Scientific Quality Improvement

A Critical Clinical Faculty Competency?

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An Uphill Road: Academic Clinicians Are (Legitimately) Skeptical About QI

- Many associate QI with old-style, punitive QA
- QI gurus overemphasize the industrial origins of QI and its “religious” aspects
- QI experts tend to focus on non-clinical processes and outcomes
- Teams trying to do QI “by the book” get bogged down in tedious process and settle for small incremental improvements
- QI leaders are not up front about the fiscal agenda
- QI programs do not provide clinicians with the data they need to improve
- QI experts do not emphasize the academic potential of QI research
Unhelpful Clinical and Research Silos

• Berwick: “uncivil” dialog between health services researchers and improvement scientists

• Major Canadian (British Columbia) academic health care and research system with silos of research capability and clinical implementation/research

• Major US integrated health care and research system, often cited as a QI exemplar – same issues

• But, reasons for optimism:
  – Researcher methodologists usually are delighted to be “pulled” into clinical settings where many of them have never been
  – QI science included in the “big tent” of HSR (AcademyHealth)
  – What the Chief of Cardiology at U of Pennsylvania said to me…. (the tide is turning and we are not ready)
How to Make Progress Towards Aligning and Integrating Organizational Quality and Safety Goals and Faculty and Medical Education Activities
In US, This is Urgent Business

- ACGME’s CLER (Clinical Learning Environment Review) and Pathways to Excellence
  - Almost certainly will become a pay-4-performance evaluation framework in due course
- MEDPAC recommendations for GME payment reform
- Institute of Medicine Report: “Graduate Medical Education That Meets the Nation's Health Needs”
  - Measurement framework TBD
  - Insufficient emphasis on interprofessional education and care
  - Transformation/innovation fund describe in vague terms
- Alignment of QI core competencies from medical school to practice (AAMC, Medical Boards/ABMS)
90-Day IHI GME Project* (in Collaboration with ACGME and Harvard Medical School)

- Purpose: to identify and vet innovations that may help teaching hospitals and GME programs become **aligned** and **capable** in quality and safety training and programming
  - **Aligned**: A shared understanding of the strategic aims and core elements of quality and safety in the institution
  - **Capable**: The ability to execute on this shared quality and safety agenda

*With additional funding from the Rx Foundation*
Barriers to Alignment and Capability are Deeply Entrenched

- Disconnect between C-Suite and GME (knowledge, aims, commitment)
- Hospital / medical school silos
- Disregard for trainees/junior doctors as improvers, innovators, and potential cost-savers
  - More likely to be seen as obstacles to institutional improvement
  - Unaided, residents *do* create waste and inefficiency, impact patient perceptions, make errors, increase risk, and erode value
- Discontinuous trainee involvement
  - Projects, M&M rounds, committees rather than ongoing system improvement
  - Scheduling nightmares
  - Episodic involvement in ambulatory settings
More Barriers

• Difficulties in scheduling and implementing essential team-based interprofessional learning and improvement
  – Simulation the default
• Failure to rush improvement expertise to the front line and provide real-time data for improvement
• Lack of faculty trained in point-of-care experiential, inter-professional learning techniques and improvement science methods
• Tortuous promotional pathway and reward structure
"Driver Diagram" for "Engaged, Capable, Motivated" Faculty

Primary Drivers

Career Pathway

Institutional Resources/Infrastructure

Professional Development

Time

Secondary Drivers – Change Ideas

Promotion pathway/metrics for promotion in QI track

Mentors

Respect/prestige

Financial Incentives

Early Career training (fellowships)

Educating the IRB for QI Research

Clear funding streams for QI research

Relevant, evidence-based, integrated curriculum

Allied professional support staff

Institutional Visibility or ROI to leverage investment

Institutional Champion

Access to continuous data and QI/systems engineering expertise

Conferences, lectures

MOC Part 4 link/CMEs

Professional network

Experiential, longitudinal training in QI

Paid % of Salary

Qualified, Capable,
Engaged, &
Motivated
Faculty Teaching
Q&S to residents
Focus on the “Career Pathway” Driver in an Academic Institution

How can a young, motivated improver achieve academic credibility?
My Personal Take on the “Science of Improvement”

• **Scientific regardless of name:**
  - Science of improvement
  - Health care delivery science
  - Implementation science
  - Systems strengthening
  - Systems engineering

• **Scientific methods include**
  - “Model for improvement” promulgated by IHI
  - Lean
  - Six Sigma
  - Lean Six Sigma
The Model for Improvement Simplified

Deming 1900-1993
System of Profound Knowledge

- Appreciation of a System
- Psychology
- Understanding Variation

The Model for Improvement

What are we trying to accomplish?
How will we know that a change is an improvement?
What change can we make that will result in improvement?

