

# Using data to improve quality of care and patient outcomes

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# Data in quality improvement



W. Edward Deming (1900 -1993)

“Without data you’re just another person with an opinion.”

“In God we trust. All others must bring data.”



# What is Quality Improvement?

Using understanding of our complex healthcare environment

Applying a systematic approach

Designing, testing, and implementing changes using real time measurement for improvement

To make a difference to patients by improving safety, effectiveness, and experience of care

# What data do we need?

Data can be used for each of these, answering different questions:

- Do we have a problem, for which patients and in what circumstances?
- Is the intervention working as intended or do we need to make changes?
- Are there any unintended consequences of the intervention?
- Is the intervention effective to improve patient outcomes?



Do we have  
a quality or  
safety  
problem?

Multiple data sources:

- Quality indicators: e.g. worrying trend over time
- Registry or audit data: e.g. worse performance relative to others
- Patient experience data or complaints
- .....etc.

**Understand your data!**

# Choosing a set of quality measures

No one-size-fits-all

In practice: often single indicators but why are these monitored?


Periodic review: indicator still needed?





# Quality improvement in registries

## Failure to administer recommended chemotherapy: acceptable variation or cancer care quality blind spot?

Ryan J Ellis <sup>1,2</sup>, Cary Jo R Schlick,<sup>1</sup> Joe Feinglass,<sup>3</sup> Mary F Mulcahy,<sup>4,5</sup> Al B Benson,<sup>4,5</sup> Sheetal M Kircher,<sup>4,5</sup> Tony D Yang,<sup>1,4</sup> David D Odell,<sup>1,4</sup> Karl Bilimoria,<sup>1,2,4</sup> Ryan P Merkow<sup>1,2,4</sup>

## Continuous Quality Improvement Program for Hip and Knee Replacement



Deborah A. Marshall, PhD<sup>1,2</sup>, Tanya Christiansen<sup>2</sup>, Christopher Smith, BCom, MBA<sup>2</sup>, Jane Squire Howden, RN, BScN<sup>3</sup>, Jason Werle, MD, FRCSC<sup>1,3</sup>, Peter Faris, PhD<sup>2</sup>, and Cy Frank, MD, FRCSC<sup>1</sup>

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sagepub.com/journalsPermissions.nav  
DOI: 10.1177/1062860614540512  
ajmq.sagepub.com  


Variation in the use of infection control measures and infection-related revision incidence after breast implant surgery in the Netherlands ☆,☆☆

Babette E. Becherer<sup>a,b</sup>, Perla J. Marang-van de Mheen<sup>c</sup>, Danny A. Young-Afat<sup>d</sup>, Rene R.J.W. van der Hulst<sup>e</sup>, Xavier H.A. Keuter<sup>e</sup>, Hinne A. Rakhorst<sup>f</sup>, Marc A.M. Mureau<sup>a,\*</sup>, Dutch Breast Implant Registry (DBIR) group.

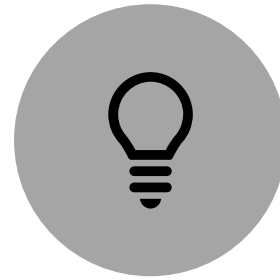
## Effectiveness of a multifaceted quality improvement intervention to improve patient outcomes after total hip and knee arthroplasty: a registry nested cluster randomised controlled trial

Peter van Schie <sup>1,2</sup>, Leti van Bodegom-Vos,<sup>2</sup> Tristan M Zijdeman,<sup>2</sup> Rob G H H Nelissen,<sup>1</sup> Perla J Marang-van de Mheen <sup>2</sup> IQ Joint study group

