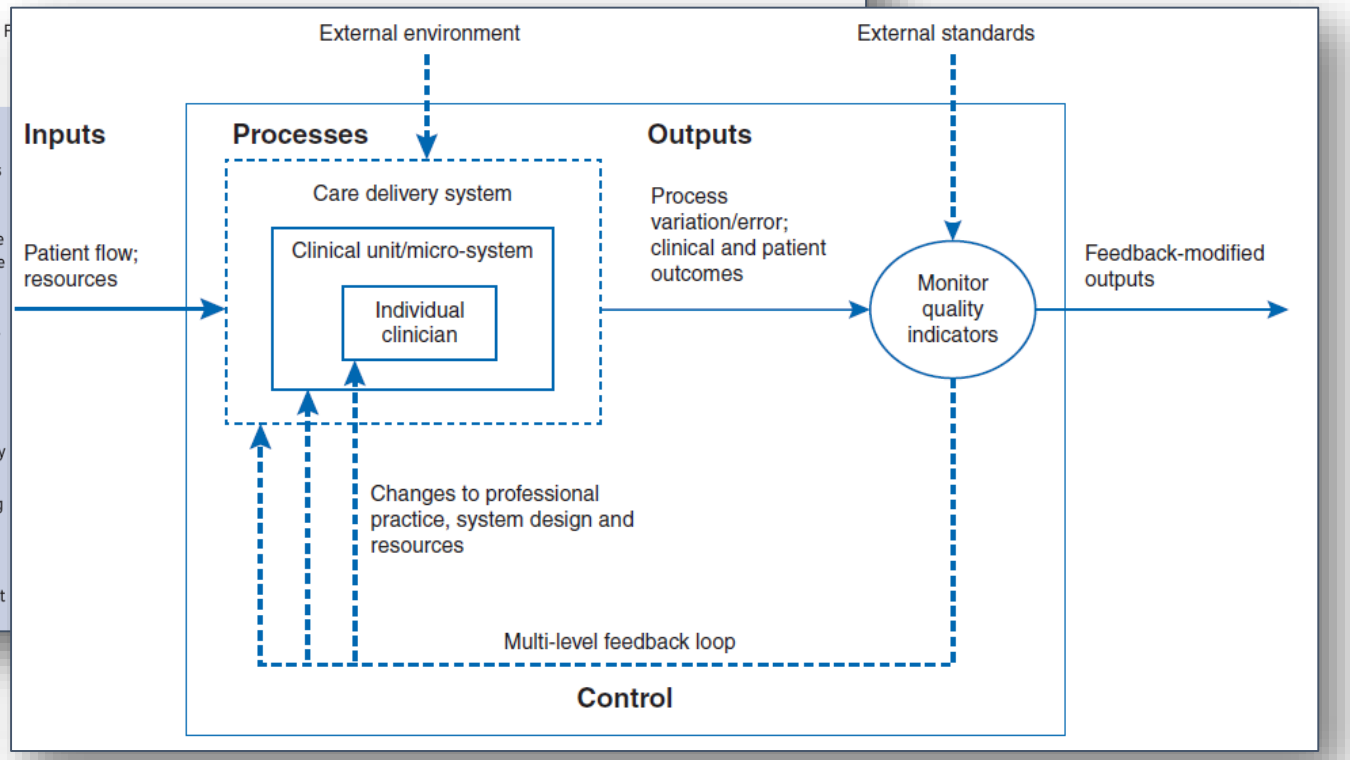
Editor's key points

- The use of quality indicators in anaesthesia is still at a very early experimental stage but is likely to become prevalent in line with the use of other performance indicators.
- It is important for the wider specialty to consider which indicators might be most useful to both improve patient care and provide valid measures of the quality of care.
- It will be pointless collecting such data without regular, non-confrontational feedback to clinicians, together with a commitment by parent organizations to



- Sustained, regular, personalised feedback for consultant anaesthetists
- Feedback control model

IMPAQT
Improving Anaesthetic Quality

Feedback in the implementation science literature

- The term 'feedback' is most often used to describe the act of providing knowledge of the results of behaviour or performance to the individual.
- Within a healthcare context, information feedback has been defined as "any summary of clinical performance of health care over a specified period of time, given in a written, electronic or verbal format". (Jamtvedt et al., 2006)
- Effective feedback characteristics from systematic reviews:
  - Van Der Veer (2010) trust in data quality, motivation of the recipients, intensity of feedback, timeliness and confidentiality/non-judgemental tone
  - De Vos (2009) Feedback reports in combination with an educational implementation strategy and/or the development of a quality improvement plan are most effective in improving quality. The following barriers to quality improvement based upon feedback were identified: unawareness, lack of credible data, lack of supportive local management, and lack of hospital resources

Colquhoun et al. Implementation Science 2013, 8:66
http://www.implementationscience.com/content/8/1/66

IMPLEMENTATION SCIENCE

RESEARCH Open Access

A systematic review of the use of theory in randomized controlled trials of audit and feedback

Heather L Colquhoun[1*], Jamie C Brehaut
Kelly Carroll[1], Mathieu Chalifoux[1] and Ke

Abstract

Background: Audit and feedback is one
research, yet also one of the most variabl
of attention to the theoretical and conce
use in studies of audit and feedback will
effectiveness and inform efforts to optim
Methods: A total of 140 studies in the 2
independently reviewed by two investig
measurement, implementation or interpr
as reported in the study were extracted.
psychology), and theory utilization was c
testing, evaluation, predictions, post hoc,
Results: A total of 20 studies (14%) repor
implementation or interpretation. In only
the intervention. A total of 18 different t
innovation perspectives were identified.
were the most widely used (3.6% and 3%
Conclusions: The explicit use of theory i
but not consistency of theory use. Advan
to theoretically informed studies and inte
Keywords: Audit and feedback, Systemat

Background

The existence of a research to practice ga
is well established [1,2]. Audit and feedba
most widely used interventions for decr
[3]. The term 'Audit and feedback' has be
ally to refer to a heterogeneous group o
that provide feedback on existing practic

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Colquhoun et al. Implementation Science (2017) 12:117
DOI 10.1186/s13012-017-0646-0

Implementation Science

RESEARCH Open Access

Advancing the literature on designing audit and feedback interventions: identifying theory-informed hypotheses

Heather L. Colquhoun[1*], Kelly Carroll[2], Kevin W. Eva[3], Jeremy M. Grimshaw[2,4], Noah Ivers[5], Susan Michie[6], Anne Sales[7] and Jamie C. Brehaut[2,8]