Model for Improvement

- Plan
- Act
- Study
- Do

Langley et al 1997

System of Profound Knowledge

- Appreciation of a System
- Psychology
- Understanding Variation

- Theory of Knowledge

What are we trying to accomplish?
How will we know that a change is an improvement?
What change can we make that will result in improvement?
Key Attributes of Improvement Science (Model for Improvement Methodology)

- Clear, measurable aim
- A measurement framework in support of reaching the aim
- Clear description of the ideas (content) and how these ideas are expected to impact results (the causal pathway from changes to desired outcomes, and their attributable effect)
  - Conceptual or logic model, or “driver diagram”
- Clear description of the implementation strategy (execution)
  - What will be done to ensure reliable adoption of the content
- Dedication to rapid testing (PDSA) - prediction and learning from tests
- Understanding/describing/visualizing systems (process map, value stream)
- Learning from variation and heterogeneity
  - Use of time-ordered data to detect special cause and improvement
  - Understanding why results differ by ward, organization, region
- Application of behavioral and social sciences
Why Translational Research Scientists Should be Comfortable With This

- My ten years working with a PhD scientist to develop a staph vaccine…
- Mice and PDSAs
- Keeping a lab book
PDSAs Made Easy

https://www.youtube.com/watch?v=8Q7qnNpTWxM&feature=youtu.be
How to Implement Credible QI Projects…

Without large grants
....By leveraging inter-professional knowledge and skills
....As part of routine work
    while learning and even having fun
....Regardless of (or because of) the job descriptions of team members
Rigorous, Publishable QI Is Possible Almost Anywhere – Without Federal Grants (!)

SQUIRE Guidelines

http://squire-statement.org/
Personal Experience
Baby Steps: Effect of Standard Antibiotic Order Form on Duration of Prophylaxis

Before use of a standard antibiotic order form

After use of a standard antibiotic order form

Durbin et al.  JAMA 1981;246:1796
Leveraging Epidemiology - Impact of Precautions Compliance on Risk of RSV Infection

Figure 1. Rise in Incidence Density of New Nosocomial RSV Infections with Increasing Levels of Exposure to Hospitalized Patients Shedding Virus, per 1000 Patient-Days.

Low compliance period

High compliance periods

If They Can Do It in Bogotá during Civil Conflict with Constrained Resources…

Reducing Post-Caesarian Infections
Endometritis After Cesarean Section

Perioperative antibiotic prophylaxis
- Utilization
  - Agent
  - Dose
  - Timing

Preparation of the skin before surgery
- Skin antisepsis
  - Agent
  - Antiseptic agent
  - Hair Removal
  - Application technique
  - Method
  - Timing

Surgical technique
- Technique
  - Training
  - Skill
  - Complications
  - Extraction of the placenta
    - Type of incision

Peripartum events
- Vaginal exams
  - Technique
  - Number
  - Labor
    - Presence
    - Duration
  - Rupture of membranes
    - Presence
    - Duration
  - Chorioamnionitis
    - Clinical
    - Subclinical

Host & Antenatal Factors
- Preexisting host factors
  - Underlying diseases
  - Nutritional status
- Pregnancy-related conditions
  - Bacterial vaginosis
  - Prenatal care

Underlying diseases
- Presence
- Duration

Bacterial vaginosis
- Presence
- Duration

Chorioamnionitis
- Clinical
- Subclinical
Meta-Analysis the Effect of Antibiotic Prophylaxis on Infection Rates after Cesarean Section

## Priority Matrix

<table>
<thead>
<tr>
<th>Factor</th>
<th>Importance</th>
<th>Within the capacity of hospital personnel to improve</th>
<th>Timeframe for improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic prophylaxis</td>
<td>4</td>
<td>4</td>
<td>short</td>
</tr>
<tr>
<td>Skin preparation</td>
<td>3</td>
<td>4</td>
<td>short</td>
</tr>
<tr>
<td>Surgical technique</td>
<td>4</td>
<td>4</td>
<td>medium</td>
</tr>
<tr>
<td>Antenatal factors</td>
<td>3</td>
<td>1</td>
<td>long</td>
</tr>
<tr>
<td>Peripartum events</td>
<td>4</td>
<td>2</td>
<td>medium</td>
</tr>
</tbody>
</table>
Utilization and Timing of Antibiotic Prophylaxis for Cesarean Section

<table>
<thead>
<tr>
<th></th>
<th>% receiving prophylaxis</th>
<th>% receiving prophylaxis ≤1 hour after delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital A</td>
<td>70%</td>
<td>31%</td>
</tr>
<tr>
<td>Hospital B</td>
<td>32%</td>
<td>70%</td>
</tr>
</tbody>
</table>
Hospital A: Existing System

Plan to perform C/S

Prescribe prophylaxis?