# Designing QI initiatives: key elements



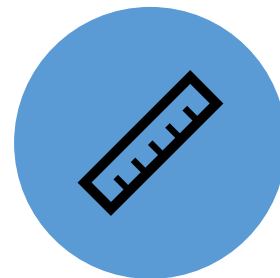
Understand the problem



Theory why the intervention will address the problem



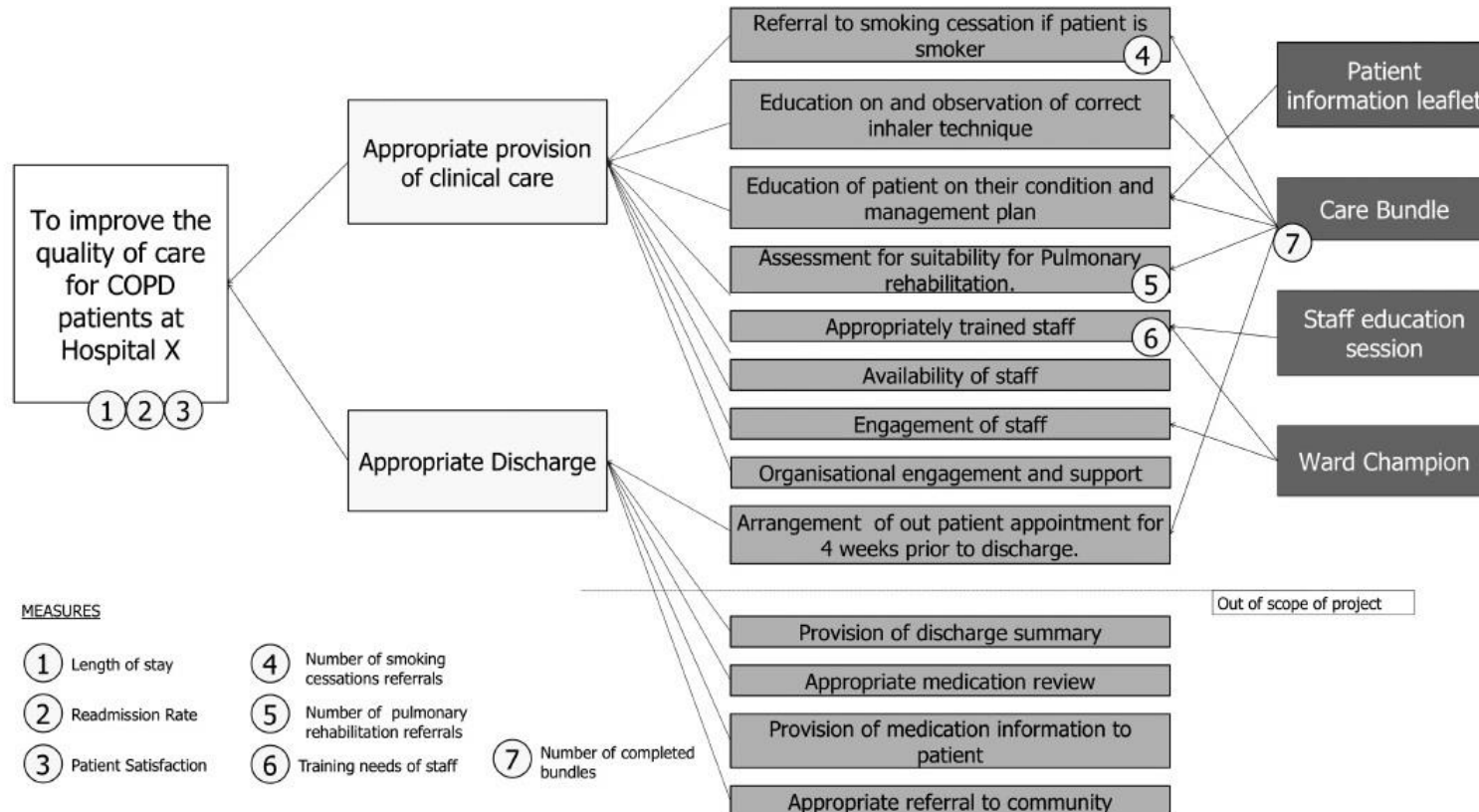
Replicable intervention  
– development and refinement



Measurements showing that intervention worked as intended



# Why can the intervention work – articulate the programme theory



- **If:**
  - staff roles are redesigned to specify prevention responsibilities, and
  - community list of prevention resources is kept up to date
- **Then:**
  - time stress is alleviated, and
  - staff can better identify how to address ingrained habits and barriers, and
  - more patients get referrals to community prevention resources
- **So that:**
  - counseling becomes a process throughout the visit and beyond, and
  - more patients are motivated, and
  - more patients use community prevention resources
- **So that:**
  - more patients change health related behaviors, and
  - staff expectations for behavior changes rise, and the redesign is sustained.

