Institute for Healthcare Improvement

PEDSnet Scholars Program
Learning Session #4

Improvement Building Blocks for your Fellowship

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Applying Improvement Methods and Tools

- We all want to improve health and healthcare, achieve better outcomes, and reduce harm
- Regardless of whether you are trying to improve adherence to HIV therapy, increase blood pressure screening, or reduce medication errors, you need sound methods to achieve results
- Improvement science uses rigorous methods to improve performance of health and healthcare systems (more on this in a minute)
  - Application of improvement methods is necessary to improve patient safety

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Applying Methods and Tools

- Safety science offers uses rigorous methods to reduce error and harm by:
  - Improving teamwork, communication, and psychological safety
  - Reporting and measuring errors and harms
  - Understanding what happened and why it happened, including consideration of human factors and root cause analysis
  - Improving systems to prevent or mitigate errors in the future by understanding health care delivery systems, improving system reliability, and failure mode and effects analysis and simulation
  - Improving training and performance using simulation training and affordances, such as checklists, clinical pathways, and standing order sets
- Improvement and safety science methods are related and complementary

What Makes Improvement Science a Science?

The scientific method in brief:

- Formulate a testable hypothesis (theory)
- Specify the outcome you expect if your hypothesis is correct
- Perform iterative experiments, collect data, and study results
- Update your confidence or "degree of belief" in your hypothesis
- Implement your idea, revise it, or abandon it based on your experimental results

Look familiar??

- *Scientific Improvement is based on hypothesis (change theory), prediction, iterative learning through experimentation and observation, and action based on analysis of the results*
  - The essence of Plan-Do-Study-Act (PDSA) cycles

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A Personal Take on the Increasingly Confusing Terminology of "Improvement Science"

- Scientific regardless of name:
  - Science of improvement
  - Health care delivery science
  - Implementation science
  - Systems strengthening
  - Systems engineering
  - And now…."Learning Health Systems" journal and society and "Engagement Sciences"
- Scientific methods include
  - "Model for improvement" promulgated by IHI
  - Lean
  - Six Sigma
  - Lean Six Sigma
  - ….And other components of the scientific improvement toolbox

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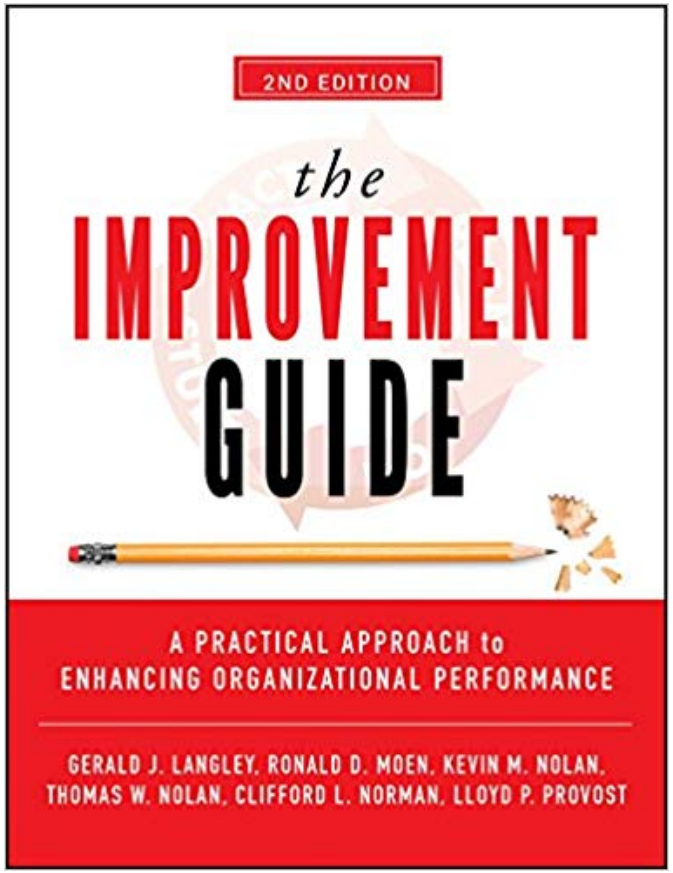
A Practical Methodology: The Model for Improvement

Developed by the Associates for Process



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If you don't have time to read the book….

- It's very important for you to know the improvement science principles in the Open School Improvement Science courses ("QI courses") or the HarvardX Massive Open Online Course (MOOC), *Practical Improvement Science*
- It is equally important to master the safety content in the Open School Courses ("PS courses")
- Today we will focus on *improvement science* and dig deeper into safety science later

http://app.ihi.org/lmsspa/#/6cb1c614-884b-43ef-9abd-d90849f183d4
https://www.edx.org/course/ph556x-practical-improvement-science-harvardx-ph556x

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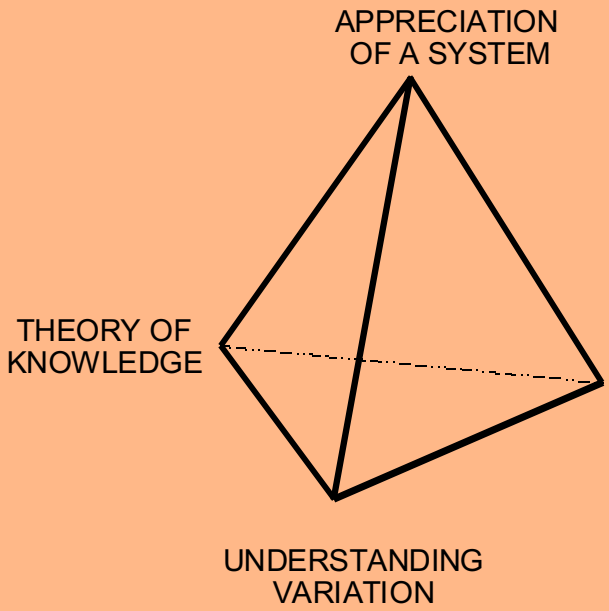
The Model for Improvement Simplified (A 7-Minute Pitch)

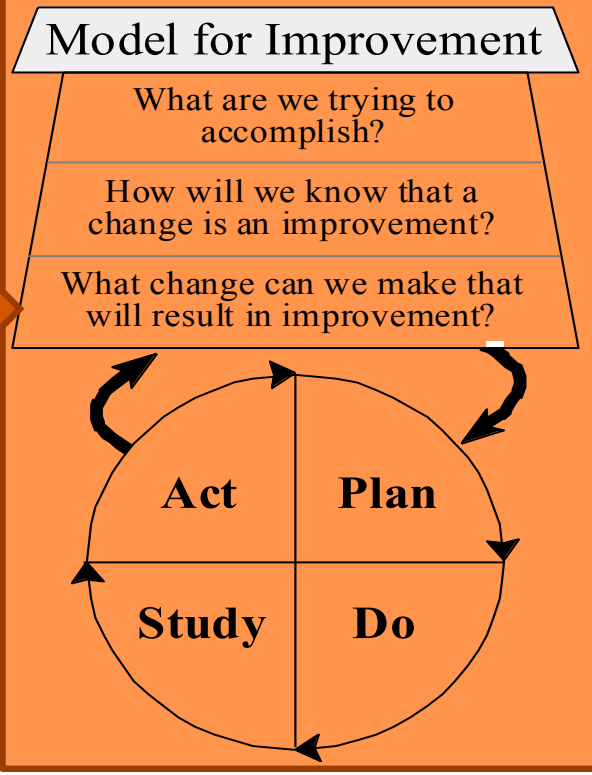
Deming 1900-1993

System of Profound Knowledge



Langley et al 1997

The Model for Improvement



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In Summary

- Specify a clear, measurable aim and state when you hope to achieve it ("*how much by when for whom*")
- Understand the *system* in which you are trying to reach your goal – precisely where it can fail, where there is inefficiency and waste, and where it needs to be improved and monitored
- Be clear about the expected (predicted) *impact* of the changes you are testing on the outcomes you want to achieve (driver diagram or logic model)
- Be clear about your *implementation plan* and the expected outputs of your planned activities
- Learn continuously from *testing* (experimentation) to determine if the changes you predict will lead to improvement *do* lead to improvement
- Use data to *track improvement over time* to see if you are getting closer to achieving your aim and to detect heterogeneity/variation among intervention sites
- Understand how to change *human behavior* (for example, through behavioral economics)

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Implementation Science

- Now the "official" government language in the US
- A widely-used definition:
  - Scientific study of methods to promote uptake of research findings in real work practice settings to improve quality of care and population health (Eccles and Mittman, 2006)

Again, doesn't this look familiar?

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What, if Anything, is Different about Implementation Science?