Yes → MD writes prescription

No → MD writes prescription

Antibiotic in L&D or pharmacy?

Yes → Transport antibiotic to patient

No → Yes → MD writes prescription

Family buys antibiotic at pharmacy outside the hospital
Hospital A: Revised System

Plan to perform C/S

MD writes prescription

Nurse puts antibiotic in packet of supplies

Packet transported to operating room with patient

Start → Delivery → Administer antibiotic → End
Utilization and Timing of Perioperative Antibiotic Prophylaxis & Surgical Site Infections After Cesarean Section

Experiential Learning – Making Rigorous QI Part of Routine Work at the Point of Care
Monitoring Patient Safety

- Voluntary event reporting
- Morbidity and mortality conferences/reports
- Chart auditing
  - IHI Global Trigger Tool
- Automated data mining
  - Patient Safety Indicators (AHRQ PSIs)
  - Automated trigger tools
- Random Safety Audit
Random Safety Audit

• Translated from industry (banking and random process audits via Paul Plesk)
• Real time by the front line
• Data and feedback virtually immediate
  – Reliability of key safety processes evident immediately
  – Motivating, enabling, reinforcing; builds self-efficacy and social norms (key elements of behavioral change theory)
• Combines audit and feedback with iterative PDSAs
  – Even better than “what can I try by next Tuesday”
Random Safety Audit

• Systematically monitors a subset of error-prone points in the system that have the potential to harm patients
• Items selected randomly to be addressed either on
  – On multi-disciplinary rounds (provider input required)
  – Any time during day (provider input not needed)
• Deck can be “packed”
• 20 items developed by expert consensus for testing in NICU (21st item added later)
• 4X6 “cards” include yes/no data form; trivia question on back
Staff Perceptions of the Random Safety Audit

- 84% of staff participated in rounds on which audit performed
- 100% agreed or strongly agreed that this improved quality and safety
- 95% agreed/strongly agreed that it increased knowledge of clinical guidelines and safety goals
- 9% agree with statement “asking a safety question of rounds took up too much time”
Three Simple Examples of Interprofessional QI Involving Residents

- Do you know who your doctor is?
- Understanding drug usage and reducing unnecessary prescriptions
- Learning how to look for medical errors as part of routine work
Theory Building, Conceptual Models, Logic Models, and Driver Diagrams
Why Bother?

• Scientific quality improvement requires an explicit theory for achieving a specific goal
  – Theories should be accompanied by a clear statement of the predicted outcome and a measurement framework to guide testing of the theory
  – Interventions should be guided by the predicted causal pathway towards the desired outcome
  – PDSA cycles embody tests of a theory along the causal pathway from promising interventions to the desired outcome
Conceptual Models, Logic Models, and Driver Diagrams All:

- Clarify the theory and inform strategy for achieving outcomes
- Insure that everyone is on the same page
- Provide a framework for measurement
- Inform evaluation, whether internal or external
- Usually are required for competitive grants and contracts
- Allow other organizations or researchers to compare their project/study design to what others have used
Conceptual Models

• Show dynamic interaction of multiple personal and environmental factors
• Generally take a broader theory-based view of a problem than logic models or driver diagrams
• Unlike logic models and driver diagrams, facilitate non-linear display of the interaction of factors that influence an outcome or behavior
• Most commonly used in sociology and behavioral science, but is a staple of health services research and can be adapted for any theory and outcome
Rich Pictures
Planned Care Conceptual Model*

Community

Resources and Policies

Self-Management Support

Health System

Organization of Health Care

Delivery System Design

Decision Support

Clinical Information Systems

Functional and Clinical Outcomes

Informed, Activated Patient

Productive Interactions

Prepared, Proactive Practice Team

* Some note that this is mainly a list of elements that does not show interactions
Driver Diagrams

• Clear, intuitive, visual demonstration of the most highly leveraged interventions and factors that are believed to promote the desired outcome
  – It’s still a theory and predictive model
• Easy to “hang” measures on each key driver
• Promote specificity regarding the impact of specific changes on the key “drivers” and the causal pathway to the desired outcome
• May be useful to construct an “anti-driver” diagram or force field analysis to explicitly call out important barriers along the causal pathway
• Not ideal for showing complexity and interactions
• Ignore “less important” and unmeasured factors in determining the outcome
Aim: An improved system

Primary Drivers

Secondary Drivers

Process Changes

Change 1
Change 2
Change 3

Effect Drives

Cause
Drivers for Weight Loss

Calories In

- Limit daily intake
- Substitute low calorie foods
- Avoid alcohol
- Work out 5 days
- Walk to errands

Calories Out

Primary Drivers

Secondary Drivers

Process Changes

AIM: A New ME!