# Develop and refine the intervention - PDSA

## Box 1 Benefits from the authentic application of plan–do–study–act cycles

- ▶ Efficient use of data—collecting just enough to inform the best action forward
- ▶ Refine measures and data collection method (to ensure that baseline and intervention data are collected in similar fashion)
- ▶ High 'return on failure ratio'<sup>12</sup> (valuable lessons learned with relatively little resources invested to learn)
- ▶ Recognise necessary refinements to the intervention
- ▶ Identify missing ingredients for the intervention
- ▶ Anticipate what might go wrong during implementation
- ▶ Increases confidence that the change under consideration will produce improvement
- ▶ Engages stakeholders in development of the intervention
- ▶ Minimises resistance when change is implemented

Each implementation phase has potential challenges:

- **Plan**
  - Failure to understand the problem fully
- **Do**
  - Failure to implement the intended intervention
  - Failure to collect the intended data
  - Failure to capture unanticipated learning
  - Failure to abandon the intervention despite negative results or side effects
- **Study**
  - Failure to appropriately analyze or interpret the data collected
  - Failure to communicate what has been learned with the team
- **Act**
  - Moving too quickly from small to large scale change

# Measurements: 3 types of outcomes

**Primary outcome:** key quality / safety issue targeted

**Intervention fidelity**  
(or process) measures:  
key things you work on  
to achieve outcomes

**Balancing measures:**  
possible unintended  
effects or harm

# Improving care using registries

Most registries provide feedback to hospitals, intended to improve care

But is it tailored to the needs and skills of clinicians?

You can lead clinicians to water, but you can't make them drink: the role of tailoring in clinical performance feedback to improve care quality

Laura Desveaux <sup>1,2</sup>, Zahava R S Rosenberg-Yunger <sup>1,3</sup>, Noah Ivers <sup>4,5</sup>

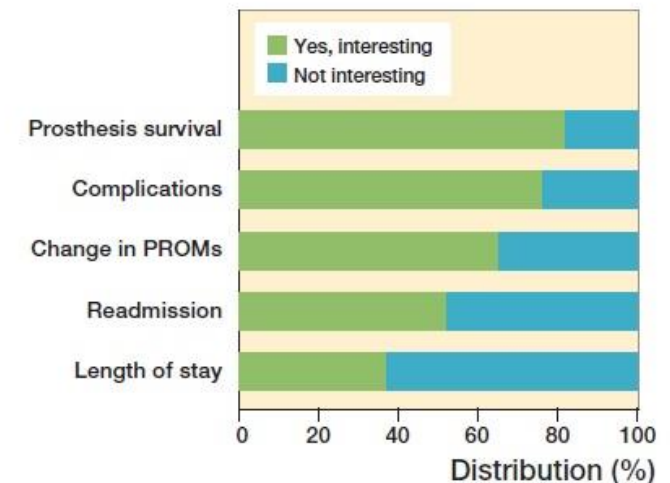
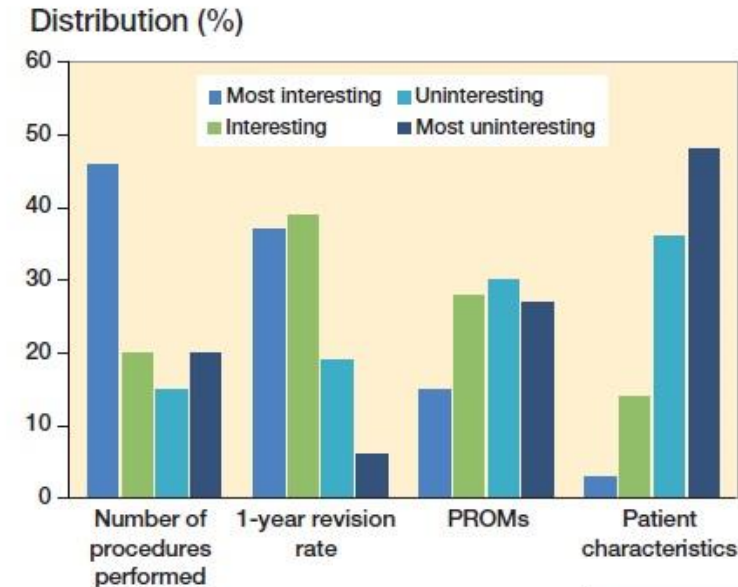
**Table 1** Challenges limiting the impact of clinical performance feedback and potential strategies to overcome them