- Emphasis on implementation outcomes of planned activities and interventions (e.g., fidelity, penetration, sustainability)
- Emphasis on context assessment
  - CFIR (Consolidated Framework for Implementation Science) https://cfirguide.org/
- Generally tends to favor randomized designs and to emphasize behavioral science

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Implementation Outcomes

Acceptability:	Extent to which implementation stakeholders perceive a treatment, service, practice, or innovation to be agreeable, palatable, or satisfactory.
Adoption:	Intention, initial decision, or action to try or employ an innovation or evidence-based practice. Adoption may also be called "uptake."
Appropriateness:	Perceived fit, relevance, or compatibility of the innovation or evidence-based practice for a given practice setting, provider, or consumer; and/or perceived fit of the innovation or evidence-based practice to address a particular issue or problem.
Cost:	Financial impact of an implementation effort. May include costs of treatment delivery, cost of the implementation strategy, and cost of using the service setting.
Feasibility:	Extent to which a new innovation or practice can be successfully used or carried out within a given agency or setting.
Fidelity:	Degree to which an intervention or implementation strategy was delivered as prescribed in the original protocol or as intended by program developers. May include multiple dimensions such as content, process, exposure, and dosage.
Penetration:	Extent to which an innovation or practice is integrated within a service setting and its subsystems.
Sustainability:	Extent to which a recently implemented practice is maintained and/or institutionalized within a service setting's ongoing, stable operations.

[1] Definitions adapted from Proctor et al. (2011) and SIRC Instrument Repository System (http://www.societyforimplementationresearchcollaboration.org/)

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How to Make Academic and Clinical Colleagues Comfortable with Improvement Science

- Remind them it's basically just the experimental method + hefty doses of systems thinking, behavioral science, and insistence on graphic analysis of data over time
- My 10 years working with a PhD scientist to develop a staph vaccine…
  - Mice and PDSAs
  - Keeping a lab book

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If Your Change Idea is an Innovation… Technical Specifications and Core Concepts

- Most innovators are sloppy about documenting the technical specifications of their innovation so that others can understand exactly what is needed to implement the innovation
  - Technical specifications include infrastructure requirements, supply chain, personnel and resources, data systems, and other elements critical for success
  - They should be as parsimonious as possible – more generally is not better (or practical)
- In particular, it is important to document the core concepts which must be implemented with fidelity, *versus* those elements which must be adapted to local contexts and conditions

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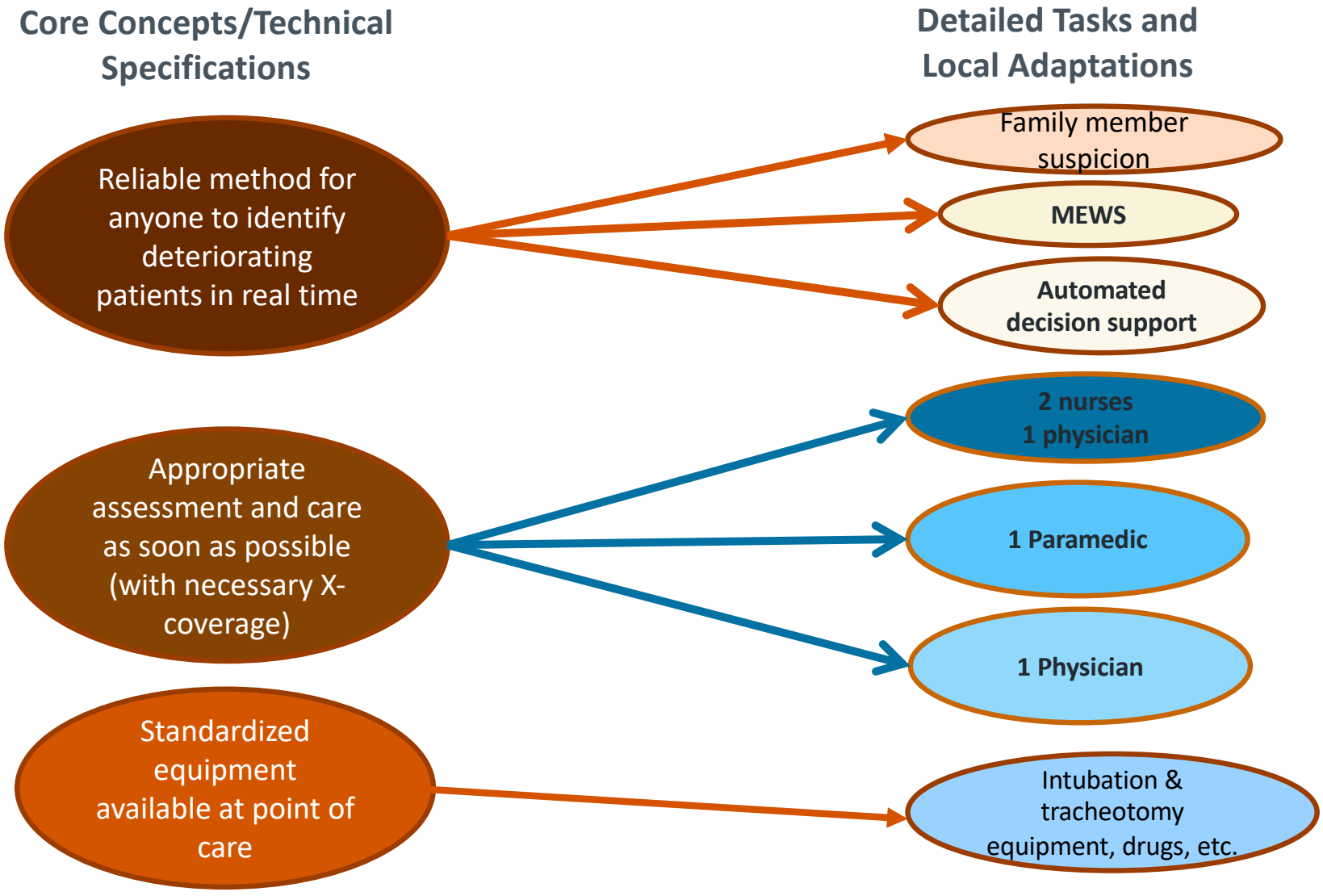
Core Concepts & Detailed Tasks – Bedside Recognition of Deteriorating Patient



Key Elements of Your Project

- Aim Statement (Preferably measurable: how much, by when, for whom)
  - Avoid multiple aims or specify primary and secondary aims
- Theory (hypothesis)
  - Be sure you can explain the causal chain between the changes you think will work and the outcomes you hope to achieve
- Opportunity Statement
- Charter (including roles and responsibilities of the each team member)
- Driver diagram and key changes embedded in the diagram
- Implementation plan

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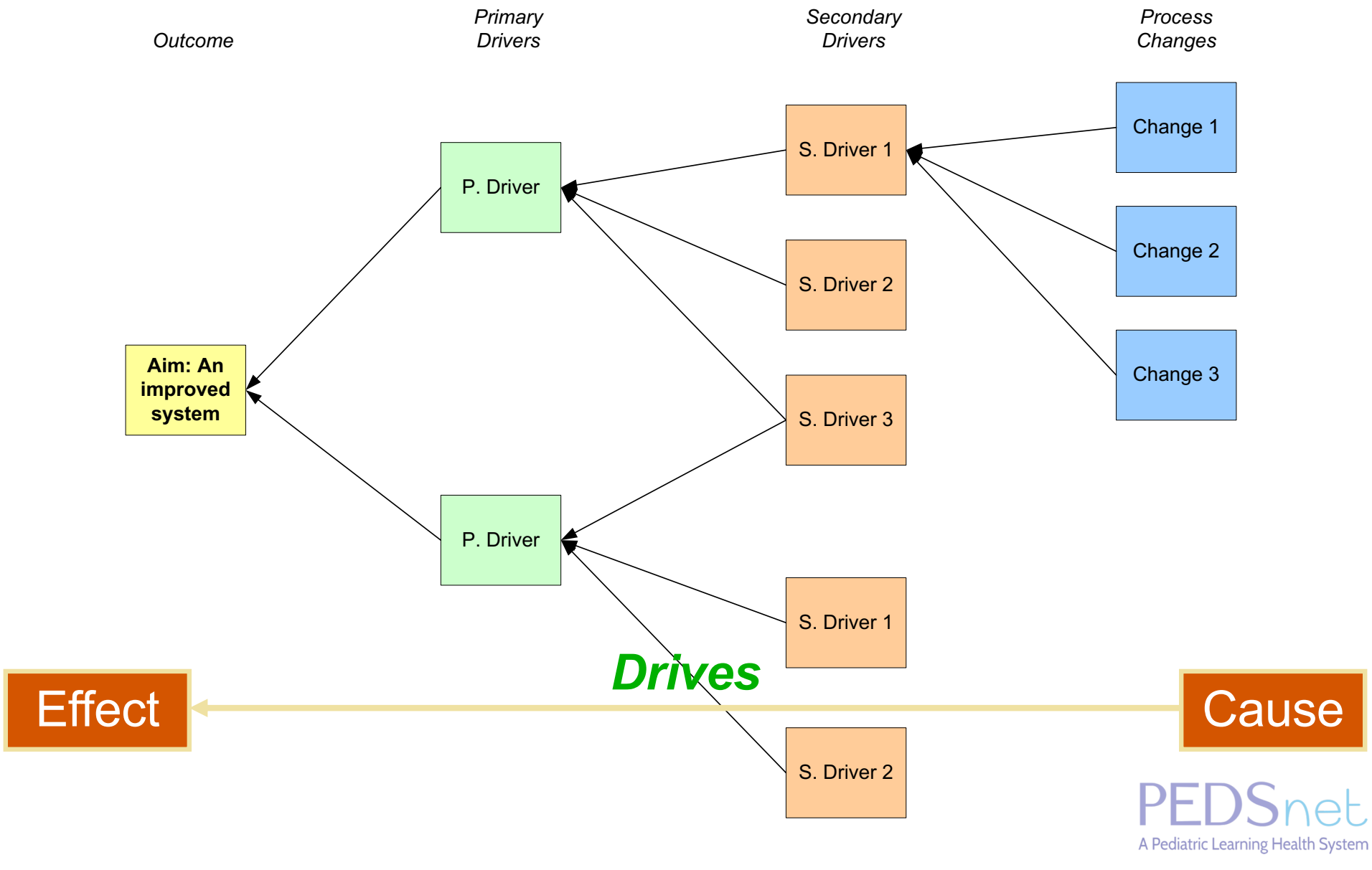
Driver Diagrams

