Quality Improvement:

Common Tools & Reliability of Interventions

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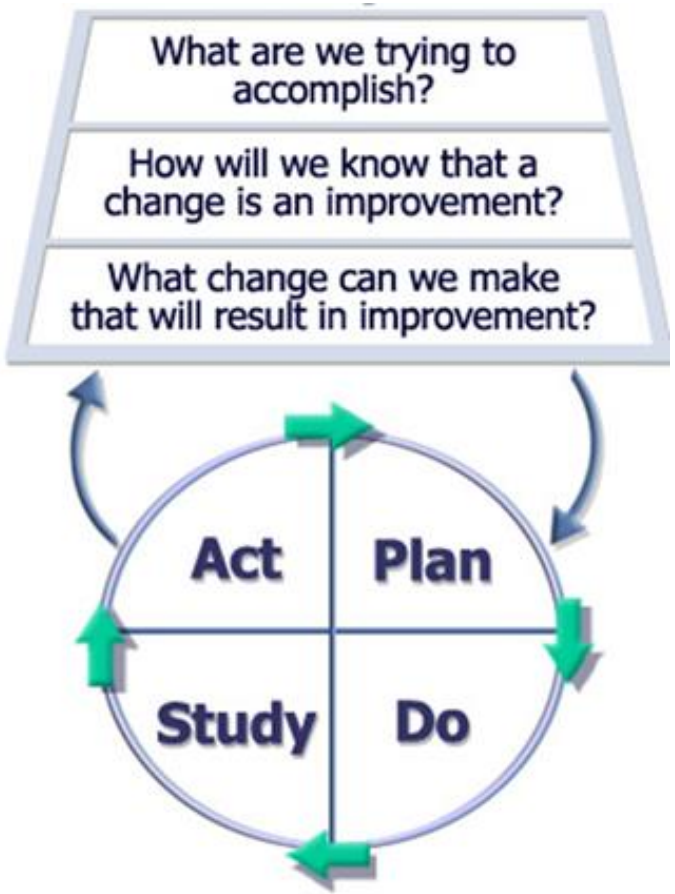
Agenda

- Brief overview of QI methodology
- Reliability of Interventions
- Common QI Tool - Driver Diagrams

Quality Improvement Methodology



Institute *for* Healthcare Improvement

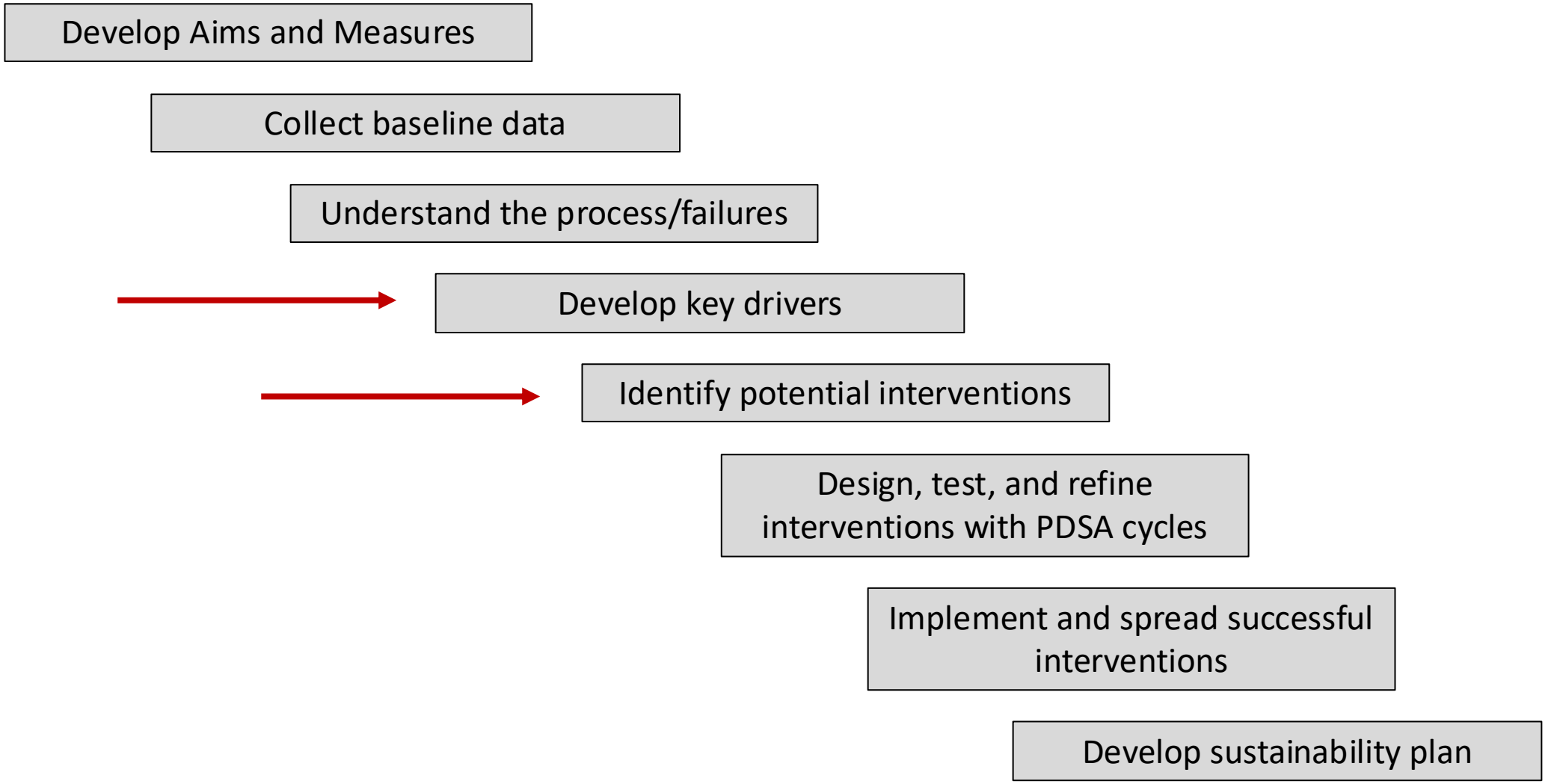
Quality Improvement Methodology

Aims and Measures

Following Data

Iterative Testing

Quality Improvement Roadmap



Reliability

- Ability of an object to perform its intended function
  - Under certain conditions
  - For a specified time period
  - “Failure free operation over time”

Nolan T, Resar R, Haraden C, Griffin FA. *Improving the Reliability of Health Care.* IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement; 2004. (Available at ihi.org)

Reliability in Health Care

- Effective – use of evidence-based practice
- Safe
- Timely
- Patient Centered

} Consistently over time

Nolan T, Resar R, Haraden C, Griffin FA. *Improving the Reliability of Health Care.* IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement; 2004. (Available at ihi.org)

Lenk MA, LaMantia S, Oehler J, Spencer D, Sosa T. Methods to Increase Reliability in Quality Improvement Projects. *Hosp Pediatr*. 2024;14(8):e372-e377. doi:10.1542/hpeds.2023-007340