Challenge	Example	Potential strategy
<b>Clinician skills and characteristics</b>		
Clinician mental model	Clinician has difficulty identifying how aggregated data regarding proportion of patients at diabetes targets relate to specific patient-centred approaches to managing diabetes.	Frame CPF as a mechanism to identify subconscious ingrained habits.
Clinician skills	Clinician understands what needs to change but is unsure how to approach a conversation with a patient who is ambivalent about adding a statin.	Support action planning by providing examples of goal-oriented actions. <sup>8,9</sup> Identify colleagues who may have discovered more effective strategies or approaches to care. <sup>10</sup>
<b>Organisational and professional culture</b>		
Psychological safety	Self-directed learning is not having an impact and the clinician worries that admitting their suboptimal performance will add to their feelings of shame.	Model openness and accessibility with an inclusive leadership approach to facilitate learning from both success and failure. <sup>28</sup>
Culture of feedback	Clinician discounts CPF credibility because no one observed their performance.	Use a commitment-based management approach that role models the desired behaviour and aligns words to actions rather than focusing on monitoring compliance. <sup>30</sup>
<b>Design for existing workflows</b>		
Workflow integration	CPF not integrated with electronic records, adding extra steps to both access the feedback and identify specific patients needing assessment.	Use a user-centred design process to guide prototype development and refinement. <sup>38</sup>
Cointerventions	Clinician does not understand where the data come from or how data are calculated, and no one is available to explain it to them in a way they can buy into.	Engage with a broad range of clinicians, including those who use the CPF and those who have not, to understand preferences and reactions to inform cointerventions. <sup>36</sup>
CPF, clinical performance feedback.		



# Understanding the problem with feedback

- About two-third of surgeons logged in – received feedback information
- 55% was aware of deviating performance – awareness
- About 60% interpreted the funnel plot correctly – interpretation of feedback



Van Schie et al. Acta Orthoped 2021;92:54-61

# Theory why feedback was ineffective

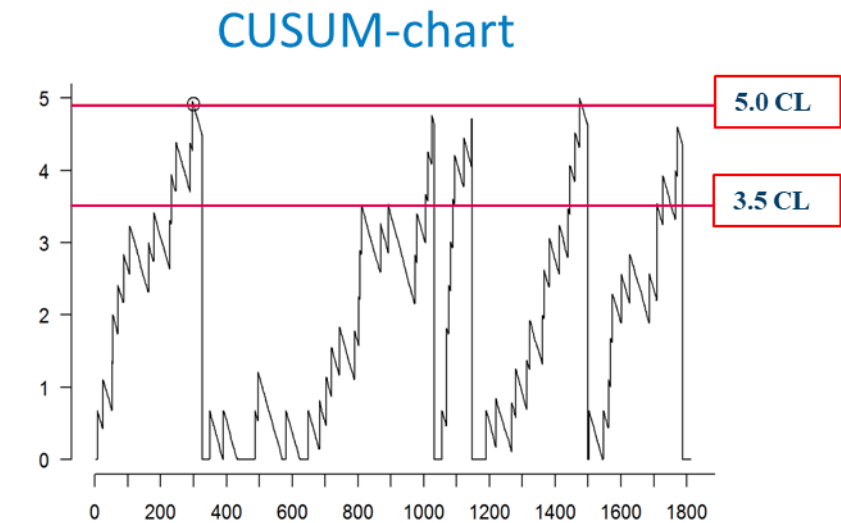
Causes	Interventions	Implementation
Need to log in	Align with workflow	Feedback by email
Incorrect interpretation	Increase knowledge Feedback aligned with mental model	Staff education Add different types of charts
Cannot link actions to feedback	Increase skills	Add toolbox to facilitate action planning
Engagement of surgeons	Credibility of data Timely feedback Culture of feedback	Use monthly registry data Choose their own QI targets, setting goals