Abstract

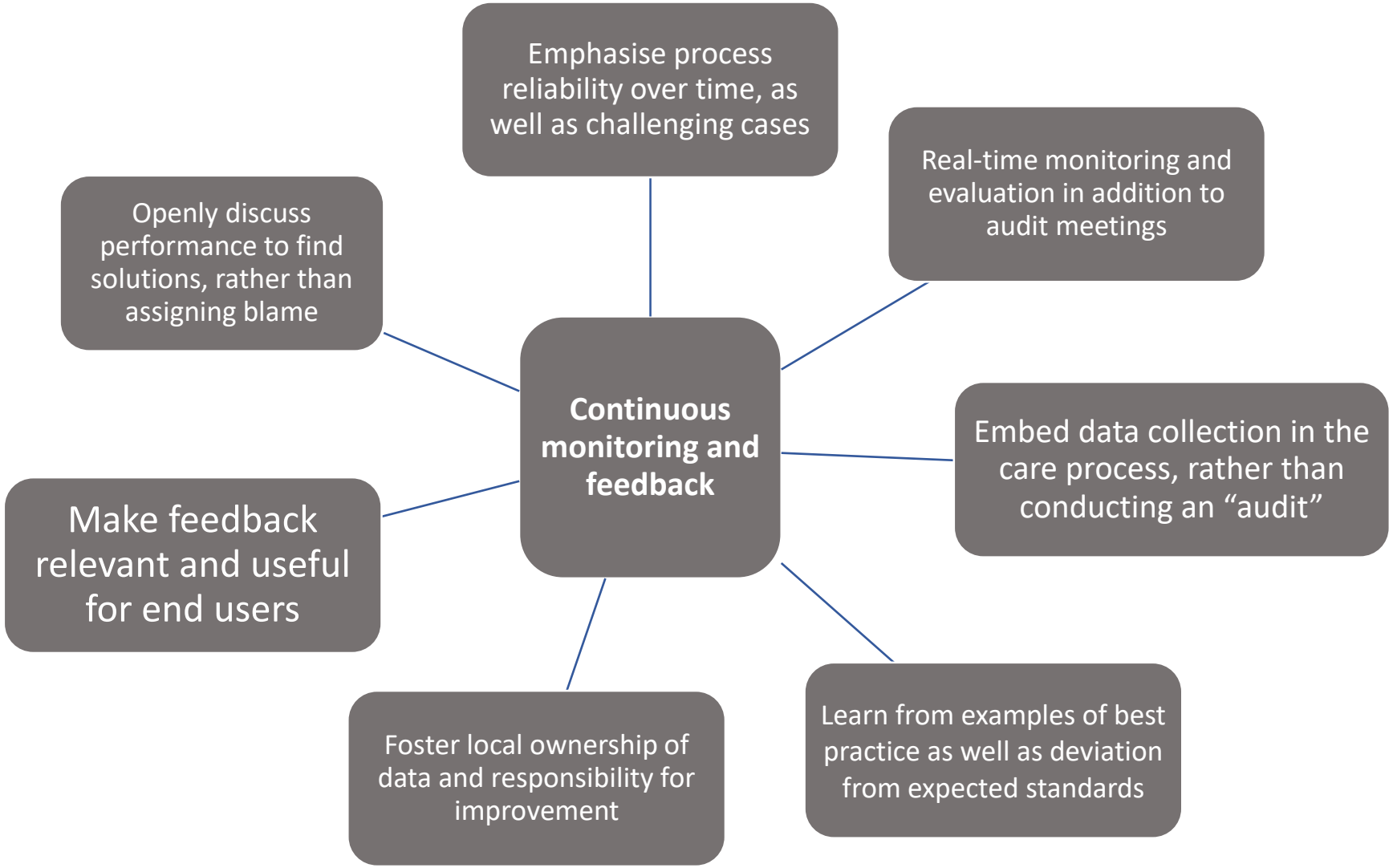
Background: Audit and feedback (A&F) is a common strategy for helping health providers to implement evidence into practice. Despite being extensively studied, health care A&F interventions remain variably effective, with overall effect sizes that have not improved since 2003. Contributing to this stagnation is the fact that most health care A&F interventions have largely been designed without being informed by theoretical understanding from the behavioral and social sciences. To determine if the trend can be improved, the objective of this study was to develop a list of testable, theory-informed hypotheses about how to design more effective A&F interventions.

Methods: Using purposive sampling, semi-structured 60–90-min telephone interviews were conducted with experts in theories related to A&F from a range of fields (e.g., cognitive, health and organizational psychology, medical decision-making, economics). Guided by detailed descriptions of A&F interventions from the health care literature, interviewees described how they would approach the problem of designing improved A&F interventions. Specific, theory-informed hypotheses about the conditions for effective design and delivery of A&F interventions were elicited from the interviews. The resulting hypotheses were assigned by three coders working independently into themes, and categories of themes, in an iterative process.

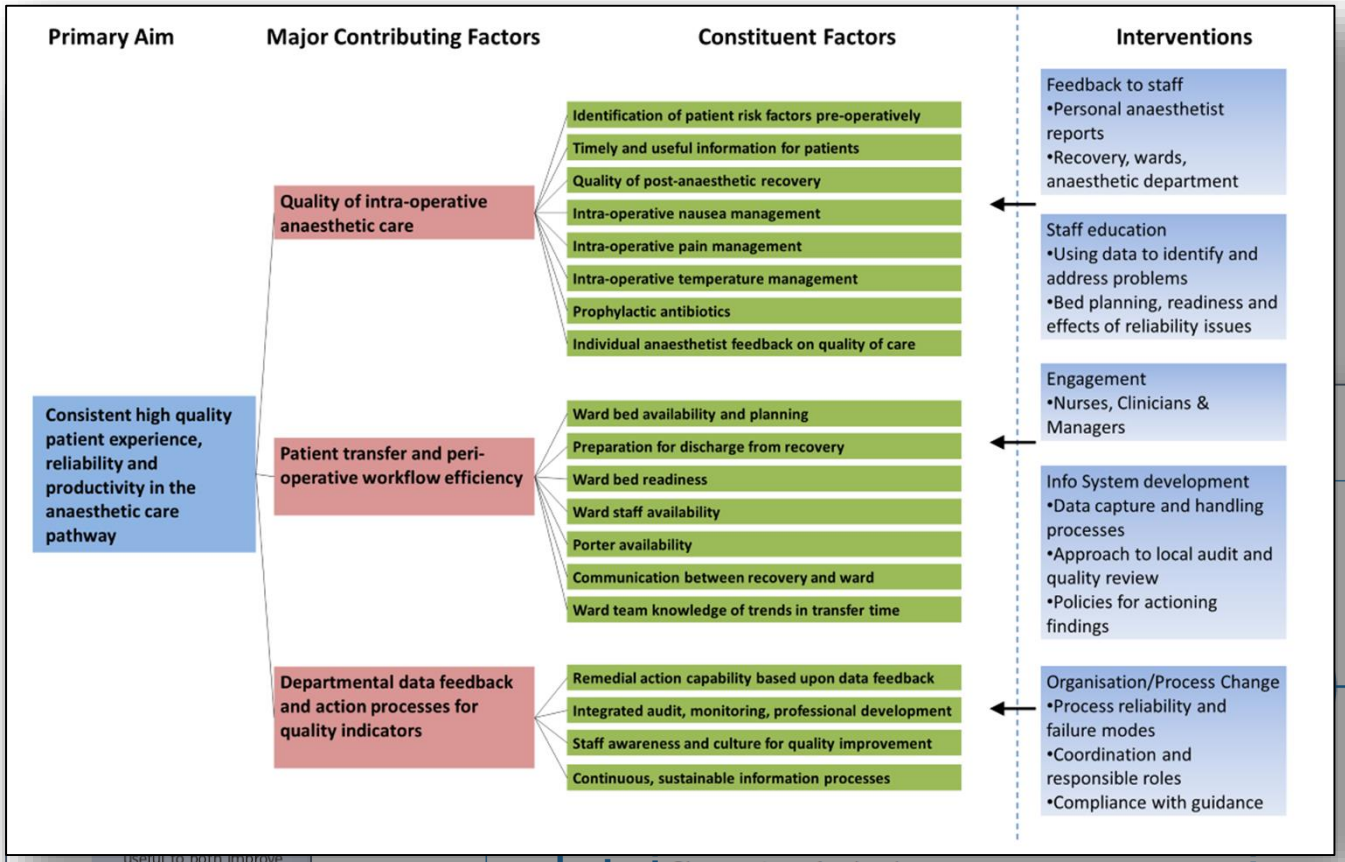
Results: We conducted 28 interviews and identified 313 theory-informed hypotheses, which were placed into 30 themes. The 30 themes included hypotheses related to the following five categories: A&F recipient (seven themes), content of the A&F (ten themes), process of delivery of the A&F (six themes), behavior that was the focus of the A&F (three themes), and other (four themes).