- Clear, intuitive, visual demonstration of the most highly leveraged interventions and factors that are believed to promote the desired outcome
  - For example: Improved screening for hypertension → BP medication → BP control → Long term reduced AMI and stroke
  - It's still a theory and predictive model
- Easy to "hang" measures on each key driver
- Promotes 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

Cause-Effect Driver Diagram



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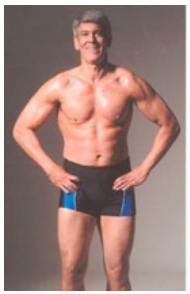
Understanding the System for Losing Weight



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

Outcome = Structure + Process
-Donabedian

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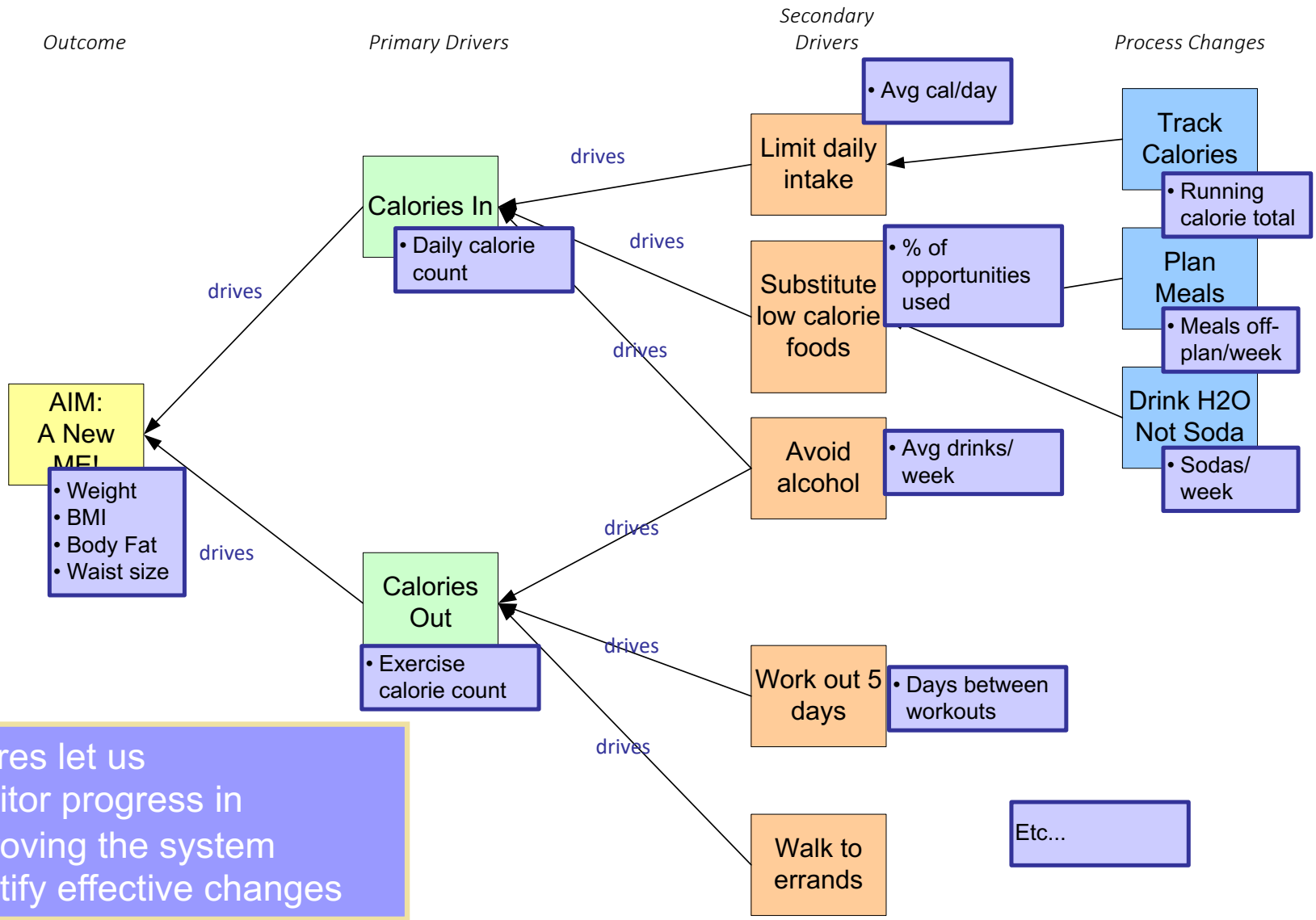
How Will We Know We Are Improving?

Measurement Framework for Losing Weight



Measures let us
- Monitor progress in improving the system
- Identify effective changes

What about a Longer Term Strategic Personal Driver Diagram?

- Specify your long term personal *or* professional goal
  - Not every personal goal is about achieving a “position”
- Identify key drivers that you think you will need to attend to in order to reach your goal
  - Where are you comfortable and just need to monitor the processes that will lead to improvement
  - Where so you see a gap that will require new learning and even innovation
    - How will you fill these gaps?

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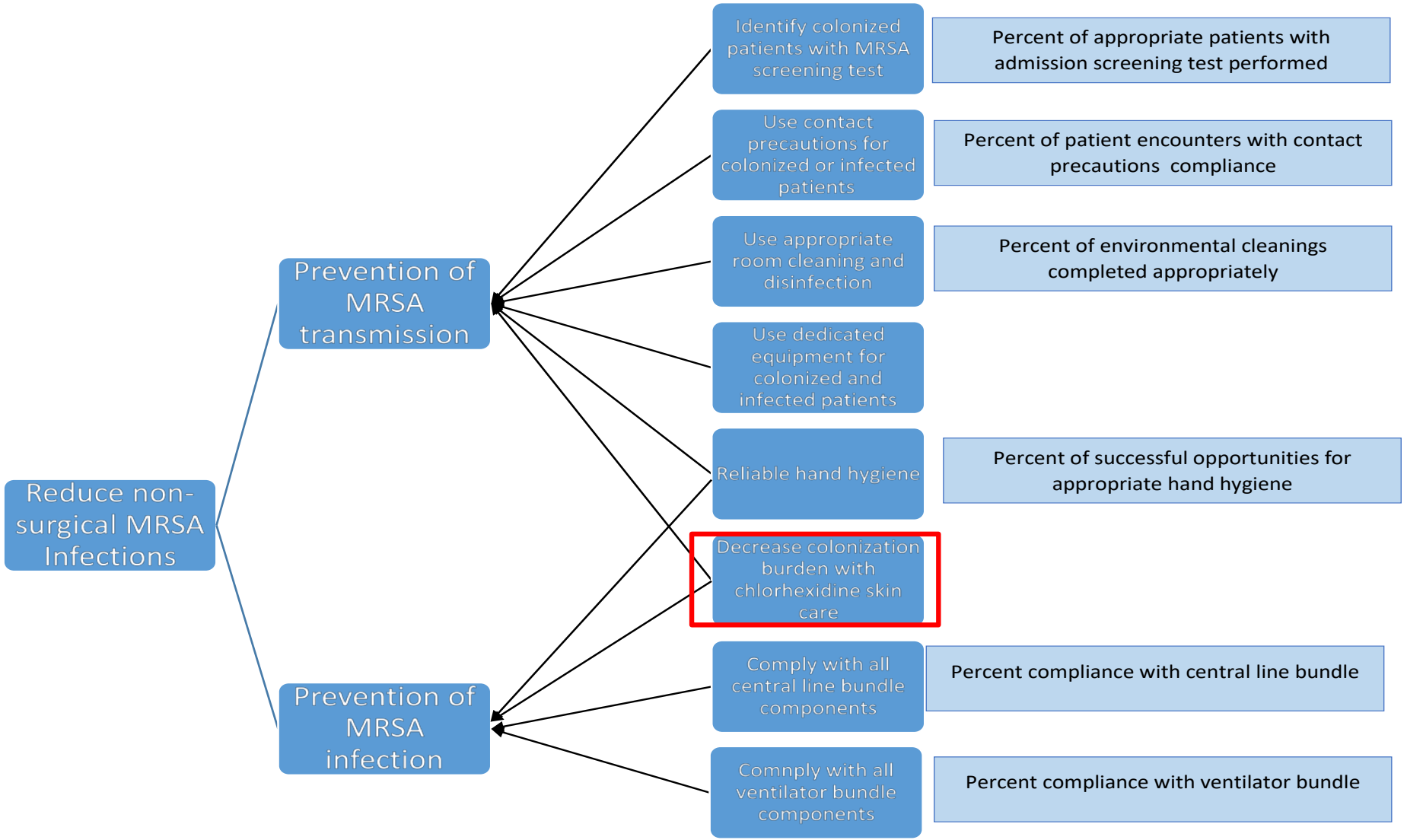
MRSA Control Driver Diagram