# Refinement of feedback

- Annual feedback vs. continuous improvement
- Funnel plots – average performance in a period
- Aggregate level data, not aligned with mental model of clinicians

CUSUM chart with 5 control limit: earlier signal

- Best accuracy (97%)
- First signal for worsening
  - THA: 18 months IQR [7-22]
  - TKA: 21 months IQR [9-25]



Van Schie et al. J Bone Joint Surg Am 2020;102:2087-94



# Link feedback to actions to improve

- Reasons for revision give more direction

Van Schie et al. J Bone Joint Surgery Am 2020;102:315-24

- Facilitate actions by providing a toolbox with evidence-based measures for each outcome

Leiden University Medical Center IQJOINT

## IQ Joint study Toolbox

**Plan - Do - Check - Act cycle<sup>1</sup>**  
 A iterative four-step management method used for the control and continuous improvement of processes, service and care delivery.

Plan	<ol style="list-style-type: none"> <li>For which outcome an improvement is possible (outlier).                      • Example: Infection.</li> <li>Identify possible reasons for the problem (define the process).                      • Example: Check the electronic patient files to see if the last 100 patient have all received antibiotic prophylaxis. <i>No, 4 patient did not.</i></li> <li>Plan Improvement/change.                      • Example: Ask the anaesthetist for each patient during the "Time Out Procedure" whether the patient had received antibiotic prophylaxis and do this for 6 months.</li> </ol>
Do	<ol style="list-style-type: none"> <li>Pilot → Carry out the improvement/change.                      • Example: As described under Plan → 3.</li> </ol>
Check	<ol style="list-style-type: none"> <li>What is the effect and is it as desired.                      • Example: Check the electronic patient files to see if the last 100 patients have all received antibiotic prophylaxis. <i>No, 1 patient did not.</i></li> </ol>
Act	<ol style="list-style-type: none"> <li>Adopt the improvement/change or abandon it.                      • Example: Adopt the change because it has led to a substantial improvement.</li> <li>Run through the cycle again.</li> </ol>

Plan-Do-Check-Act cycle - Tague, Nancy R 2005  
 IQ Joint studiegroep:  
 • P van Schie, coördinerend arts-onderzoeker  
 • Prof. dr. RGHM Nelissen, orthopedisch chirurg  
 • Dr. P.J. Marang-van de Mheen, assistent professor medisch bestelkunde

Leiden University Medical Center IQJOINT

## IQ Joint study Toolbox

### Outcome: Infection (THA & TKA)

Topics are described where quality improvement initiatives could be considered.