Conclusions: We have identified a set of testable, theory-informed hypotheses from a broad range of behavioral and social science that suggest conditions for more effective A&F interventions.
This work demonstrates the breadth of perspectives about A&F from non-healthcare-specific disciplines in a way

Intervention principles drawn from improvement and implementation science

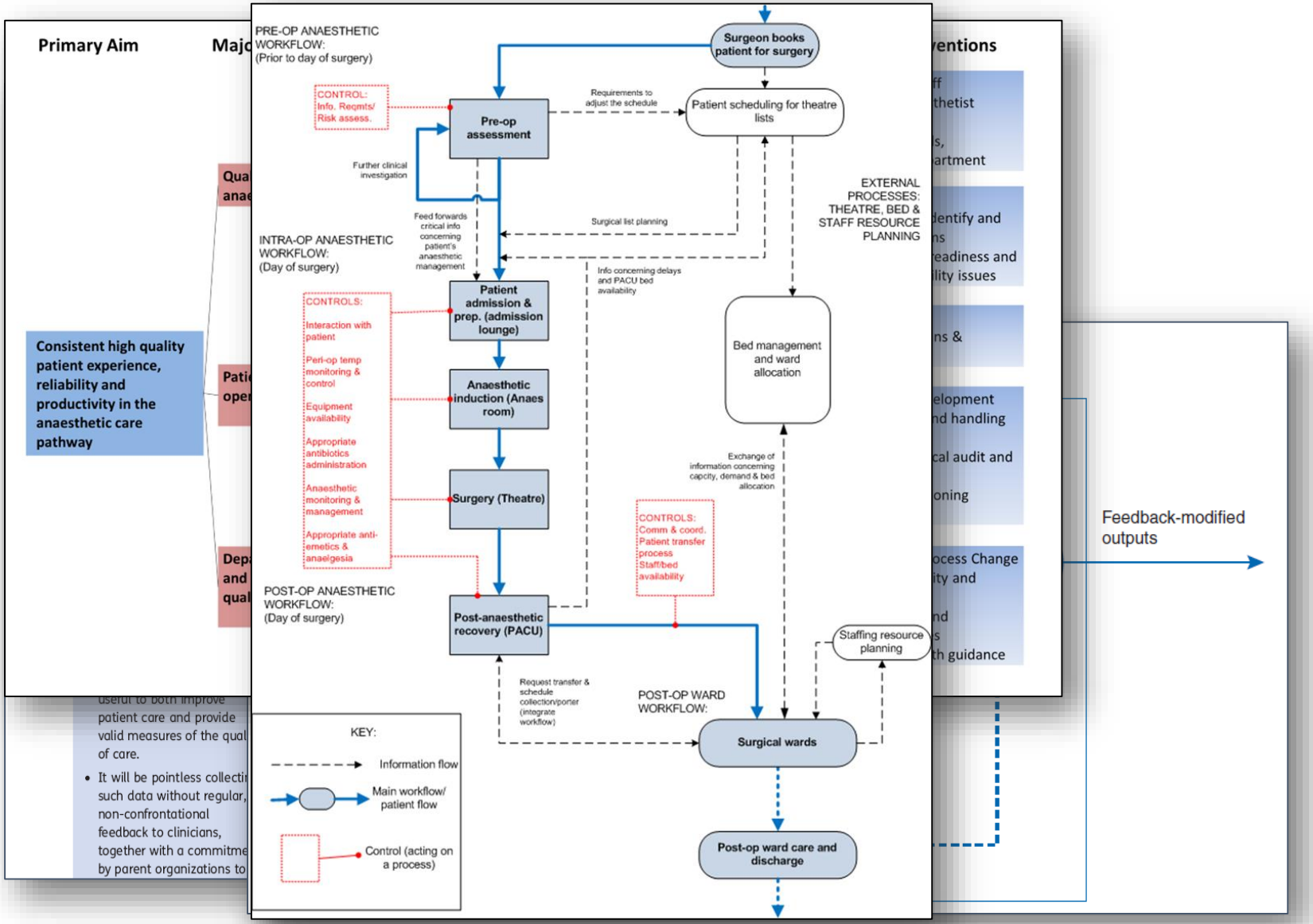


Analysing the drivers of high quality anaesthetic care