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A Caution about PDSA cycles

- It's not just "what can I test by next Tuesday"

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Personal Journey

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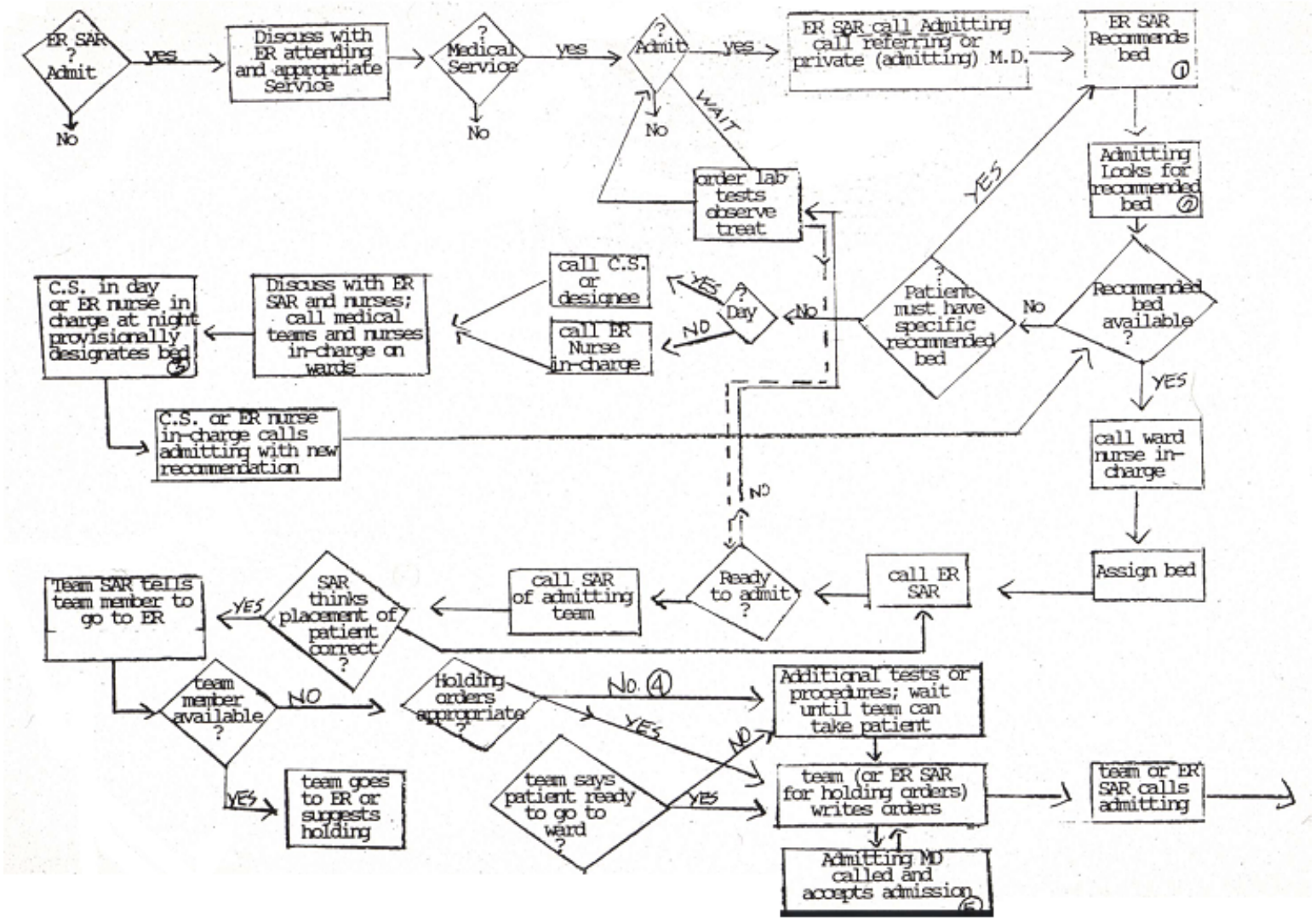
My First Quality Improvement Assignment at Boston Children's Hospital – "Fix the Emergency Department Admissions Problem!



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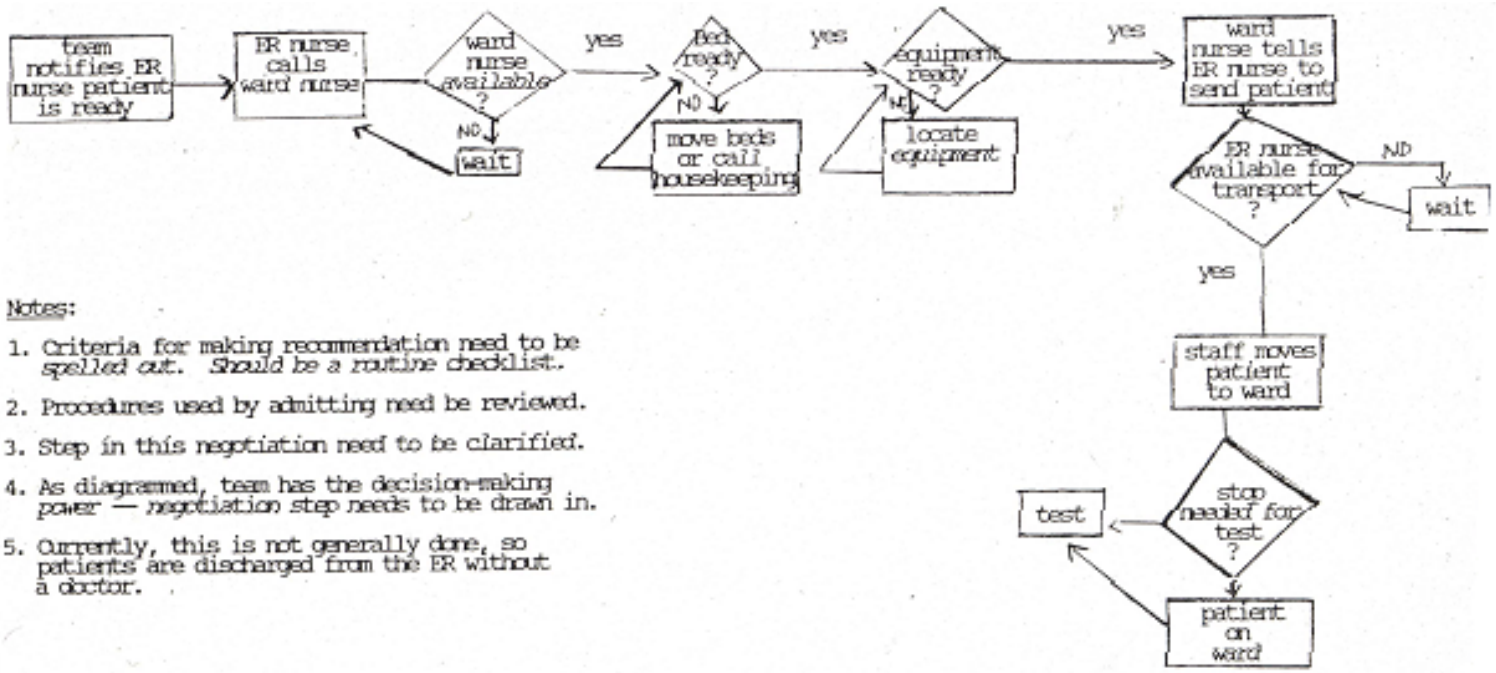

Notes:

1. Criteria for making recommendation need to be *spelled out. Should be a routine* checklist.
2. Procedures used by admitting need be reviewed.
3. Step in this negotiation need to be clarified.
4. As diagrammed, team has the decision-making power — negotiation step needs to be drawn in.
5. Currently, this is not generally done, so patients are discharged from the ER without a doctor.