Pre-operative	<b>Patient-specific factor optimization</b> <ul style="list-style-type: none"> <li>Poor nutritional status: Aim for Albumine blood levels &gt;34g/L (healthy range: 34-54 g/L).<sup>1,2,3</sup></li> <li>Overweight: Aim for a BMI &lt;30 kg/m<sup>2</sup>. Every BMI-point decrease in obese patients reduces the chance on postoperative infection.<sup>1,4</sup></li> <li>Smoking: Convince patients to participate in smoking cessation programs. Smoking cessation for at least 4 weeks before surgery reduced infections.<sup>5,9</sup></li> <li>Immunocompromising diseases / Immunosuppressive drugs: Choose the most suitable moment to perform the operation. Consult other physicians if needed.</li> <li>Glycaemic blood level control. Different glucose target levels were specified.<sup>14</sup></li> </ul> <b>MRSA screening &amp; decolonisation</b> <ul style="list-style-type: none"> <li>Screening &amp; decolonisation with mupirocin ointment and chlorhexidine show minimal reduction for infections.<sup>15,16</sup> Not recommended in NOV-guidelines (NOV guidelines - preoperative decolonisation)</li> </ul> <b>Skin disinfection</b> <ul style="list-style-type: none"> <li>Consider to apply chlorhexidine around the operating area the night before and the morning of surgery.<sup>16,17</sup></li> </ul>
Intra-operative	<b>Antibiotic prophylaxis</b> <ul style="list-style-type: none"> <li>As recommended in NOV-guidelines (NOV guideline - systemic antibiotic prophylaxis).</li> <li>Consider vancomycin for MRSA-colonized patients and institutions with high prevalence of MRSA-infections.<sup>18</sup></li> </ul> <b>Lavage</b> <ul style="list-style-type: none"> <li>Consider 3 minutes lavage with dilute antiseptic (betadine/chlorhexidine).<sup>19</sup> Avoid lavage with surfactants or antibiotics.<sup>20</sup> Use a low-pressure delivery system for a &lt;2L volume of solution.<sup>21</sup></li> </ul> <b>Prevent transfusions</b> <ul style="list-style-type: none"> <li>Check pre-operative hemoglobin level and correct if necessary preoperatively.</li> <li>Tranexamic acid might help minimize blood loss and wound infection.<sup>20,21</sup></li> </ul> <b>Cement loaded with antibiotics</b> <ul style="list-style-type: none"> <li>As recommended in NOV-guidelines (NOV guidelines - Antibiotica-laden cement).</li> </ul> <b>Surgical approach</b> <ul style="list-style-type: none"> <li>Lateral surgical approach results in more infections compared to posterior approach.<sup>2</sup> However, each of the approaches has their own set of complications and benefits.</li> </ul> <b>Bearing surface</b> <ul style="list-style-type: none"> <li>Ceramic-on-ceramic and ceramic-on-polyethylene surfaces are associated with lower risk of revisions for infection after 12 and 24 months respectively compared to metal-on-polyethylene.<sup>4</sup></li> </ul>
Post-operative	<b>Antibiotic prophylaxis</b> <ul style="list-style-type: none"> <li>As recommended in NOV-guidelines (NOV guideline - systemic antibiotic prophylaxis).</li> </ul> <b>Wound leakage</b> <ul style="list-style-type: none"> <li>Is a wound leakage protocol available and is it followed sufficient?</li> </ul> <b>Patient-specific factor optimization</b> <ul style="list-style-type: none"> <li>Blood glucose levels: Fasting blood glucose value &lt;200mg/dl is suggested.<sup>22</sup></li> </ul>

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# Engagement of surgeons

- Use registry data they have submitted themselves
- More frequent feedback
- Setting goals, choose own targets to improve
- Survey to:
  - Encourage reviewing feedback
  - Which improvement initiatives conducted

## Four stages of facing reality

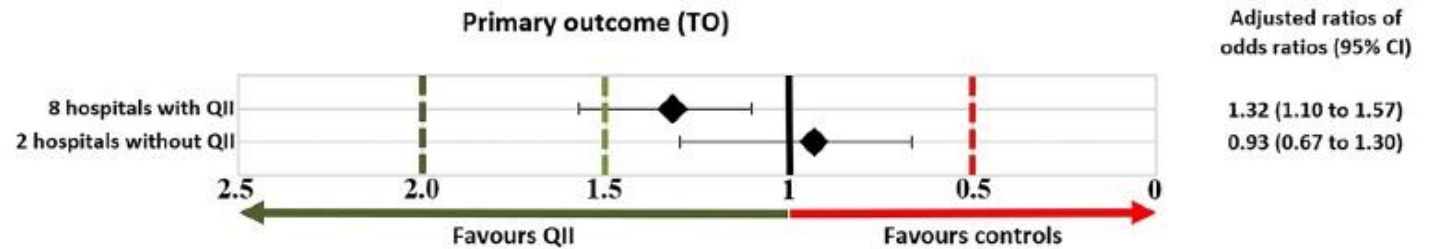
Stage 1	The data are wrong
Stage 2	The data are right, but it's not a problem
Stage 3	The data are right, it's a problem, but not my problem
Stage 4	The data are right, it's a problem, it's my problem