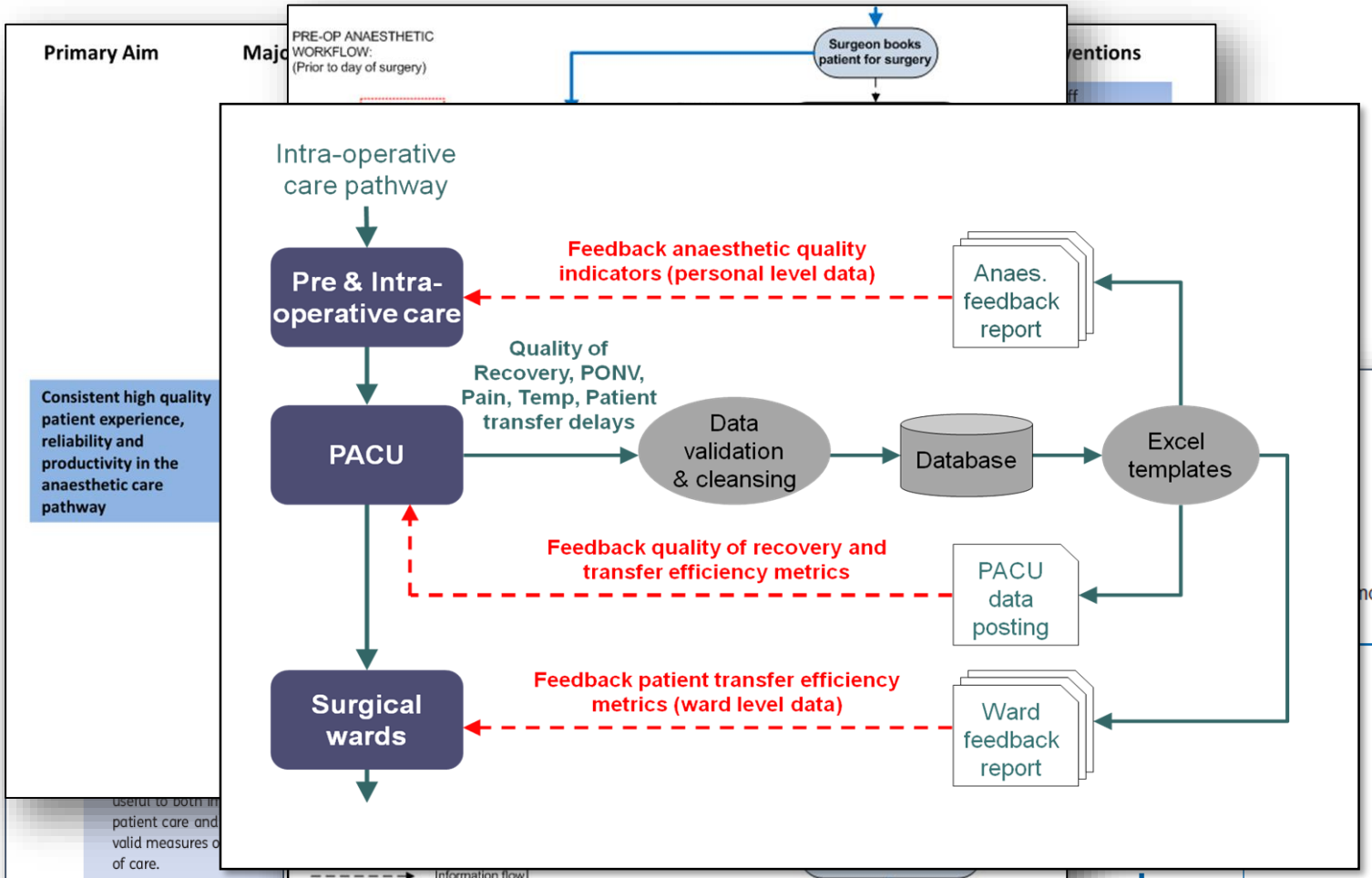
Improving Anaesthetic Quality

Mapping the perioperative workflow



Improving Anaesthetic Quality

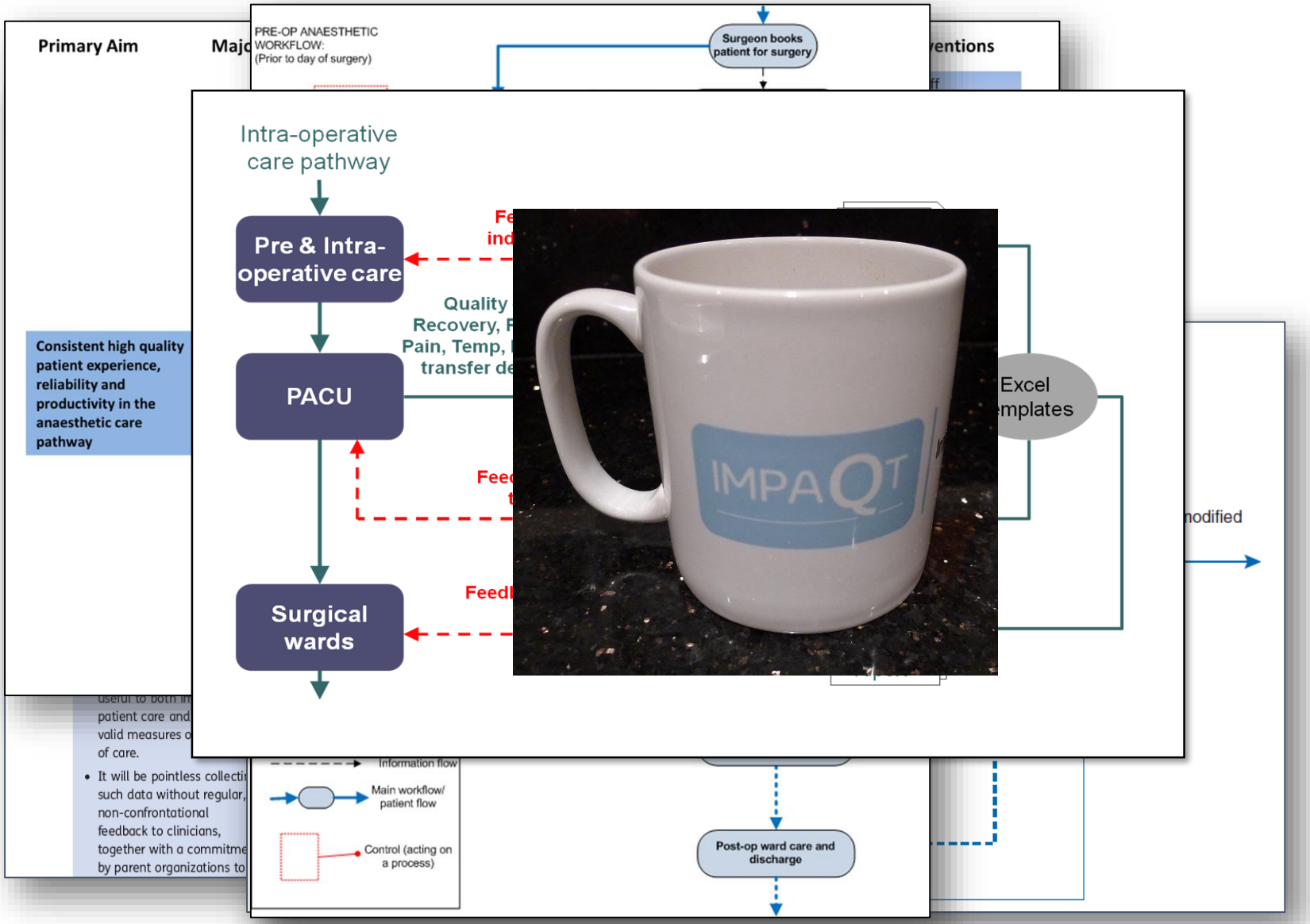
Design of an information system



IMPAQT

Improving Anaesthetic Quality

Design of an information system

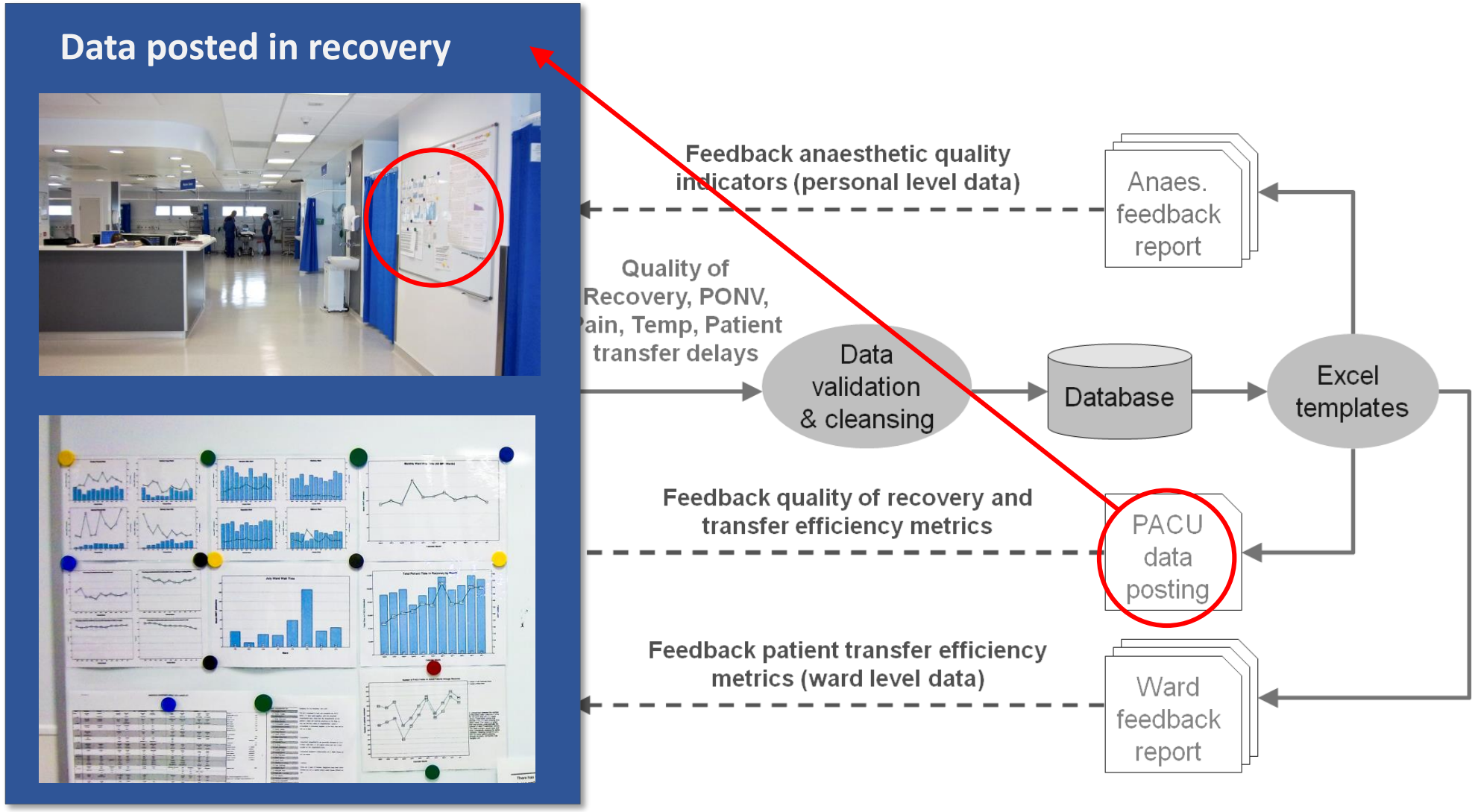


Improving Anaesthetic Quality

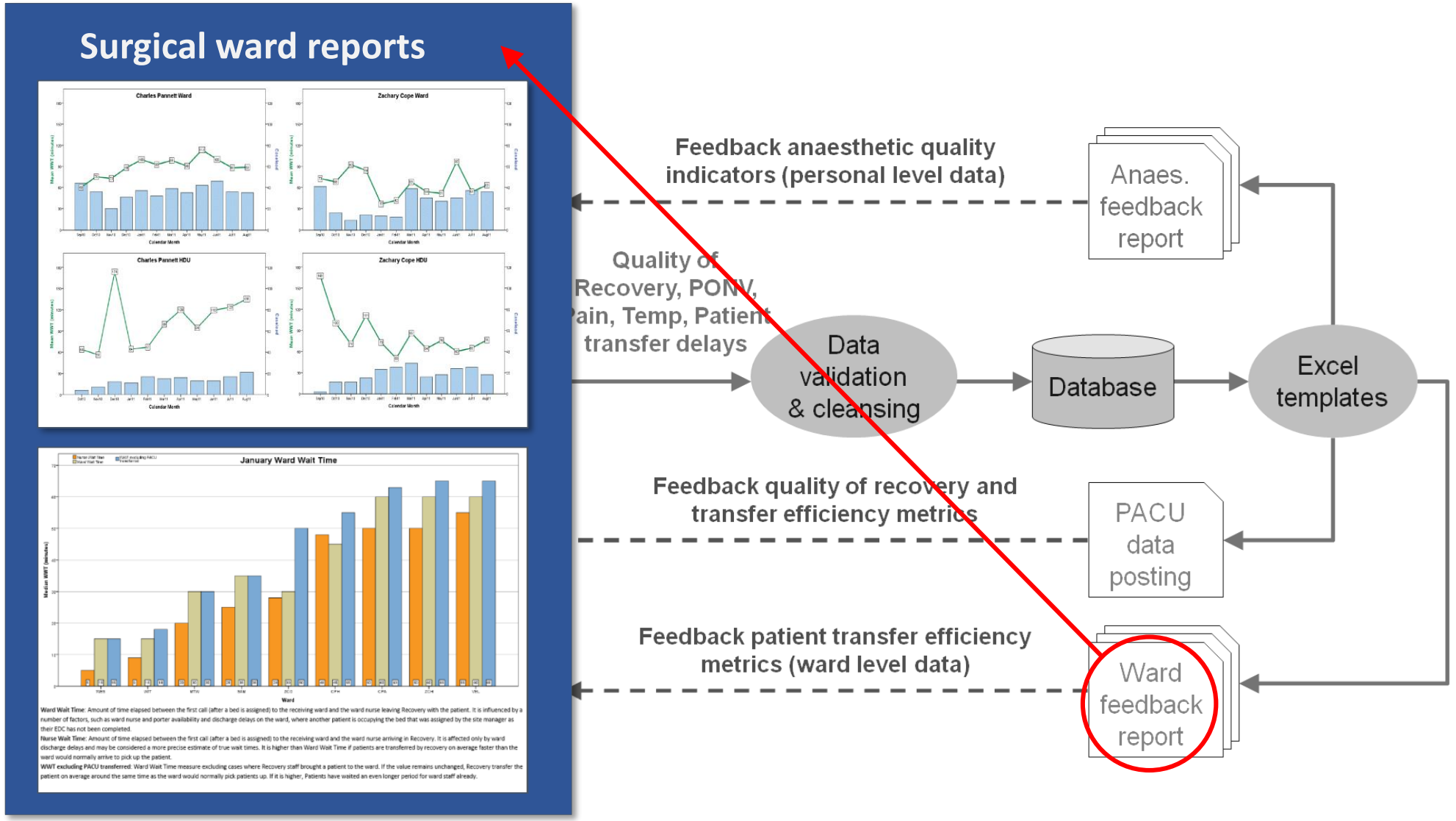
Target measures for improvement

- Anaesthetic quality indicators (PACU data collection)
  - Temperature on arrival in recovery (NICE Guideline)
  - Quality of recovery:
    - Patient reported Quality of Recovery (QoR) 16-point scale (Myles, 1999)
    - Post Operative Nausea and Vomiting (PONV) (2 x Ordinal scales)
    - Post-operative pain during recovery (Ordinal and continuous scale)
- Patient transfer efficiency (PACU data collection)
  - “Ward Wait Time” – interval between discharge-ready decision and patient leaving PACU