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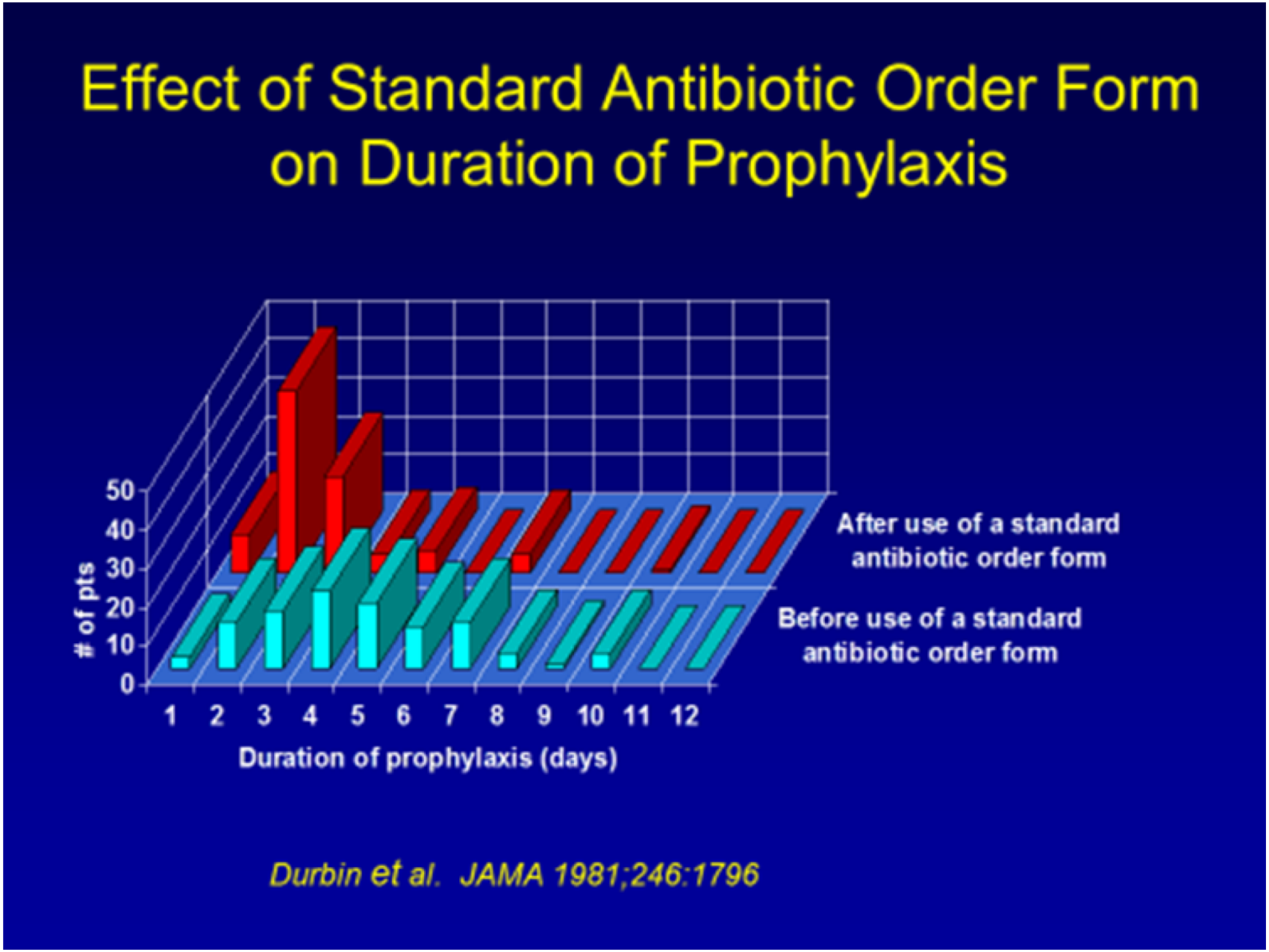

A simple before-after study without comparison group + a terrible graph

Four Simple Examples of Interprofessional QI Involving Trainees

- Do you know who your doctor is?
- Understanding drug usage and reducing unnecessary prescriptions
  - —A million $ discovery by the medical residents
- Learning how to look for medical errors as part of routine work
- “He’s always late for rounds”

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Personal Improvement Projects

- Sometimes the system needs major change, not tinkering
  - “Watching the tele…”
- PDSA tests made simple – how to grow cucumbers

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https://youtu.be/MSHO0BiQX2M

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

Reducing Post-Caesarian Infections

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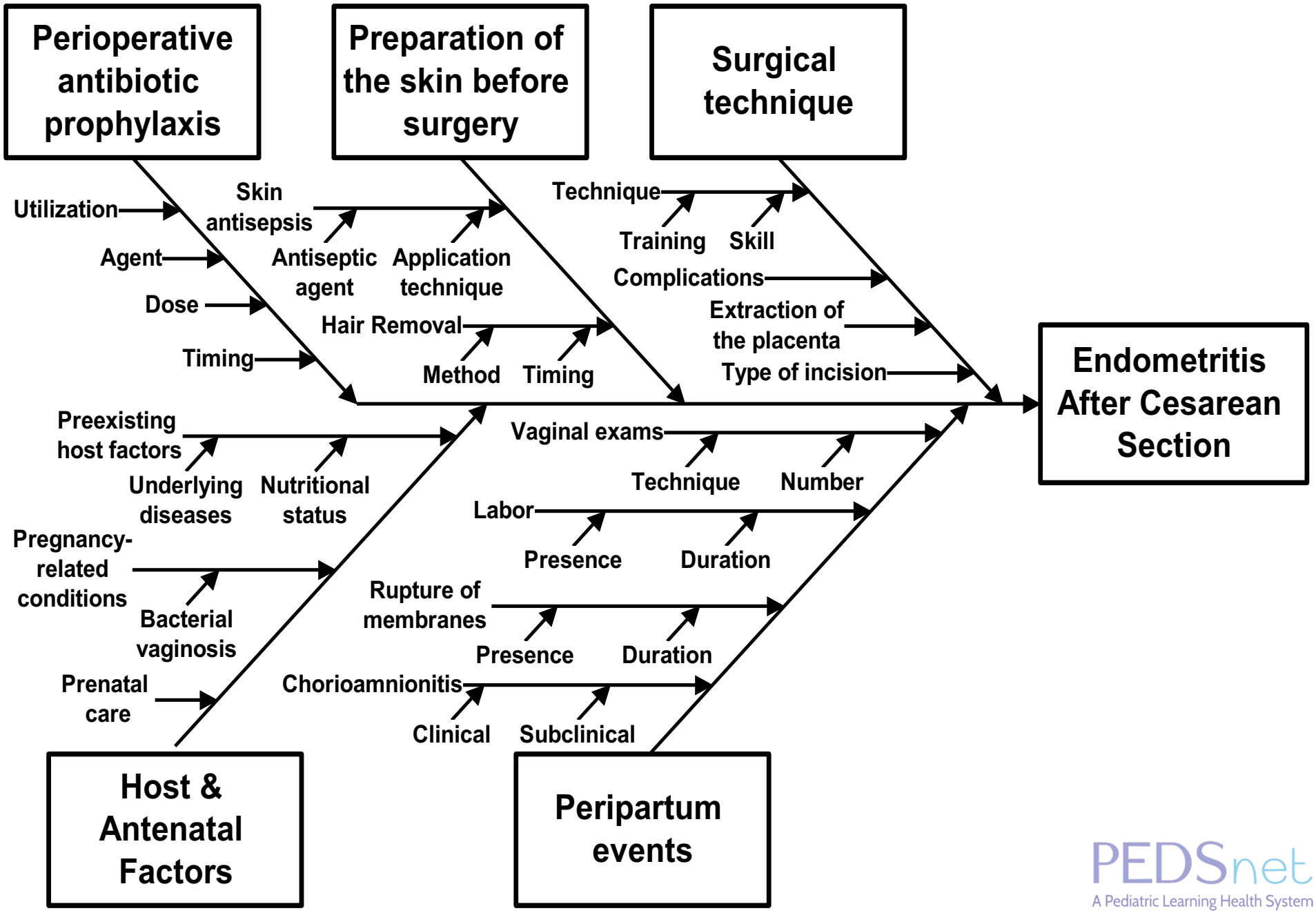
Cause and Effect Diagram



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Cause and Effect Diagrams v. Driver Diagrams

- A cause and effect diagram forms the basis for a driver diagram showing the main interventions that are necessary to achieve the desired outcome – the "causal pathway" to results.
- But where do you start? How do you sequence your improvement projects?