Reliability

$$\text{Reliability} = \frac{\text{Number of actions that achieve the intended result}}{\text{Total number of actions taken}}$$

$$\text{Reliability of OCC} = \frac{\text{7 deliveries with optimal cord clamping}}{\text{10 total deliveries}}$$

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Levels of Reliability

- Chaos: Failure > 20% of all opportunities
- Level 1: (10^{-1}) 80-90% reliability
  1-2 failures per 10 opportunities
- Level 2: (10^{-2}) ~95% reliability
  <5 failures out of 100 opportunities
- Level 3: (10^{-3}) ~99.5% reliability
  <5 failures out of 1000 opportunities
- Level 4: (10^{-4}) ~99.95% reliability
- Level 5: (10^{-5}) ~99.995% reliability

Reliability of Interventions

- Chaos: “Natural” state
- Level 1: Personal commitment
  - Intent, vigilance, and hard work
- Level 2: System design
  - Human factors engineering concepts
- Level 3: Behavioral system design
  - High reliability organization concepts
- Level 4: Automation
- Level 5: Increasing automation

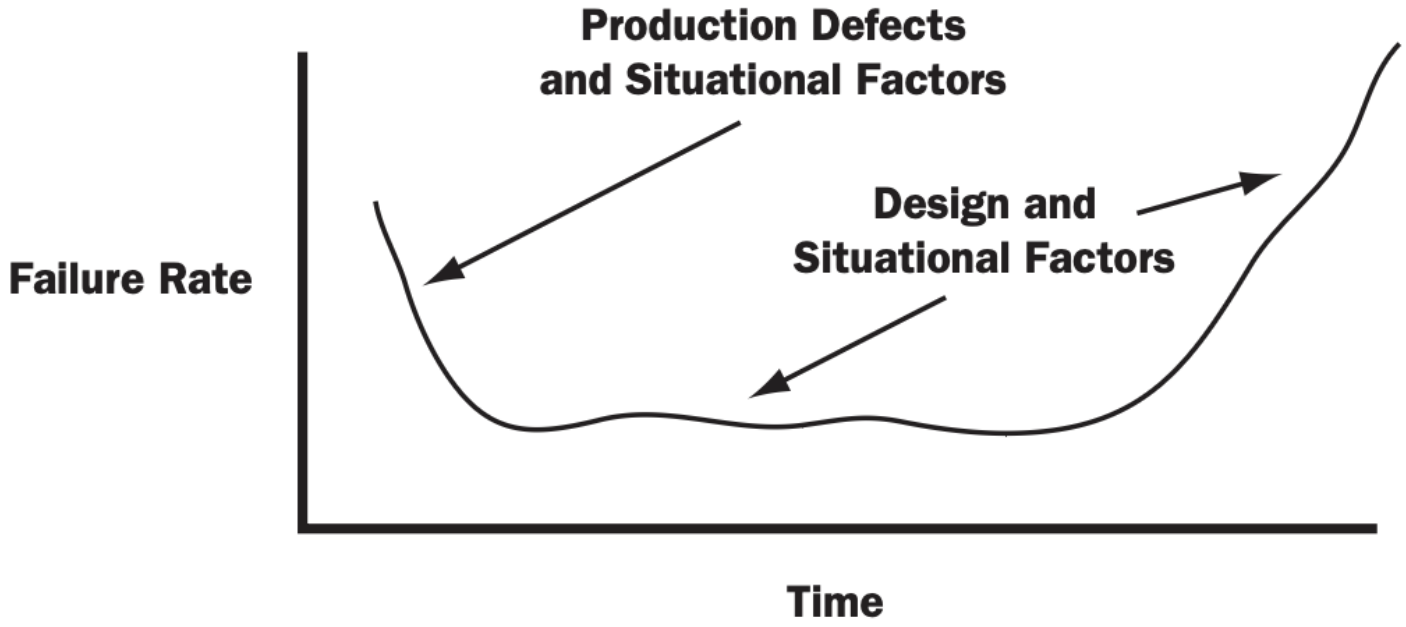
Level 1 – Vigilance and Hard Work (80-90%)

- Awareness and Training
  - Emails
  - Signs
  - Education
- Feedback mechanisms regarding compliance
- Memory aides
  - Checklists
- Basic standardization (ex: room standardization, equipment)

A start but not enough!

Bathtub curve

Figure 1. The “Bathtub” Curve



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Level 2 – System design (95%)

- Error proofing the system
- How do I make the individual behavior change easier for the end user?
- How do I make the unwanted behavior harder for the end user to do?

Human Factors Engineering

- Investigates and applies human behavior, abilities, limitations and other characteristics to the design of products and systems.
- Focuses on usability