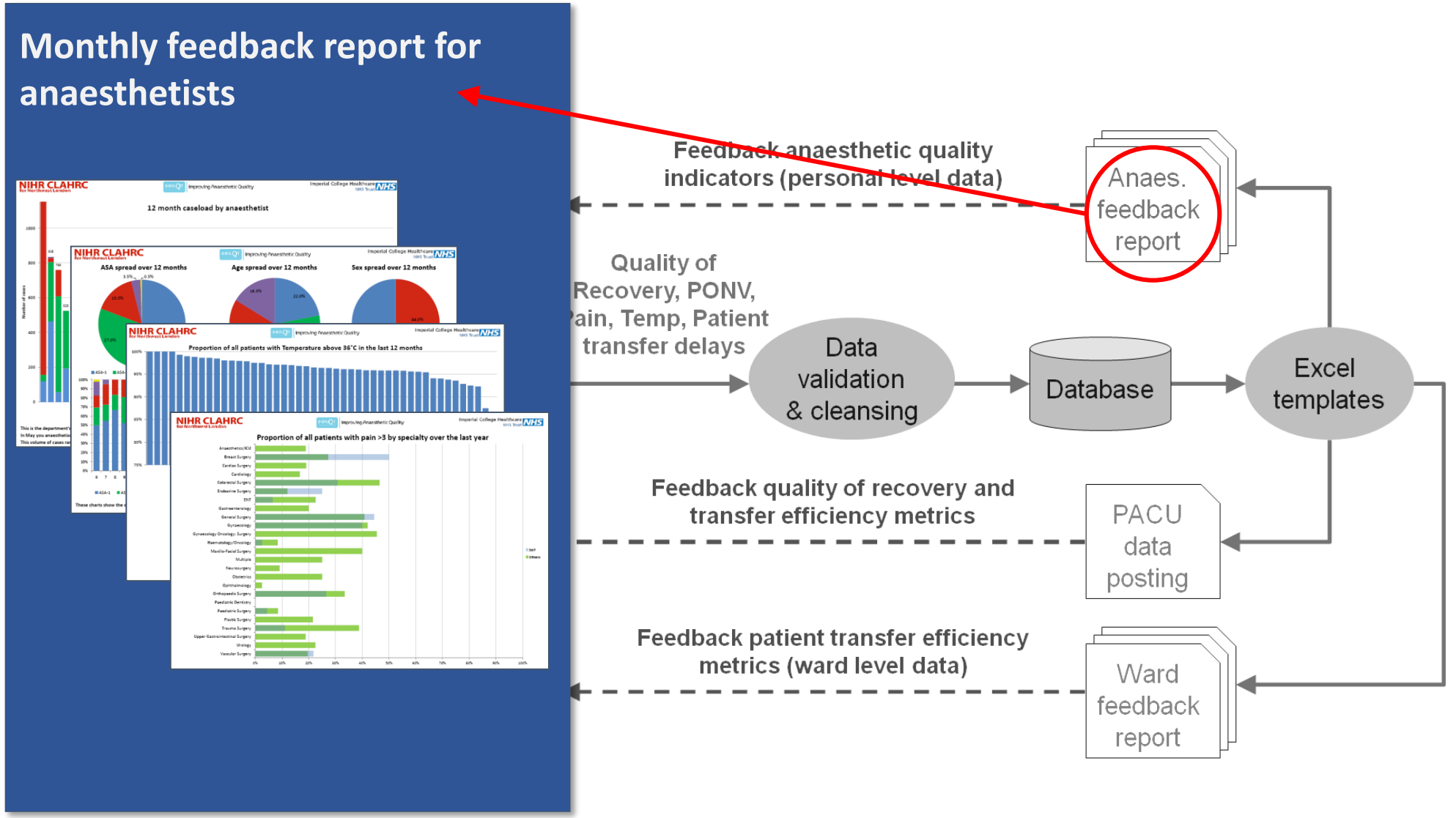
Implementation: St Mary's Hospital, London



Implementation: St Mary's Hospital, London



Implementation: St Mary's Hospital, London



Personalised feedback for anaesthetists (Initial version)

ID:
Year: 2010
Month: 8

Dear Colleague

Please find attached your most recent quality metric data.
This represents only patients anaesthetised in the main QEQM theatre block.

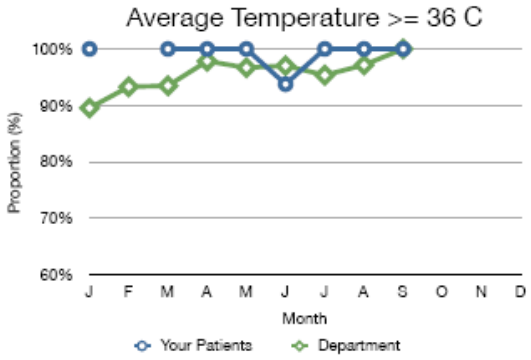
	Aug	YTD
Number of patients with data forms:	6	100
Number of patients consented:	1	7
Actual number of cases from TheatreMan:	29	
Proportion of caseload elective:	86%	
Proportion of caseload ASA 1-3:	93%	
Proportion of caseload age <16 years:	31%	
Average temperature of your patients in recovery:	36.3	36.5
Proportion of your patients with a temperature >36.0 C:	100%	97%
Proportion mostly free from PONV:	100%	91%
Proportion mostly free from moderate to severe pain:	50%	79%
Average Quality of Recovery Score:	15.50	15.23

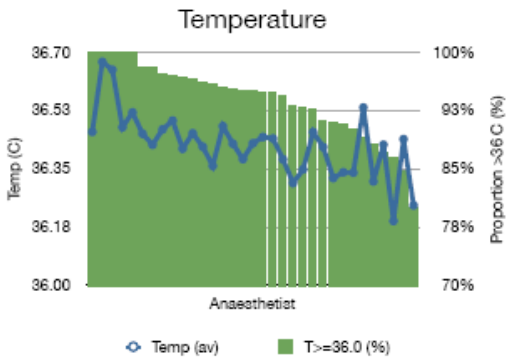
If you have any questions about this data please let me know.

Likewise if there is any information you would like to see (or not).

Best wishes

Glenn





Enhanced feedback reports (Final version)

- Features:
  - Comparative perspective: individual vs peer group
  - Longitudinal perspective: variation in personal and group practice over time
  - Identification and description of statistical outlying cases to support case-based learning
  - Specialty-specific reporting of Pain scores (to account for case mix variations)
  - Multi-site data
- Developed responsively, based upon interviews with end-users
- Programme of active, trust-wide engagement and support for specialty sub-group initiatives

Evaluation: Research methods

- Interrupted time series analysis of quality of recovery indicators for 2 time points: Basic and Enhanced feedback conditions
  - 22,670 surgical cases, performed by 44 consultant anaesthetists over a 4 year period
    - Primary analysis: All surgical cases
    - Secondary (sensitivity) analyses: Timeline variants and control of age/gender/ASA score
- Formative qualitative evaluation using semi-structured interviews:
  - 35 informants including consultant anaesthetists and perioperative service leads. 2 time points.
- End-user evaluative survey (consultant anaesthetists)
  - Baseline (28 respondents)
  - After basic feedback implementation (22 respondents)
  - After enhanced feedback implementation (13 respondents)

Time series analysis results: Patient-reported post-operative nausea and pain

- 12% increase in proportion of patients reporting no/mild pain upon arrival in recovery, compared with baseline ($P<0.001$)
- 7.2% increase in proportion of patients reporting freedom from severe pain, compared with baseline ($P<0.01$)
- 5.8% increase in proportion of patients reporting absence of nausea during the recovery stay, compared with baseline ($p<0.001$).

Benn J, Arnold G, D'Lima D, Wei I, Moore J, Aleva F, Smith A, Bottle A, Brett S. (2015) Evaluation of a continuous monitoring and feedback initiative to improve quality of anaesthetic care: a mixed-methods quasi-experimental study. Health Services and Delivery Research 3(32).

Reported changes to professional practice

- Switch to intravenous preparation to ensure analgesic effect early in recovery
- Use of active warming for short duration cases and ambient heating in the anaesthetic room
- Reduction of unnecessary antiemetics
- Revised level of analgesics for specific patient groups, including improvements to opioid practice
- Increased use of morphine in non-regional block patients undergoing localized procedures
- Better understanding of relationship between nitrous oxide use and postoperative nausea and vomiting (PONV)

"I now have hot air blowers on the patients in the anaesthetic room if I'm going to be in there for a while rather than leave them cooling off for fifteen minutes, because you never catch that fifteen minutes up."

"I saw that my bariatric patients were in a bit more pain than anyone else so it just made me think about giving more analgesia"

"I used to give everybody Cyclizine as routine and that does make people a little bit drowsy…..So I've cut down on that because my PONV scores were so good – I thought, 'Well why am I making everybody drowsy?'"