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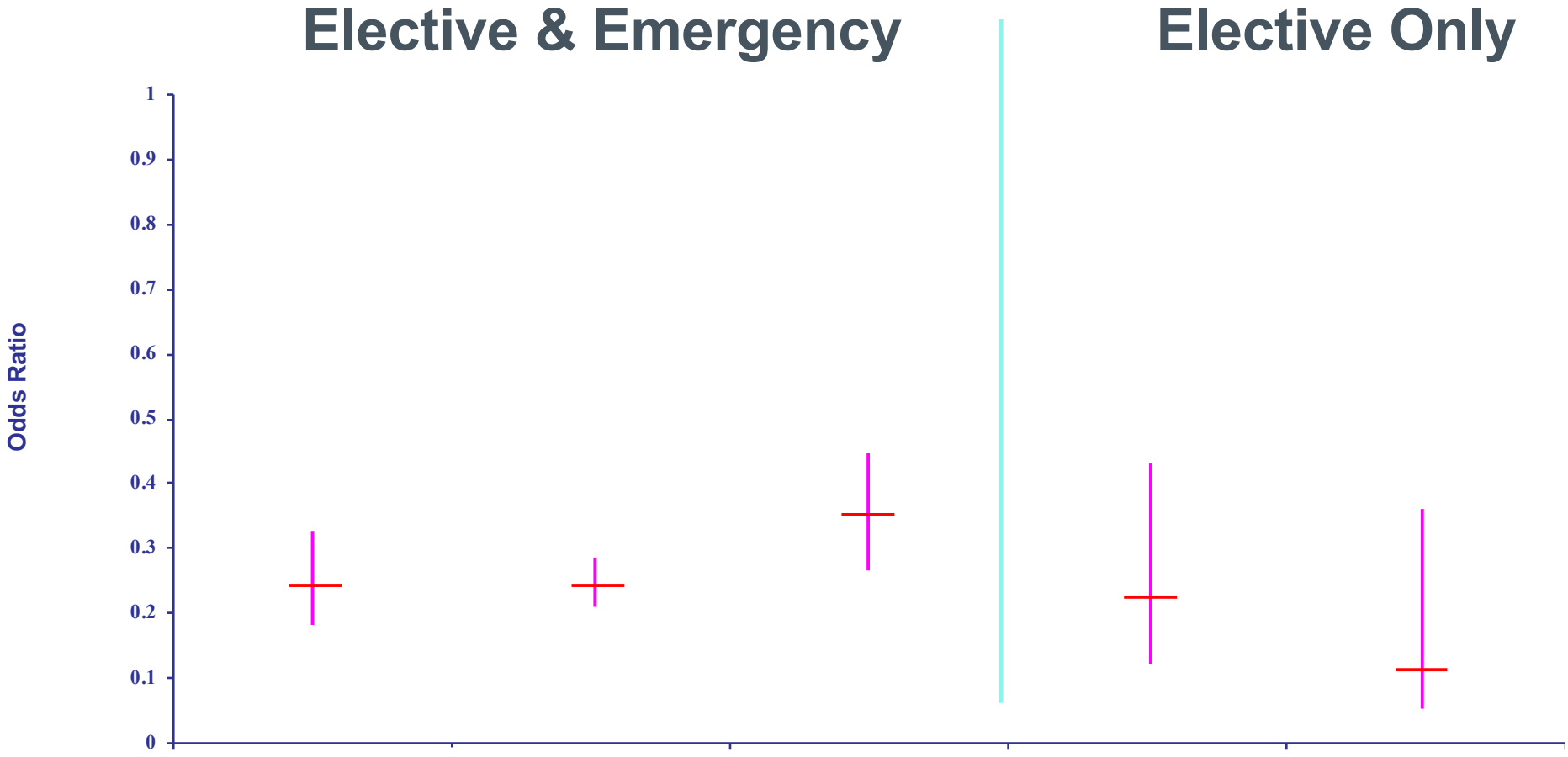
Meta-Analysis the Effect of Antibiotic Prophylaxis on Infection Rates after Cesarean Section



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Priority Matrix

Factor	Impact	Within "Span of Control"	Ease of Implementation	Cost	Timeframe (short)
Antibiotic prophylaxis	4	4	4	3	4
Skin preparation	3	4	4	4	4
Surgical technique	3	4	3	4	3
Peripartum care	4	3	2	3	3
Antenatal factors	3	1	1	2	1

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How to Choose Kale Seeds

Scale:
4 = Best
1 = Worst

	Dinosaur Kale	Dwarf Blue Kale	Red Russian Kale	Meadow Lark Kale
Heirloom	2	1	4	4
Flavor	4	2	4	2
Pest Resistance	3	4	2	4
Space	3	4	2	2
Time to Harvest	3	4	4	2
Heat Tolerance	4	3	3	2
Cost	4	4	3	3
	23	22	22	19

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Utilization and Timing of Antibiotic Prophylaxis for Cesarean Section

	% receiving prophylaxis	% receiving prophylaxis ≤1 hour after delivery
Hospital A	70%	31%
Hospital B	32%	70%

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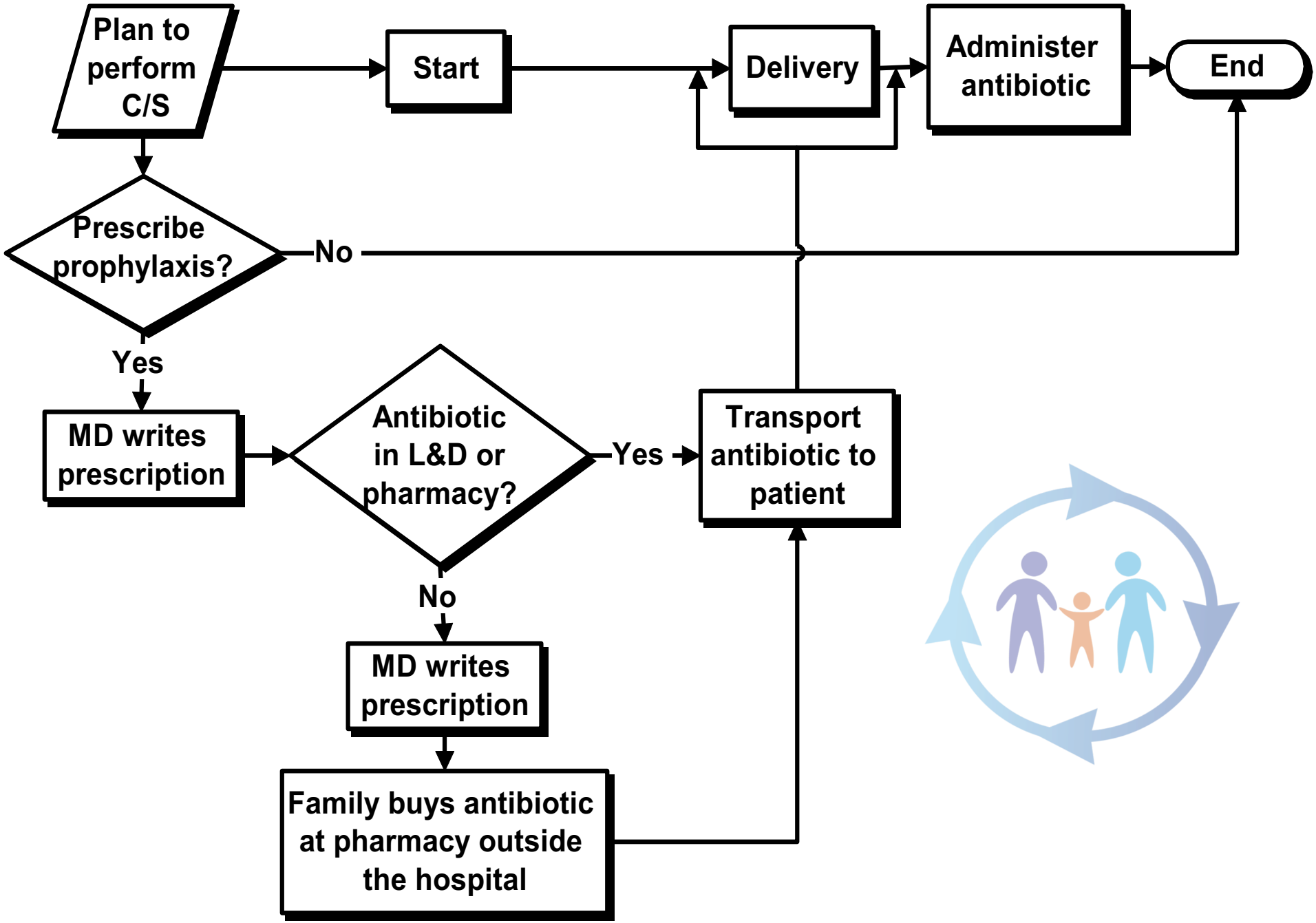
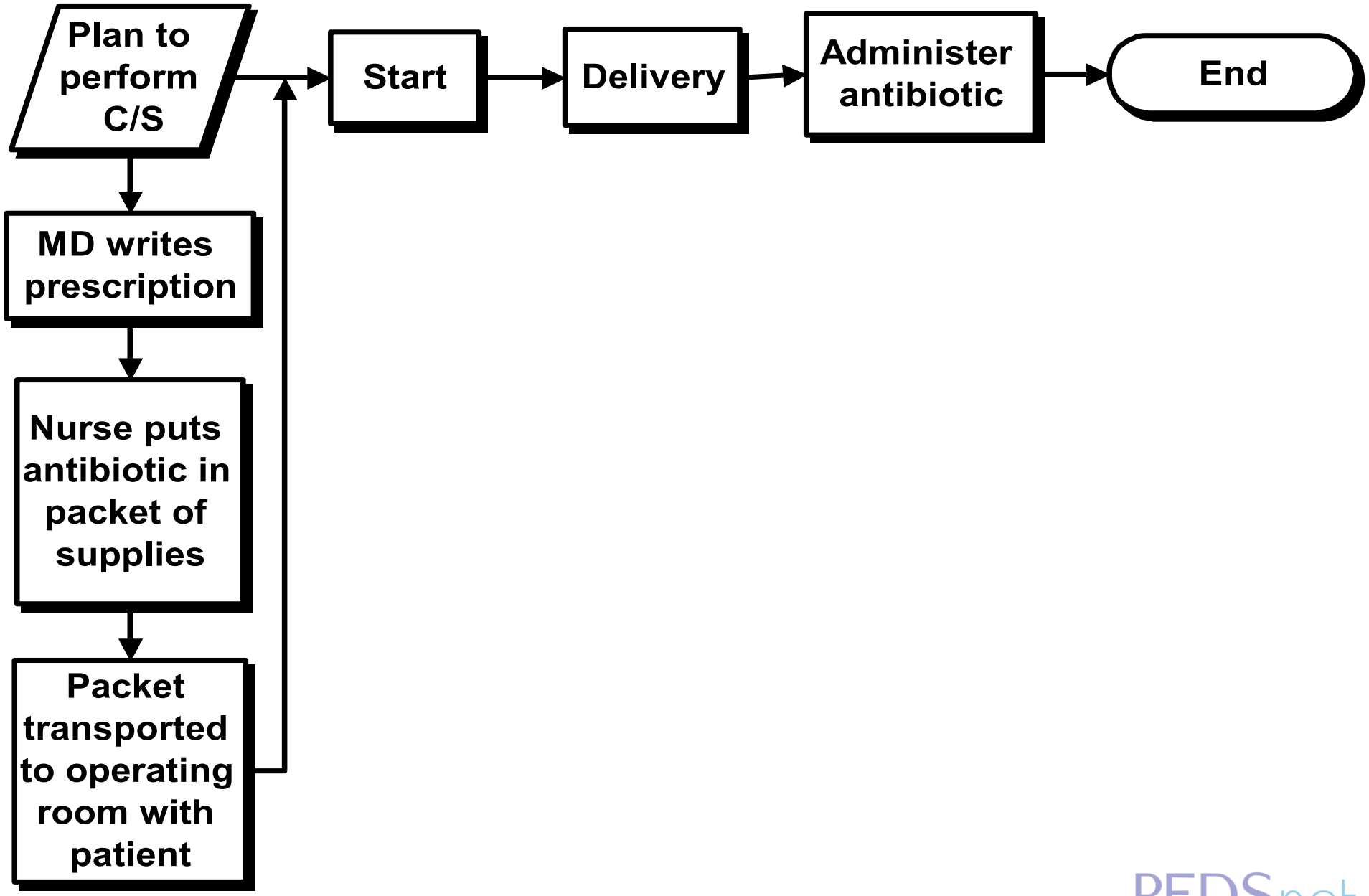
Hospital A: Existing System