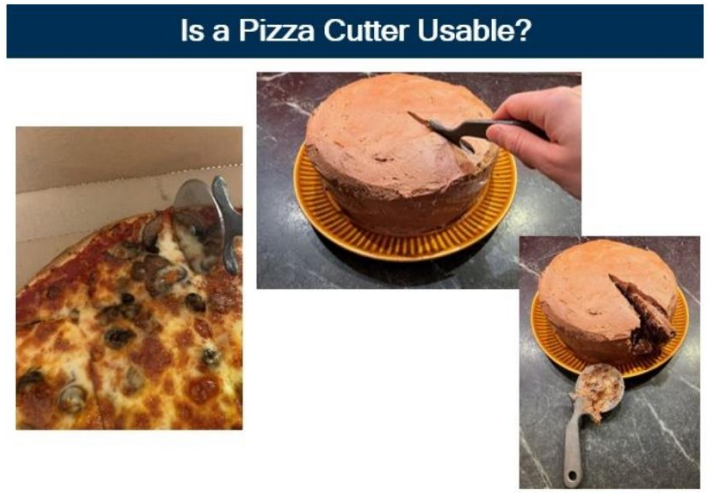
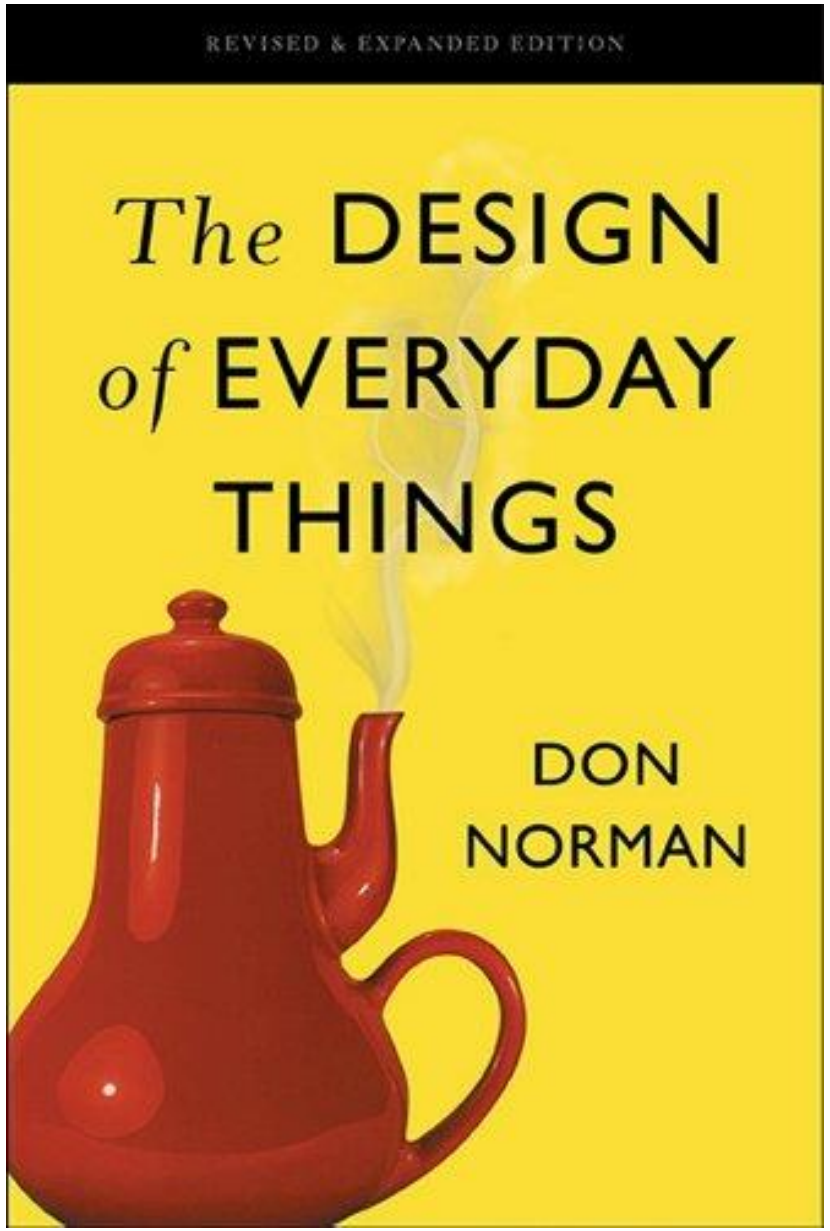


Figure 1: Everyday example of importance of context of use for usability. The pizza cutter may be highly usable in one setting (slicing pizza) but not very usable in another (slicing a layer cake).

Fuller, H., Adams, K., Achee, T., Arnold, T. (2024). Incorporating Human Factors Methods into Healthcare Process Improvement Work. In: Jay Kalra (eds) Healthcare and Medical Devices. AHFE (2024) International Conference. AHFE Open Access, vol 130. AHFE International, USA.


REVISED & EXPANDED EDITION
The DESIGN of EVERYDAY THINGS
DON NORMAN

Level 2 – System design (95%)

Creating intentional redundancy

- 2-person check of high-risk medications and breastmilk
  - PLUS required documentation in EHR
- Bar code scanning of medications

Level 2 – System design (95%)

Decision aids/reminders <u>built into the system</u>

- Differ from Level 1 reminders
- Must understand the workflow and place information at critical point in workflow

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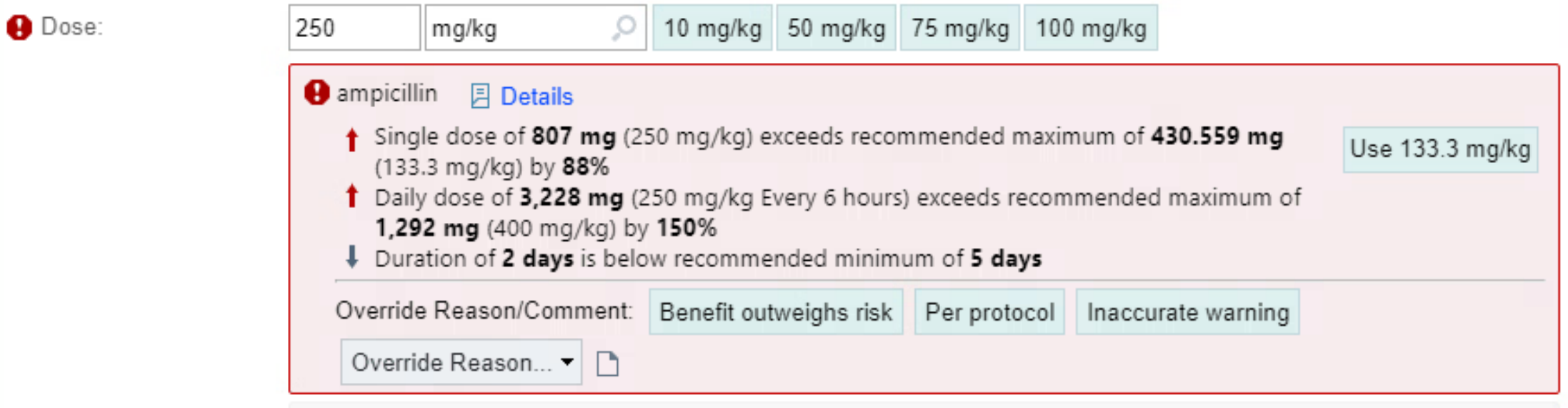
Alerts & Best Practice Advisories (BPA)



Level 2 – System design (95%)

Differentiation (by color or shape, etc.)

Level 2 – System design (95%)

Differentiation (by color or shape, etc.)

The Joint Commission Journal on Quality and Patient Safety

Labeled Problem Areas in Current Medication Trays

Figure 2. *Problems A–E are identified by location in the current medication trays (also available in color in online article).*

Labeled Solution Areas in Prototype Medication Trays

A. Spice rack vial slots
B. Flexible vial slots
C. Asymmetric tray sizes (5S control error-proofing)
D. Medicines placement order (frequency of use principle)
E. Left-side tray compartmentalization (grouping principle)

Ergonomic and Lean principles applied:
- Reduce "waste of correction"
- 5S "sorting" and "setting"

Figure 3. *Solutions A–E are identified by location in the prototype medication trays (also available in color in online article).*