D'Lima D, Arnold G, Brett SJ, Bottle A, Smith A, Benn J (2017) Continuous monitoring and feedback of quality of recovery indicators for anaesthetists: a qualitative investigation of reported effects on professional behaviour. *British Journal of Anaesthesia*, Vol: 119, Pages: 115-124

Understanding the mechanisms by which feedback influences behaviour

Theoretically-informed qualitative analysis:

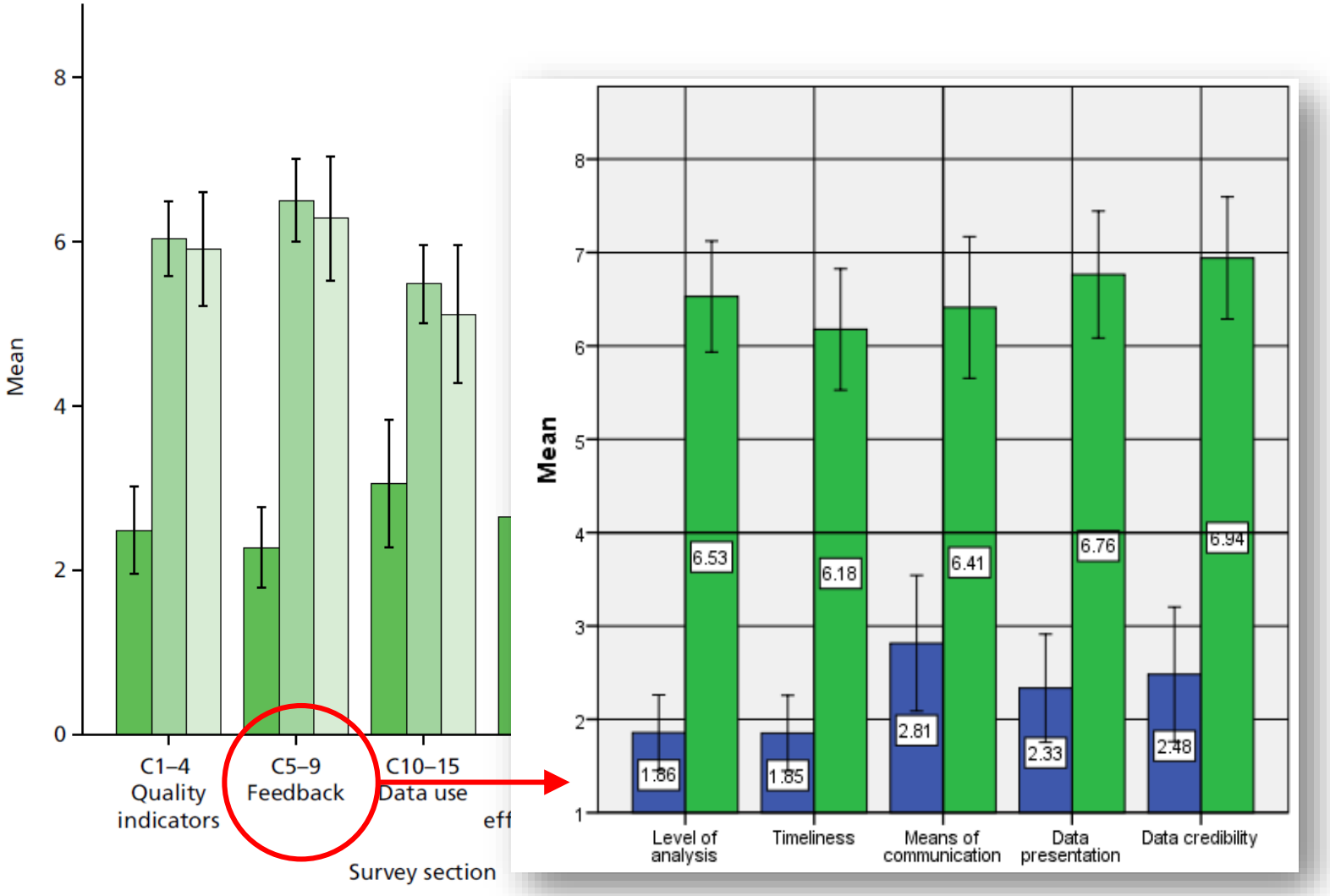
- Control theory
- Theory of Planned Behaviour & Behaviour change theory
- Diffusion of Innovation & Technology Adoption Model
- Educational theory
- Cognitive dissonance

Multiple regression analysis of evaluative survey data:

- Perceived local relevance of data and credibility of feedback source were significant predictors of perceived value of feedback

D'Lima, D., Moore, J., Bottle, A., Brett, S., Arnold, G & Benn, J. (2015). Developing effective feedback on quality of anaesthetic care: what are its most valuable characteristics from a clinical perspective? Journal of Health Services Research and Policy, 20:1, 26.

End-user evaluation: Feedback efficacy



Item descriptions

- Level of analysis: Relevance of data to personal practice
- Timeliness: Adequate frequency for monitoring variation
- Communication: Effectiveness of channel and method of dissemination
- Data presentation: Clarity and usefulness of graphical formats
- Credibility: Perception of trustworthiness and freedom from bias

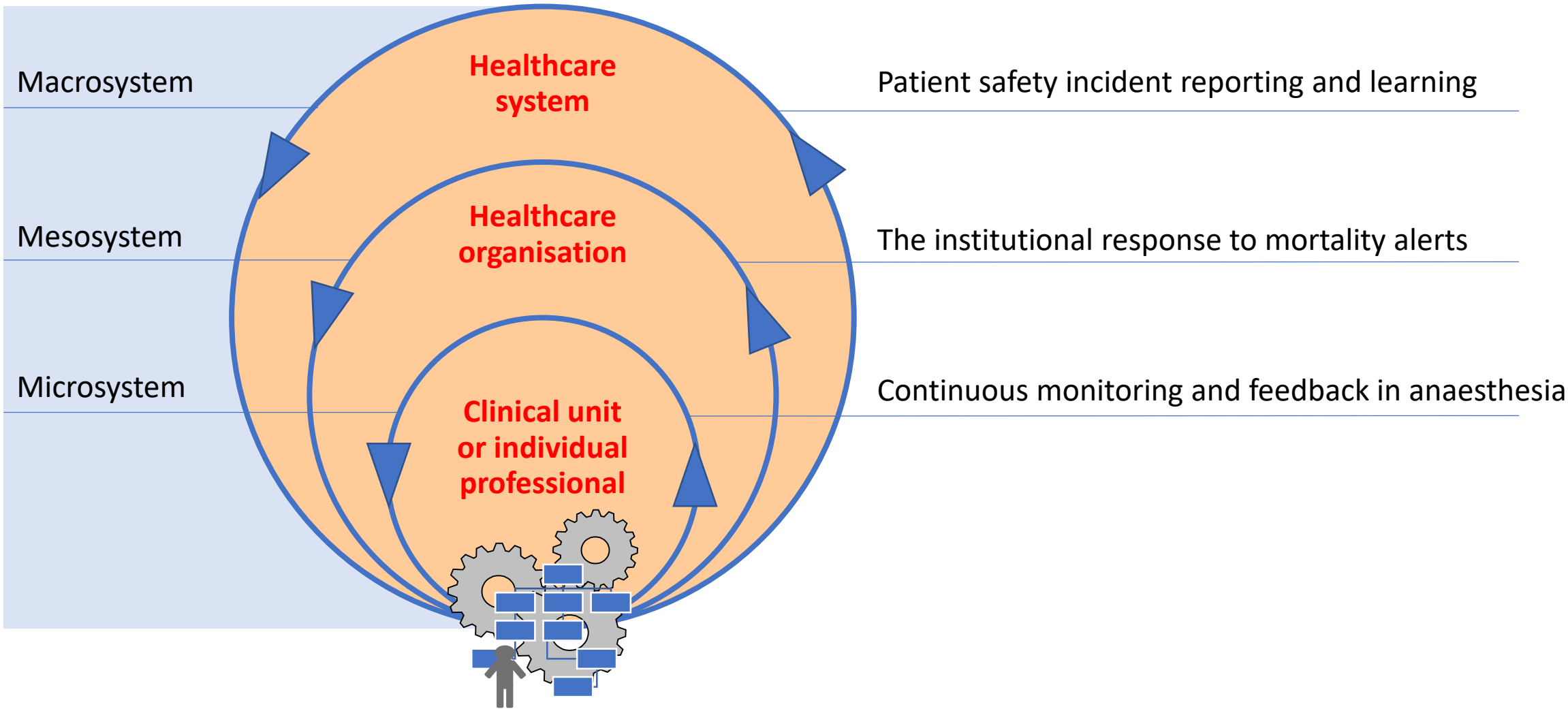
Scale:

1 “Completely inadequate” to 8 “Excellent”

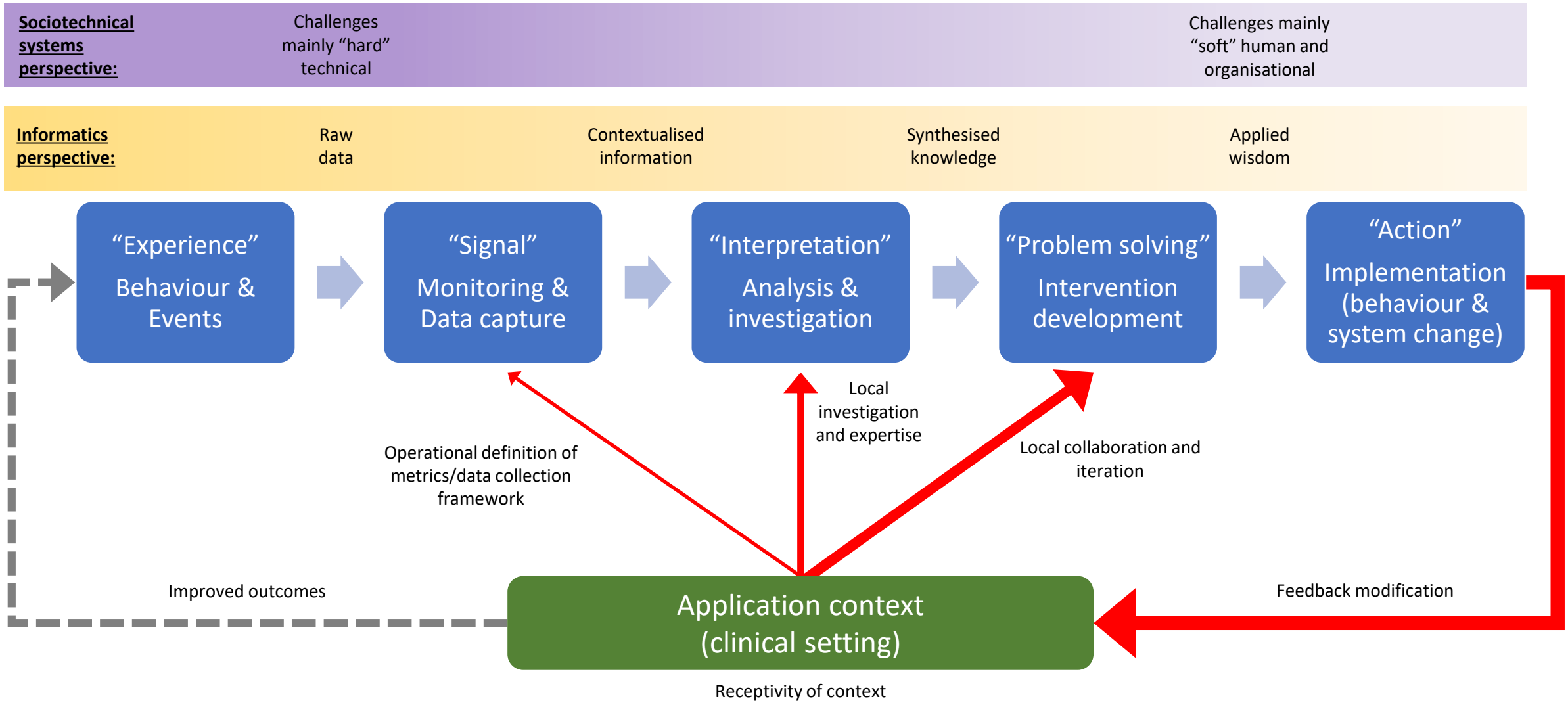
Conclusions from case study in anaesthesia

- **Implementation of enhanced feedback was associated with improvement in a range of anaesthetic quality indicators, including post-op pain and nausea.**
  - Effective feedback has user-requested features, multiple data views, broad engagement and peer-led dialogue on quality of care issues. Fosters local relevance, a sense of ownership and trust in the source of data.
- **Strong positive subjective response to the implementation of feedback**
  - Anaesthetists found the initiative acceptable and useful. 57% reported changing their practice in some way in response to the feedback.
- **Findings support conclusions drawn from systematic reviews**
  - Audit and feedback typically has a small to moderate positive effect; process measures are more sensitive than outcomes (Jamdtvedt, 2005)
  - Adding education & quality improvement elements to basic data feedback reports enhances their effectiveness (van der Veer, 2010; de Vos, 2009)

Case study summary

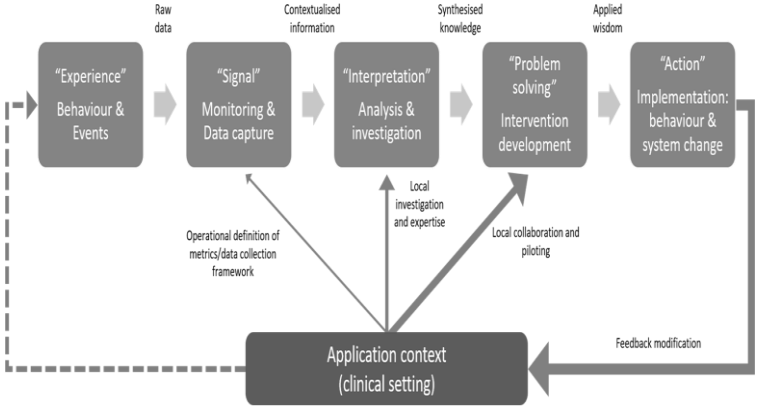


Generic model for data-driven improvement



Lessons learnt about effective data-driven improvement

- It is important that we close the loop and provide feedback from quality monitoring
- Feedback should be designed to maximise learning and stimulate improvement by aiming it at the right level and making it “actionable”
- The feedback recipient should be conceptualised as “end-user” and their requirements for usability should be understood
- Feedback is a two-way process: end–users should be involved in definition of metrics, interpretation of data and development/ implementation of solutions
- Effective data-driven improvement is a sociotechnical process requiring broad interdisciplinary collaboration



Requirements for future research and development

- Need to complement health informatics perspectives with research focusing on:
  - Human and organisational factors in the implementation of actions generated by monitoring systems
  - How we develop and implement quality monitoring and feedback systems, with the involvement of end-users
  - Acceptability of different forms of monitoring and feedback by end-user groups
- Study how local cultural and institutional context influences effective use of data and receptivity to feedback.
- Understand the characteristics of effective feedback for improvement through comprehensive evaluation and experimentation (e.g. quasi-experimental and mixed-methods evaluation of ongoing initiatives, such as national audit).
- Develop research apparatus and conceptual frameworks to help describe and evaluate initiatives in this area
  - View information and monitoring/feedback systems as complex sociotechnical interventions