Hospital A: Revised System



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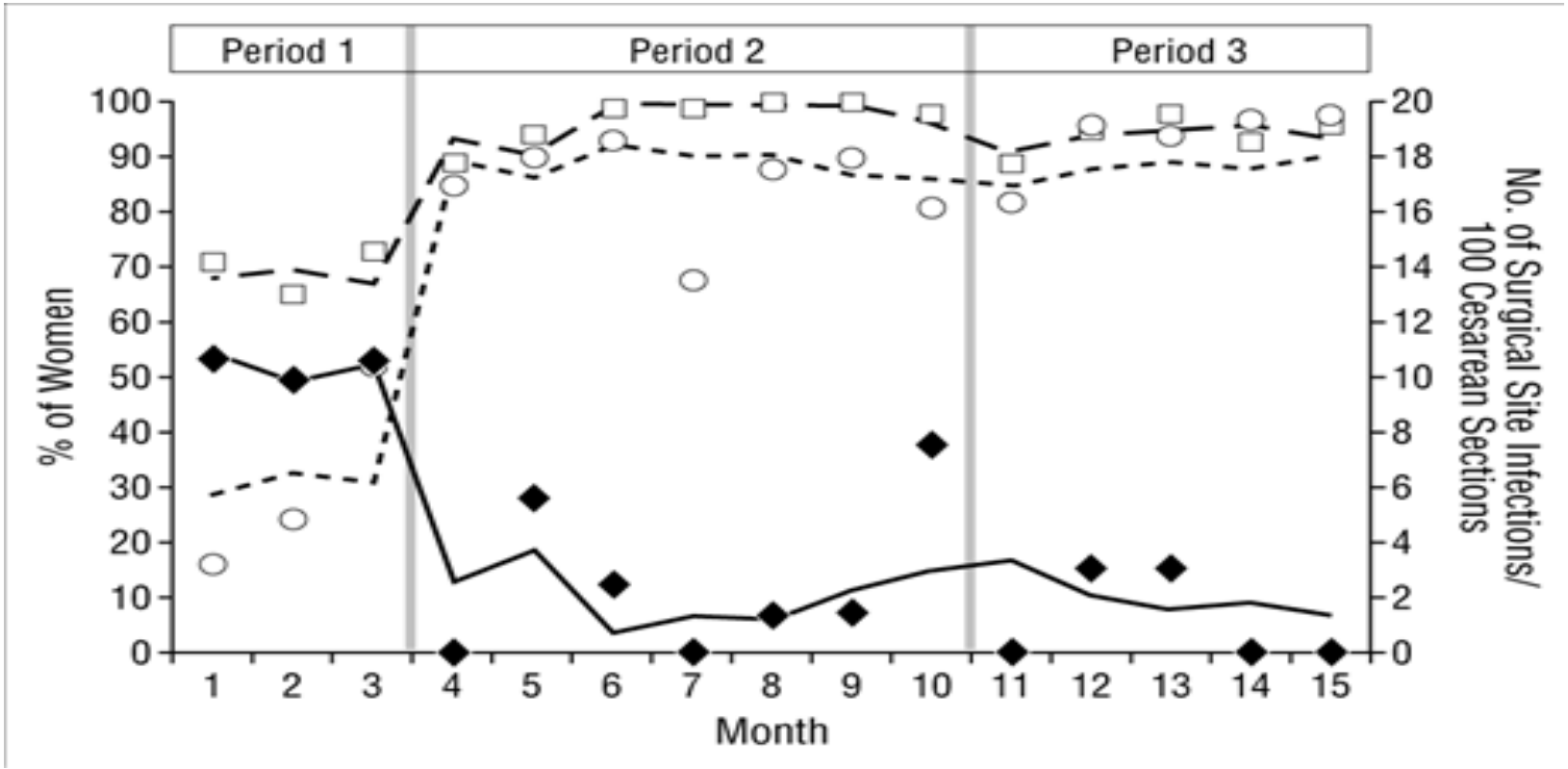
Utilization and Timing of Perioperative Antibiotic Prophylaxis & Surgical Site Infection Rate, Hospital B



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

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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

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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”

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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 multi-disciplinary rounds *(provider input required)*
  - At any time during the 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

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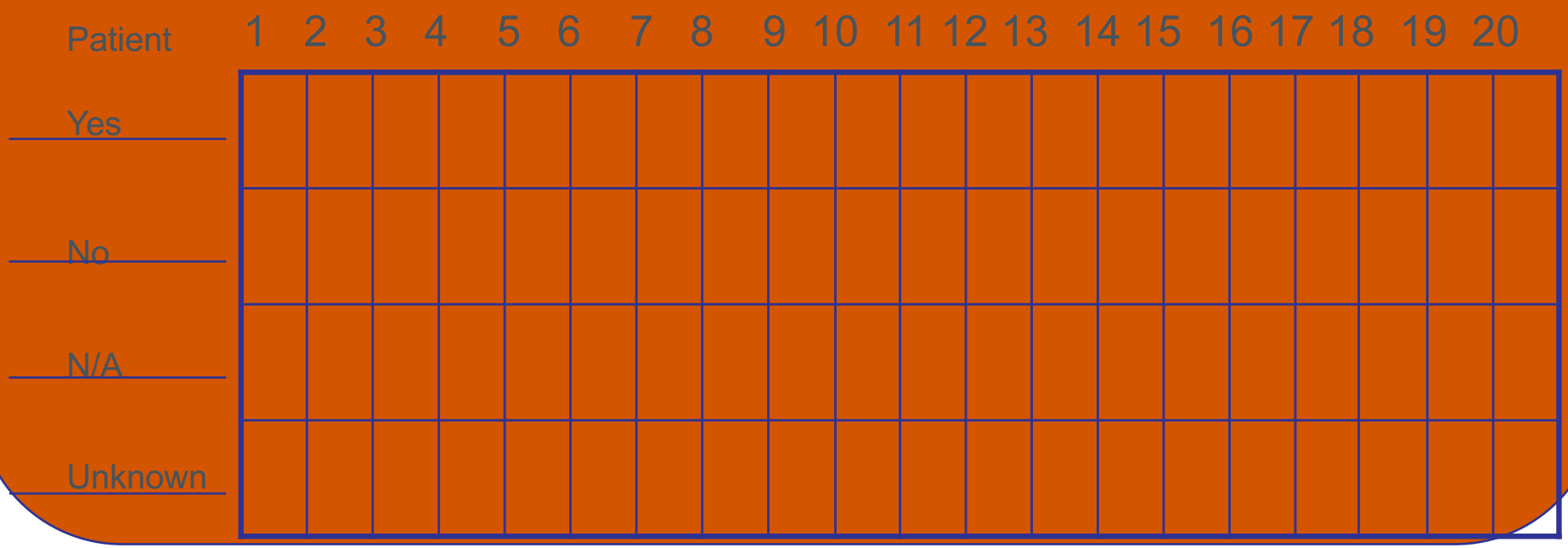
Data Recording Card

Audit infants receiving TPN:
Is the patient currently receiving more than 120 mL/kg/day of enteral feedings?