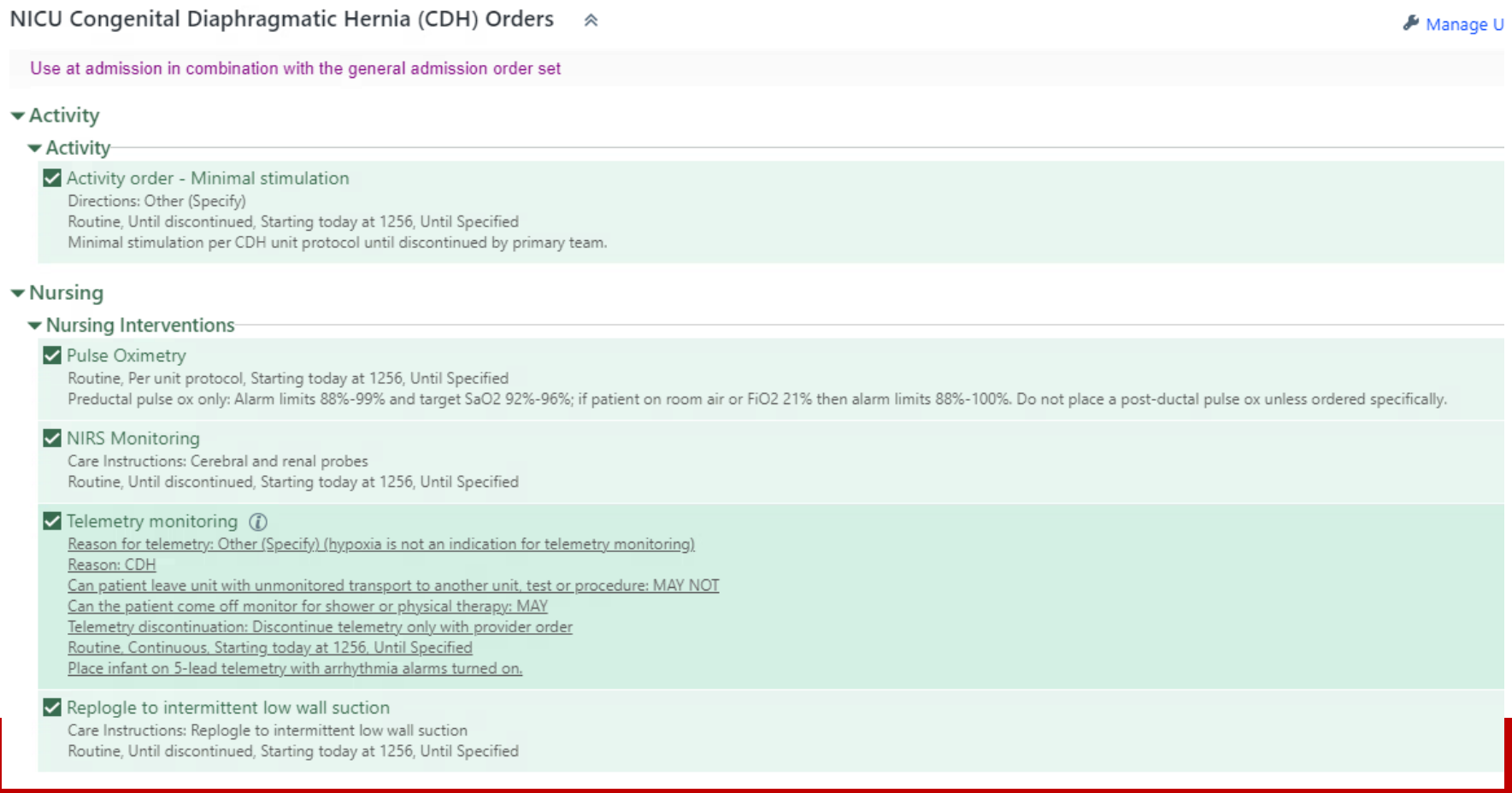
Chen DW, Chase VJ, Burkhardt ME, Agulto AZ. Using Human Factors Design Principles and Industrial Engineering Methods to Improve Accuracy and Speed of Drug Selection with Medication Trays. *Jt Comm J Qual Patient Saf*. 2016;42(10):473-477. doi:10.1016/s1553-7250(16)42065-9

Level 2 – System design (95%)

	Breakfast	4pm	Bedtime
Timolol (yellow)	Both eyes	Both eyes	
Simbrinza (green)	Both eyes	Both eyes	Both eyes
Rhopressa (white)			Left eye

Level 2 – System design (95%)

Use of defaults based on the evidence – “opt out” rather than “opt in”



Level 2 – System design (95%)

Standardization of essential tasks

- Differs from basic level 1 standardization – focuses on standard process

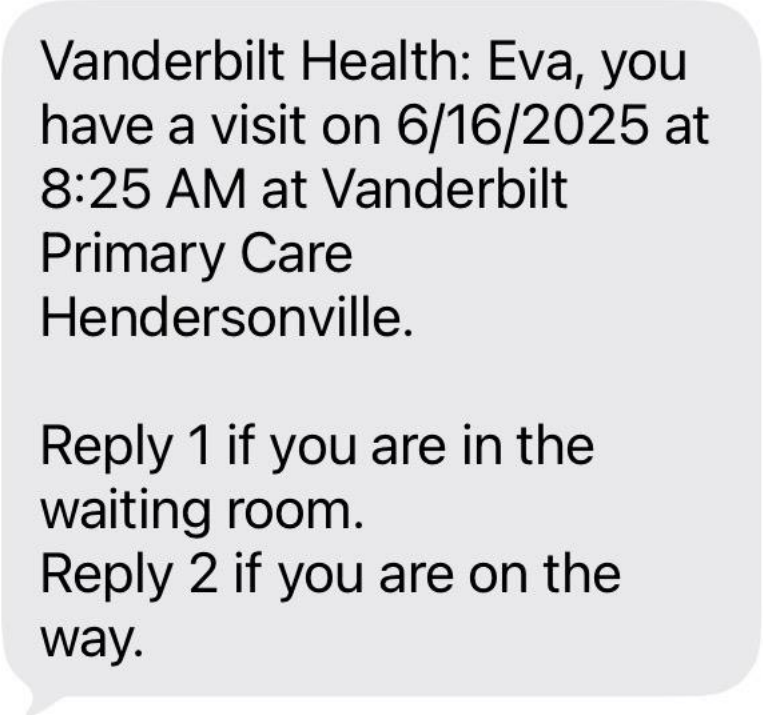
- NRP
  - Basic standardization: set up delivery room resuscitation area the same way
  - Process of resuscitation follows standardized norm

- CLABSI, VAP, or other prevention bundles
  - Standardize process of care
  - We still need to have higher reliability interventions to make it easy to follow bundles

Level 2 – System design (95%)