<https://www.ihl.org/resources/Pages/ImprovementStories/ImprovementTipTakeTheJourneyToJiseki.aspx>

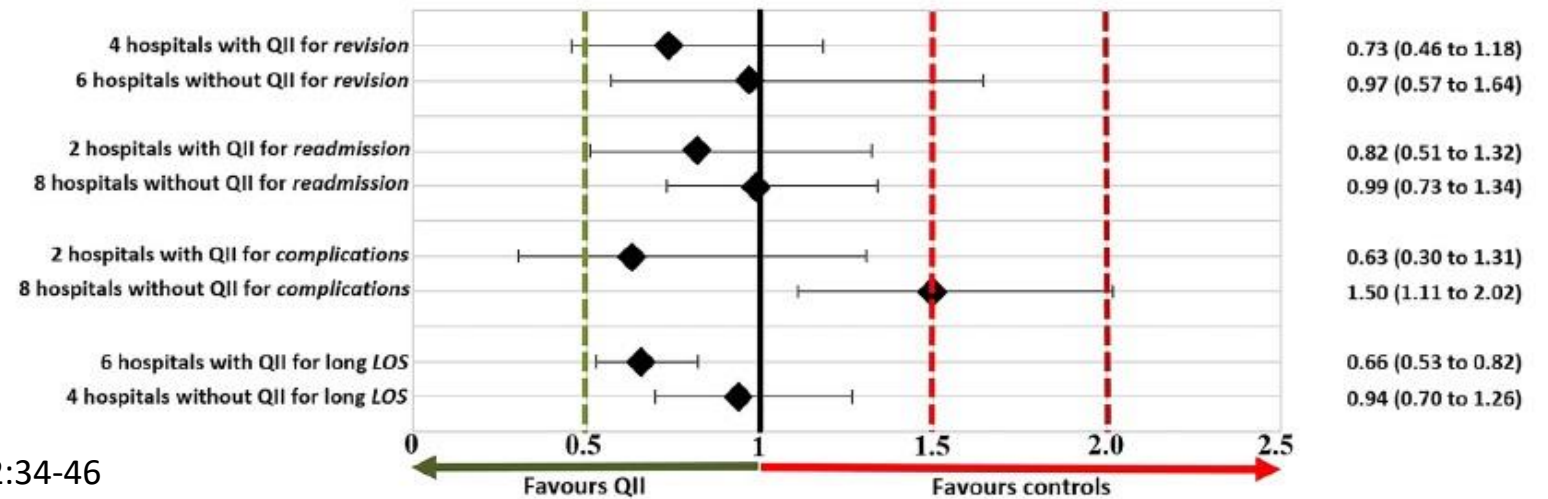
# Testing effectiveness to improve patient outcomes

More improvement in patient outcomes intervention group

Effect size dependent on introducing quality initiatives



**Secondary outcomes (revision, readmission, complications, and LOS)**



Van Schie et al. BMJ Qual Saf 2023;32:34-46

# Lessons learned – what worked well

“We were doing pretty well on hospital stay, but other hospitals were faster without compromising other outcomes. That makes you wonder, what can we do to get to that point?”

“Particularly the education session where it was explained how we should interpret the data, was very helpful.”