Notes

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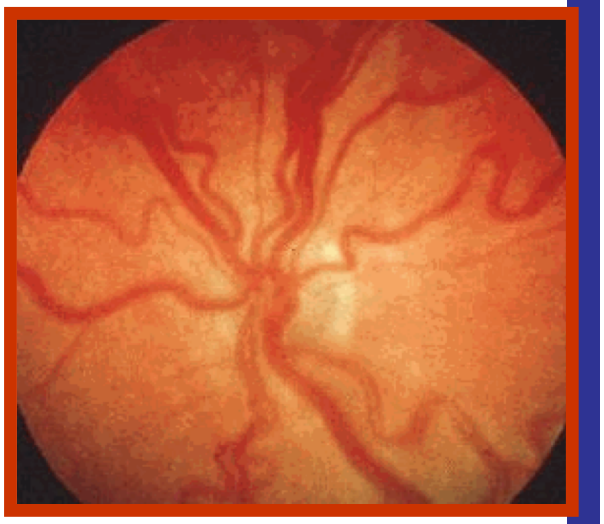
Inappropriate Pulse-Oximeter Alarm Settings

42% of premature babies with high oxygen saturation alarm settings of ≥98%



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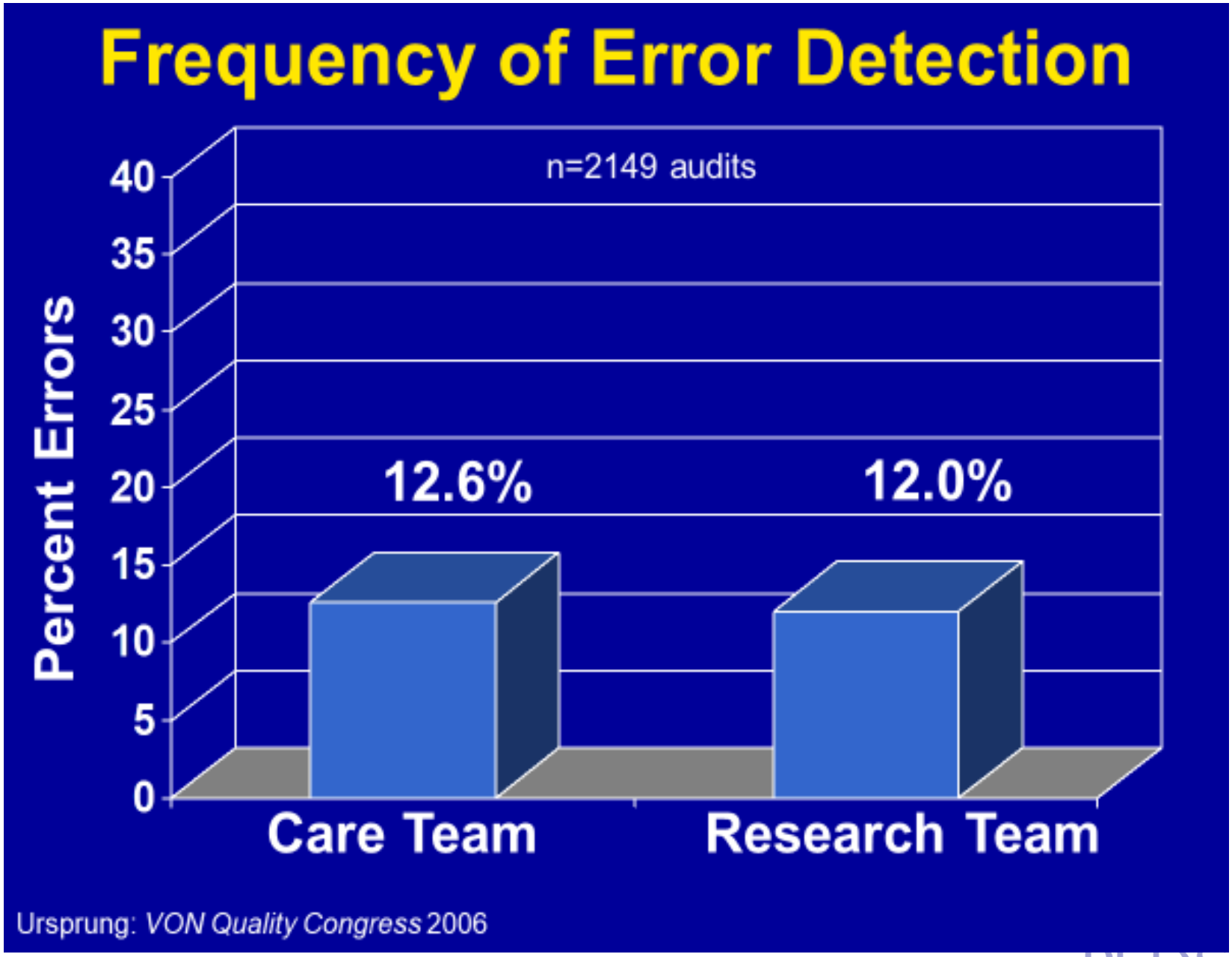

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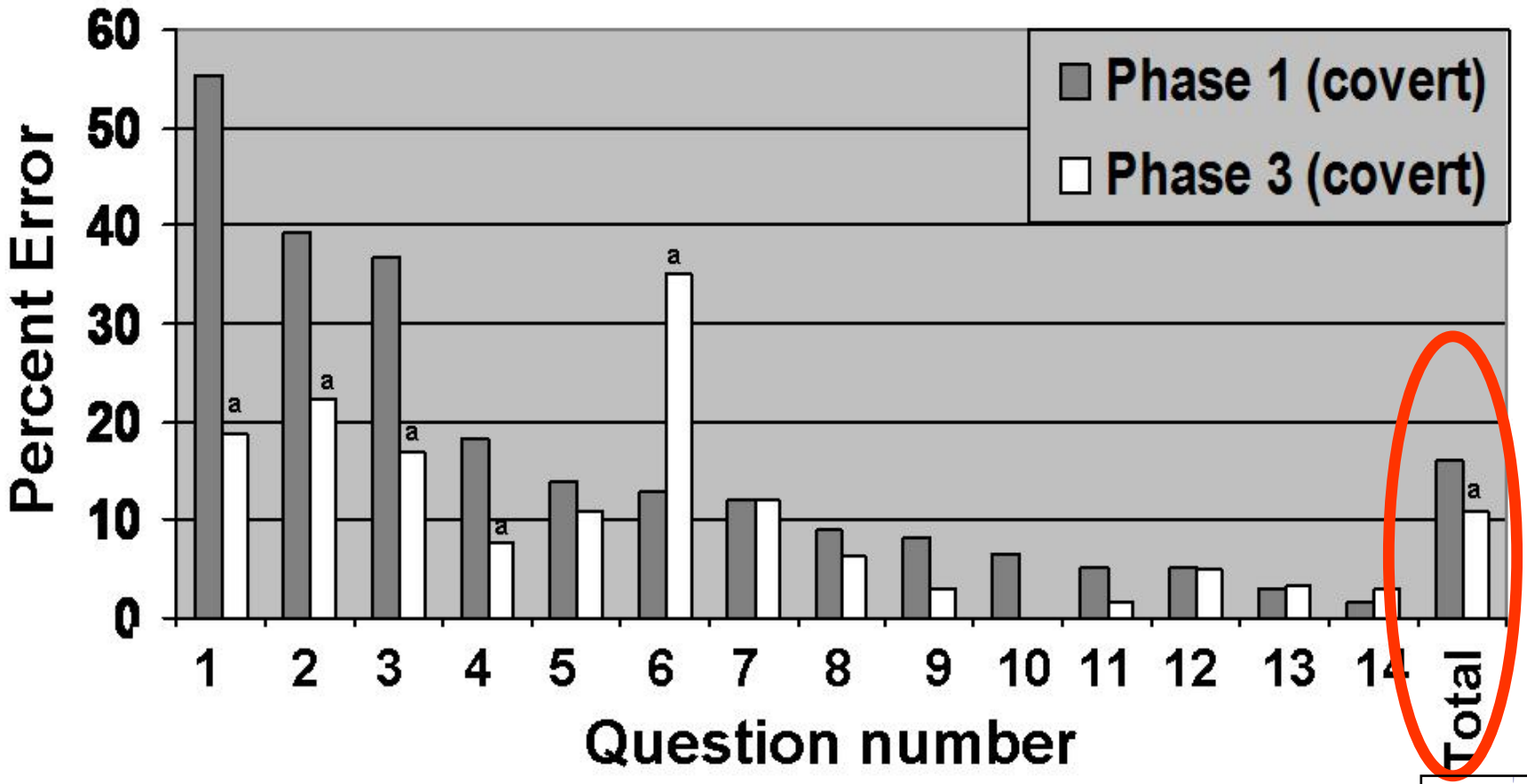
Errors Decreased Over Time
Phase 1 vs Phase 3

FIGURE 2

Group I items: Frequency of error detection during Phase 1 (covert) and Phase 3 (covert) auditing

[a] P<0.05



a: P < 0.05

Ursprung: *VON Quality Congress* 2006

Staff Perceptions of the Random Safety Audit

- 84% of staff participated in rounds on which audit was performed
- 100% agreed or strongly agreed that this improved quality and safety
- 95% agreed or strongly agreed that it increased knowledge of clinical guidelines and safety goals
- 9% agreed with the statement “asking a safety question of rounds took up too much time”

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Even 3rd-5th Grade Students Can Be Engaged

- Sandora TJ, Shih MC, Goldmann DA. Pediatrics. 2008 121:e1555-62. *Reducing absenteeism from gastrointestinal and respiratory illness in elementary school students: a randomized, controlled trial of an infection-control intervention*.
- Young students can make their own run charts and do tests of change…as in a school improvement project in Chile related to nutrition and obesity..

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