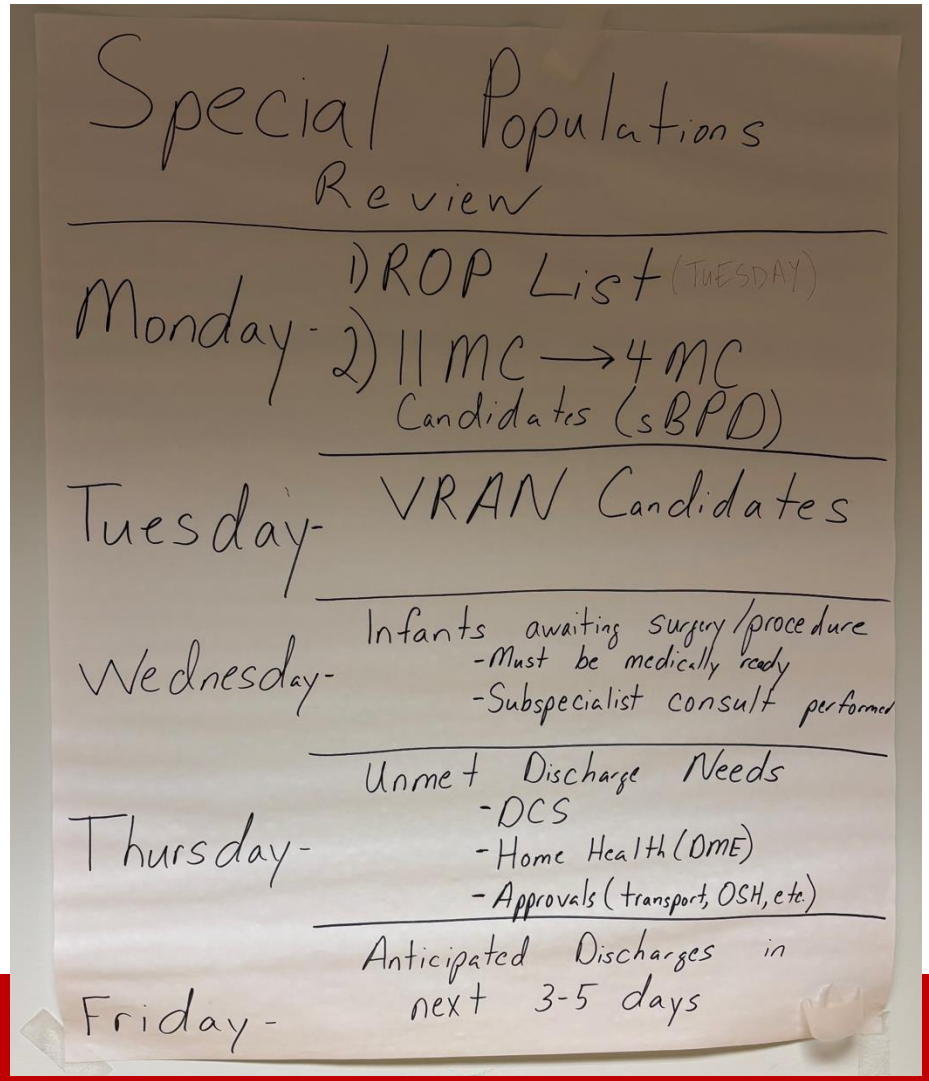
Scheduling of key tasks

- Automated appointment reminders
- HC/Length night – every Monday in prep for growth day every Tuesday
- Bed board/huddle – scheduled every day at same time; now woven into the workday



Level 2 – System design (95%)

Piggybacking (use of existing habits)



Level 3 - High Reliability Organizations (99.5%)

- Preoccupation with failure
- Reluctance to simplify interpretations
- Sensitivity to operations
- Commitment to resilience
- Deference to expertise

HRO Goals (Berwick)

- No needless deaths
- No needless pain
- No helplessness
- No unwanted waiting
- No waste

Lenk (2024)

METHOD/OLOGY

Methods to Increase Reliability in Quality Improvement Projects

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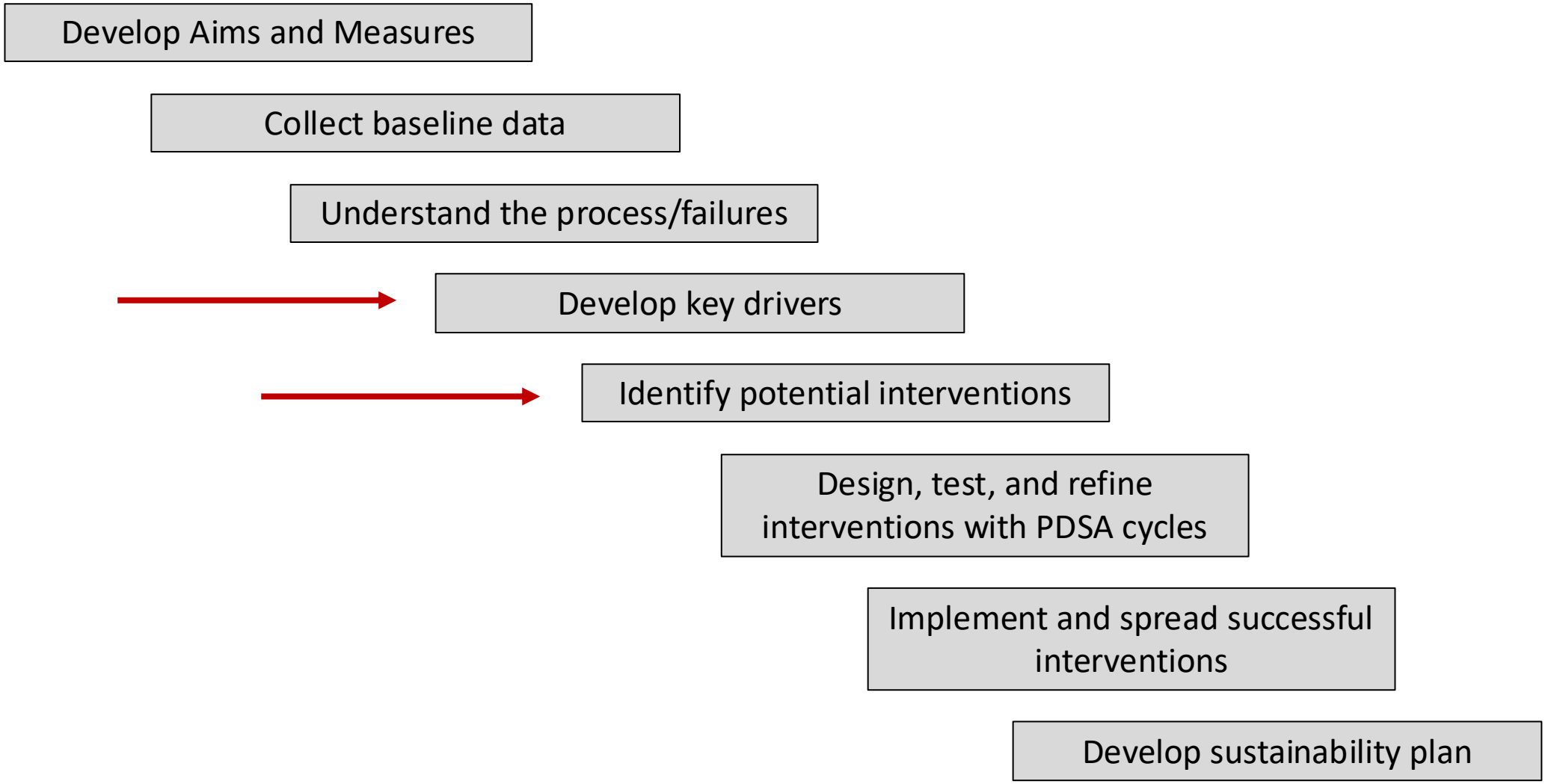
ABSTRACT Although many quality improvement initiatives in health care see early and laudable success, 1 of the greatest challenges is sustaining the gains and avoiding the natural tendency of systems to revert to their original state, function, and outcomes. Reliability science describes a mathematical and systematic framework for understanding the level of reliability of interventions, and therefore the anticipated success and failure rate of both the steps of a process and the cumulative process overall. Successful utilization of this framework, along with the mindful organizing principles of high-reliability organizations, will facilitate ongoing and long-lasting improvement in outcomes. In this article, we describe practical methods to increase the reliability of interventions toward achieving and sustaining improvement goals.