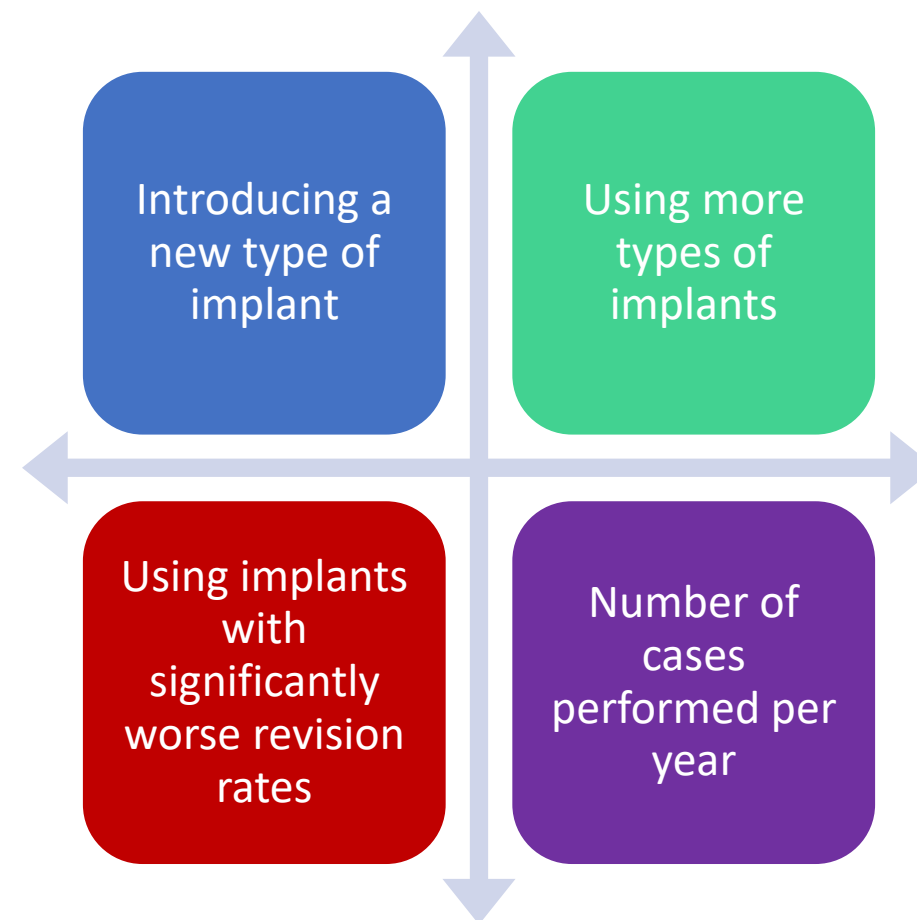
“The rapid cycle feedback with information on your patient characteristics. It shows where you deviate from other hospitals and you also quickly gain insight whether adjustments in care are having effect.”

“We analysed why we had more revisions of the hip and started improvement initiatives. The intervention may have been too short but you could already see it in our numbers.”

“We joined together with X. Because we were evaluated separately we could distil best practices. If one did worse on one part than the other, we could immediately investigate why that occurred. Very helpful.”

# Lessons learned – what could be improved

- No feedback on implants relative to others -> improving choice of implants
- Stratification by type of patients – logistics vs patient complexity
- No involvement of patients – different outcomes targeted by improvement initiatives



Penfold et al. J Arthroplast 2021;36:1239-45. Evans et al. PLOS Med 2020; 17:e1003291. Penfold et al. J Arthroplast 2020;35:699-705. Hoskins et al. Clin Orthop Relat Res 2022;480:464-81

# Sustainability of improvement initiatives

- What changes when a QI initiative ends – are resources still available?
- Planning for sustainment
  - Make it easier to do the right thing – facilitate action in workflow
  - What intervention elements are crucial?
- Avoid availability bias
- Leverage the role of caregivers to design and sustain initiatives

**Sustaining quality improvement efforts: emerging principles and practice**

Robert E Burke,<sup>1,2,3</sup> Perla J Marang-van de Mheen<sup>4</sup>

# Using data to drive quality improvement

- More is needed than data alone: engagement, time and resources
- Frequent feedback needed for continuous improvement
- Tailored to the needs and skills of clinicians, aligned with workflow



**“You can’t do quality between surgical cases and tea time”**

Taitz JM, Lee TH, Sequist TD. *BMJ Qual Saf* 2012;21:722–8.