“Every system is perfectly designed to achieve the results that it gets”

Outcome = Structure + Process

- Track Calories
- Plan Meals
- Drink H2O Not Soda

“Every system is perfectly designed to achieve the results that it gets” - Donabedian
Drivers for Weight Loss

**Primary Drivers**

**Outcome**
- AIM: A New ME!
  - Weight
  - BMI
  - Body Fat
  - Waist size

**Secondary Drivers**
- Calories In
  - Daily calorie count
- Limit daily intake
- Substitute low calorie foods
- Avoid alcohol
- Work out 5 days
- Walk to errands

**Process Changes**
- Track Calories
  - Avg cal/day
- Plan Meals
  - Running calorie total
  - Avg drinks/week
- Drink H2O Not Soda
  - Meals off-plan/week
  - Sodas/week
- % of opportunities used
- Days between workouts

**Measures let us**
- Monitor progress in improving the system
- Identify effective changes
Reducing MRSA Transmission and Infection

Outcomes

P1. Prevention of transmission

O1. Reduce infections from MRSA, VRE and C. difficile by 30%

1. Rate of occurrence of MRSA BSI and HAP per 1000 patient days
2. Rate of occurrence of VRE BSI and UTI per 1000 patient days
3. Percent of patients with C. difficile associated disease

Primary Drivers

P1. Prevention of transmission

S1. Identify patients with ASC

S2. Use contact precautions for colonized or infected patients

S3. Use appropriate room cleaning and disinfection

S4. Use dedicated equipment for colonized and infected patients

S5. Reliable hand hygiene

S6. Comply with all central line bundle components

S7. Comply with all ventilator bundle components

S8. Use decolonization to decrease burden of organisms

Secondary Drivers

- Percent of appropriate patients with admission surveillance culture collected
- Percent of patient encounters with compliance for contact precautions
- Percent of environmental cleanings completed appropriately
- Percent of successful opportunities for appropriate hand hygiene
- Compliance with central line bundle
- Compliance with ventilator bundle

Compliance with all central line bundle components
Always Understand and Plan for “Anti-Drivers”

Always Anticipate and Monitor Unintended Consequences
Ten Tips for Incorporating Rigorous Quality Improvement into Everyday Work

BMJ Qual Saf. 2011 Apr;20 Suppl 1:i69-72
Tip 1

• Select projects that really will make a difference to providers and patients
  – Focus on clinically relevant projects that substantially improve those processes of care that are tightly linked to the outcomes of interest to providers and patients
  – Think of a headline the CEO or CMO would want to feature on the organization’s website
Tip 2

- Set bold, clear, measurable aims and a specific timeline for achieving them
  - Think of fundamental advances that will measurably impact care and outcomes and engage clinical staff
Tip 3

- Assemble a multi-disciplinary team including providers, stakeholders, and methodologists, tailored to the specific aim of the project
  - Be agnostic with respect to disciplines and titles when assigning roles and rewards
  - If publication is anticipated, define roles and authorships very early on
    - Giving appropriate first authorships to non-MDs does not jeopardize publication in leading journals
Tip 4

• Be creative in recruiting experts
  – Behavioral scientists, sociologists, economists, epidemiologists, statisticians, qualitative researchers, and other experts often are looking for opportunities to partner with clinical researchers, especially if there is a prospect of co-authorship
Tip 5

- Adopt the most rigorous study design possible without disrupting routine work unduly
  - Incorporate data collection into usual activities of professional staff (eg: infection control, clinical pharmacists)
Tip 6

- Do everything possible not to sacrifice data quality and completeness
  - Develop simple data collection tools that also simplify and increase reliability of daily work
  - Checklists and standardized order sets are especially useful
Tip 7

• Take advantage of emerging certification requirements for clinical staff and make improvement academically viable
  – MOC requirements can be satisfied by improvement activities (eg: Vermont Oxford’s NICQ collaborative)
  – Morph “good citizen” work, such as CPG development and evaluation, into publications and other CV-worthy work products
Tip 8

- Do not assume that substantial external grant funding is required to perform credible quality improvement work
  - Leverage institutional resources
  - Encourage development of institutional small grant awards for quality improvement
  - Consider support from payers, industry, and professional societies
  - Look for “free” hands, such as graduate students
Tip 9

- Pay careful attention to the ethics of quality improvement work, but try to craft projects that are unlikely to require formal IRB approval
  - Remember
    - Poorly designed projects are unlikely to yield useful knowledge and arguably are not ethical
    - Patients have a right to expect that unexpected consequences will be considered and monitored
Tip 10

- Anticipate publication
  - Apply the SQUIRE guidelines
  - Write a “dummy” abstract and construct “dummy” tables and figures
  - Be clear about authorships
  - Make the most of “negative” studies