Hospital Pediatrics 2024 Aug 1;14(8):e372-e377.

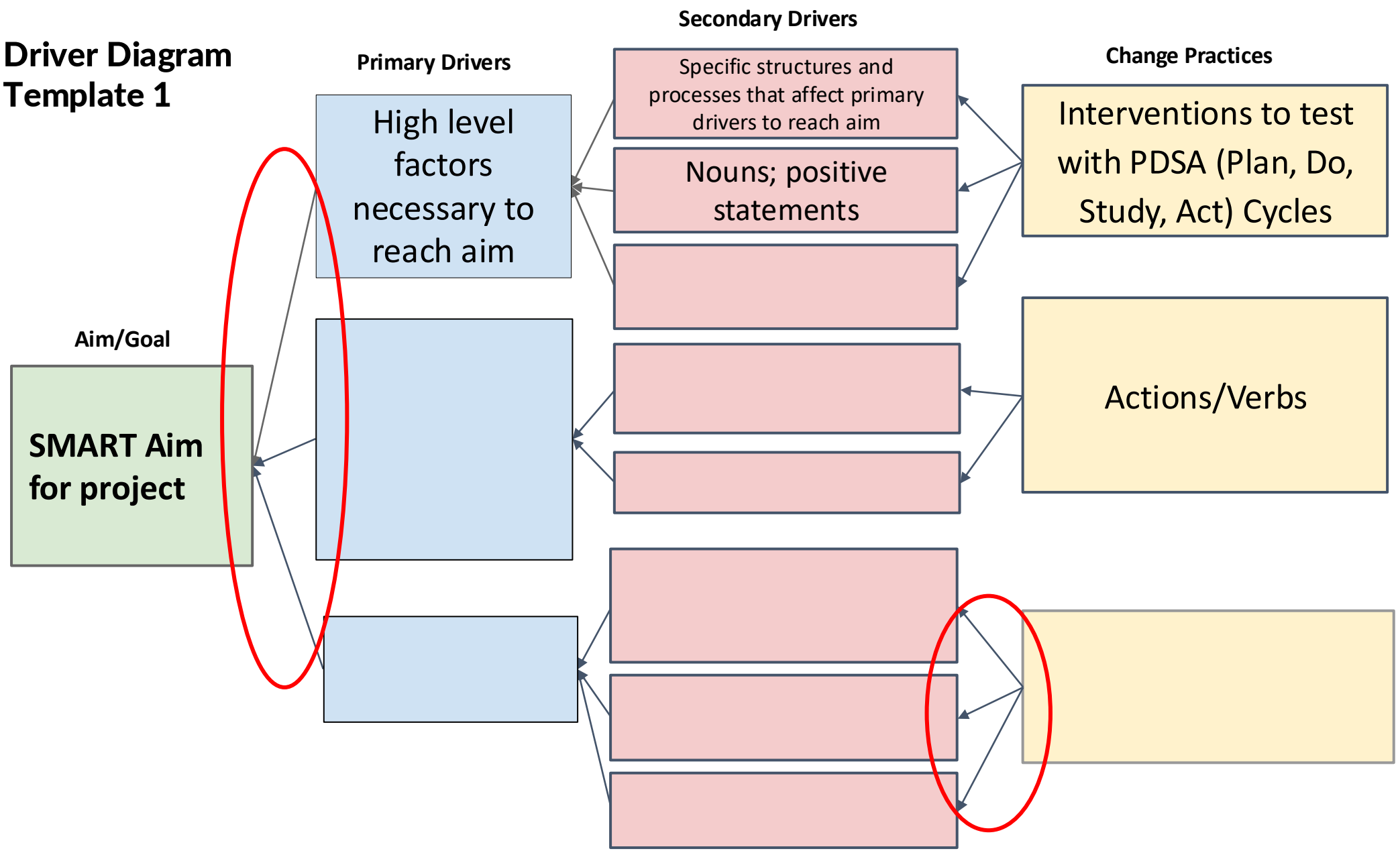
Quality Improvement Roadmap



Driver Diagrams

- A tool to organize and provide the theories for change
- Improvement is more likely if you have an idea (or theory) of why the process is not what you want it to be
- Dynamic, “living” document – update and change through out the project

Driver Diagram Template 1



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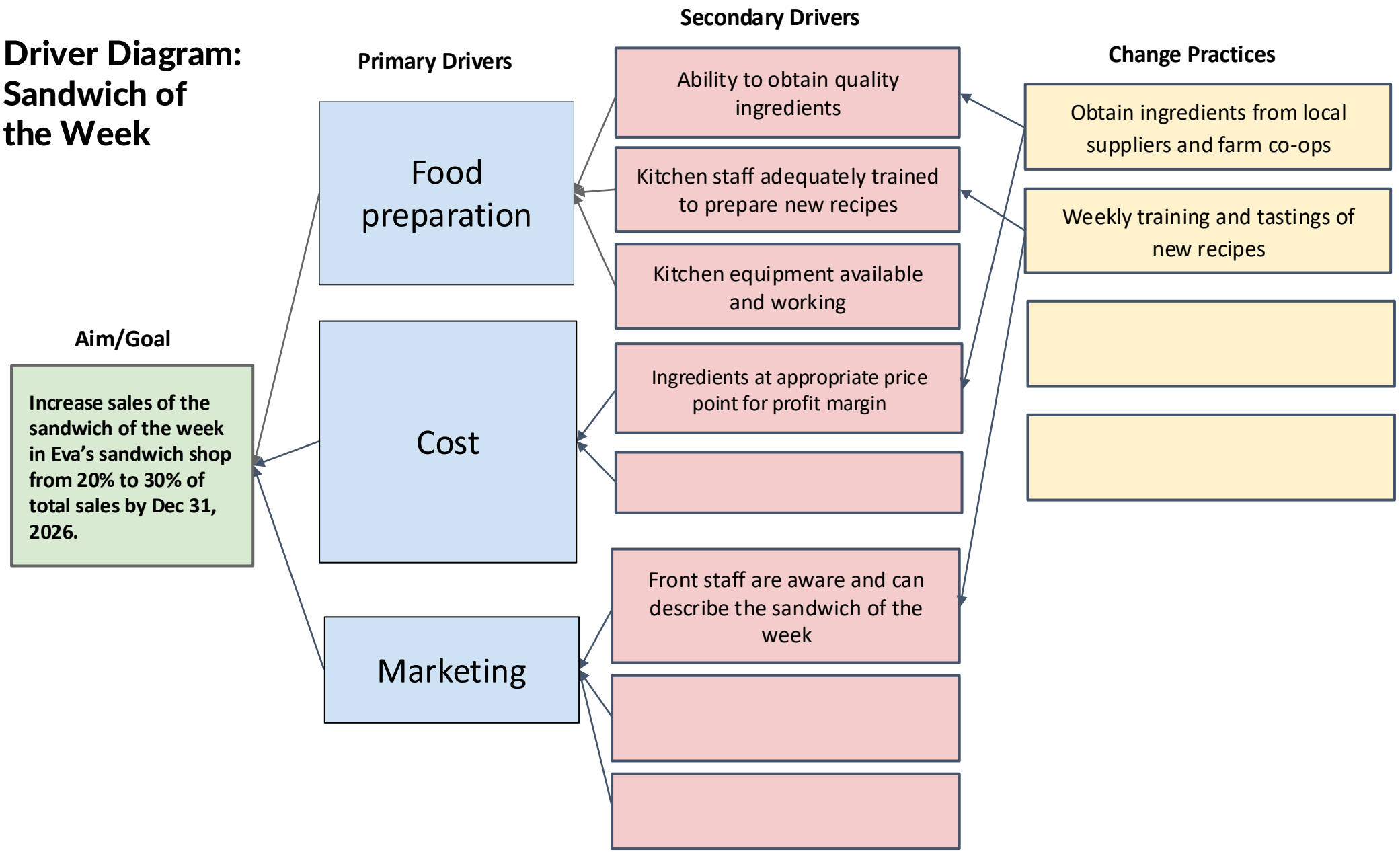
Driver Diagram: Sandwich of the Week



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Reduction of NEC
Version: 11 Date: February 2026

SMART Aim

Reduce the percent of infants born < 30 weeks gestation with NEC from XX % in 2024 to YY% by December 31, 2025.

PrimaryDrivers

- Delivery Room practices
- Feeding Practices
- Staff Buy In and Engagement
- Prevention of Dysbiosis in Gastrointestinal Tract

Secondary Drivers

- Optimal cord clamping after delivery
- Decrease effects of antenatal risk factors
- Exclusive breast milk diet: prioritize mother's own milk; donor milk is available
- Standardized approach to enteral feeding
- Aseptic milk preparation and storage
- Standardized diagnosis for NEC
- Milk handling insures limited time of milk at room temperature
- Appropriate feeding tube care
- Antibiotic stewardship to reduce unnecessary antibiotics
- Use of Probiotics pending FDA approval
- Administration of Oral Immune Therapy with cares if not orally feeding

Interventions

- Development of probiotics protocol for select infants (on hold)
- Early identification/treatment of PDAs (adopted 10/21)
- Exclusive human milk fortification in high-risk infants(abandoned)
- 48-hour antibiotic hard stops
- Early pumping of milk with goal 6 hours after delivery
- Milk preparation in formula room
- Provide OIT/colostrum kits to mothers shortly after delivery
- Fresh frozen milk bank DBM (adopted 4/22; previous shelf stable DBM)
- Delay and divide caffeine loads for 22-24 week GA infants (adopted 6/22)
- Continue DBM to 36 week in select populations (adopted 6/22)
- Optimize process of getting donor milk when ordered
- Routine replacement of feeding tubes (adopted 11/21)
- Feeding tube hygiene (new ENFIT process 4/23)
- Standardize oral care with breastmilk (4/23)
- Tiny Baby Feeding Protocol (adopted 9/22; previous protocols 2013)
- Updated NEC diagnosis and treatment protocol (adopted 2/24)

Gold shaded box – in progress
Dashed line – future work
Gray box – completed
Hatch marks – on hold or abandoned

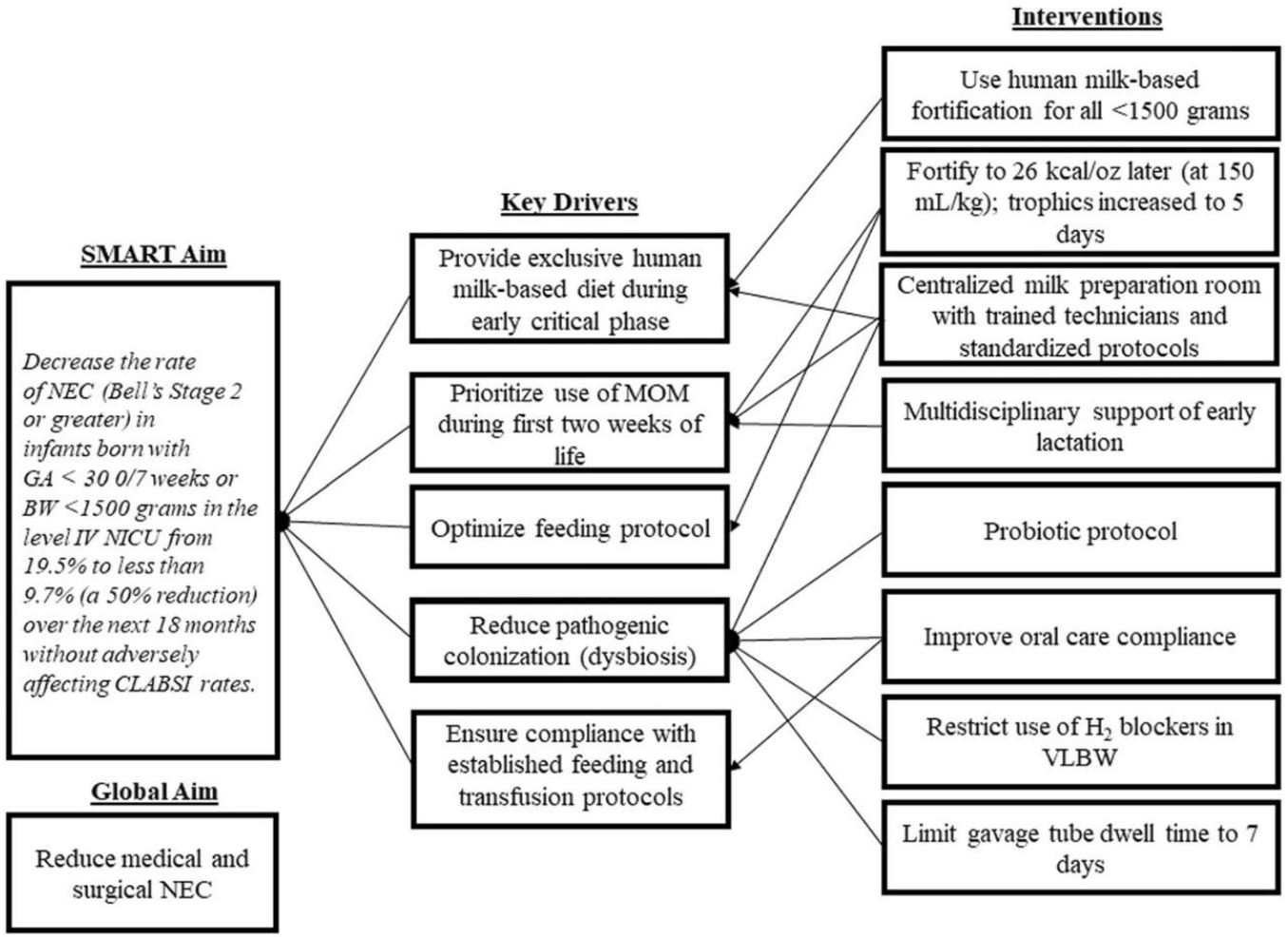
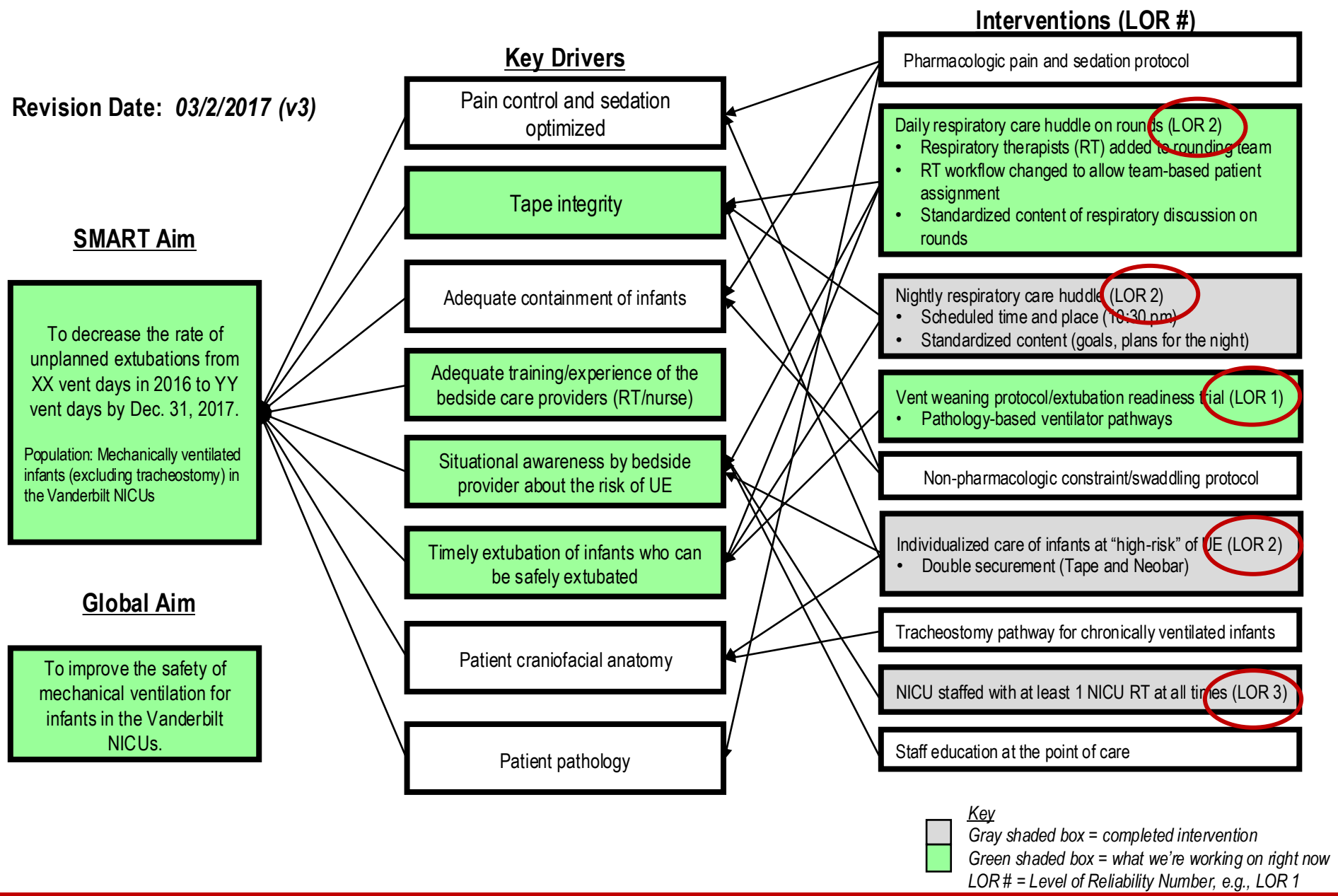


Fig. 1 Key driver diagram summarizing the improvement theory. NEC necrotizing enterocolitis, GA gestational age, BW birthweight, CLABSI central line-associated bloodstream infection, MOM mother's own milk, VLBW very low birth weight.

Mavis SC, Gallup MC, Meyer M, Misgen MM, Schram LA, Herzog DL, Smith BN, Schuning VS, Stetson RC, Fang JL. A quality improvement initiative to reduce necrotizing enterocolitis in high-risk neonates. J Perinatol. 2023 Jan;43(1):97-102.

Common Key Driver Categories

- Reliable completion of process steps
- Standardized process
- Culture
- Buy-in
- Adequate staffing
- Knowledge/Awareness
- Skill/Competency
- Parental engagement
- Equipment/supplies/resource availability
- Communication
- Accountability


Revision Date: 03/2/2017 (v3)
SMART Aim
To decrease the rate of unplanned extubations from XX vent days in 2016 to YY vent days by Dec. 31, 2017.
Population: Mechanically ventilated infants (excluding tracheostomy) in the Vanderbilt NICUs
Global Aim
To improve the safety of mechanical ventilation for infants in the Vanderbilt NICUs.
Key Drivers
Pain control and sedation optimized
Tape integrity
Adequate containment of infants
Adequate training/experience of the bedside care providers (RT/nurse)
Situational awareness by bedside provider about the risk of UE
Timely extubation of infants who can be safely extubated
Patient craniofacial anatomy
Patient pathology
Interventions (LOR #)
Pharmacologic pain and sedation protocol
Daily respiratory care huddle on rounds (LOR 2)
• Respiratory therapists (RT) added to rounding team
• RT workflow changed to allow team-based patient assignment
• Standardized content of respiratory discussion on rounds
Nightly respiratory care huddle (LOR 2)
• Scheduled time and place (10:30 pm)
• Standardized content (goals, plans for the night)
Vent weaning protocol/extubation readiness trial (LOR 1)
• Pathology-based ventilator pathways
Non-pharmacologic constraint/swaddling protocol
Individualized care of infants at "high-risk" of UE (LOR 2)
• Double securement (Tape and Neobar)
Tracheostomy pathway for chronically ventilated infants
NICU staffed with at least 1 NICU RT at all times (LOR 3)
Staff education at the point of care
Key
Gray shaded box = completed intervention
Green shaded box = what we're working on right now
LOR # = Level of Reliability Number, e.g., LOR 1

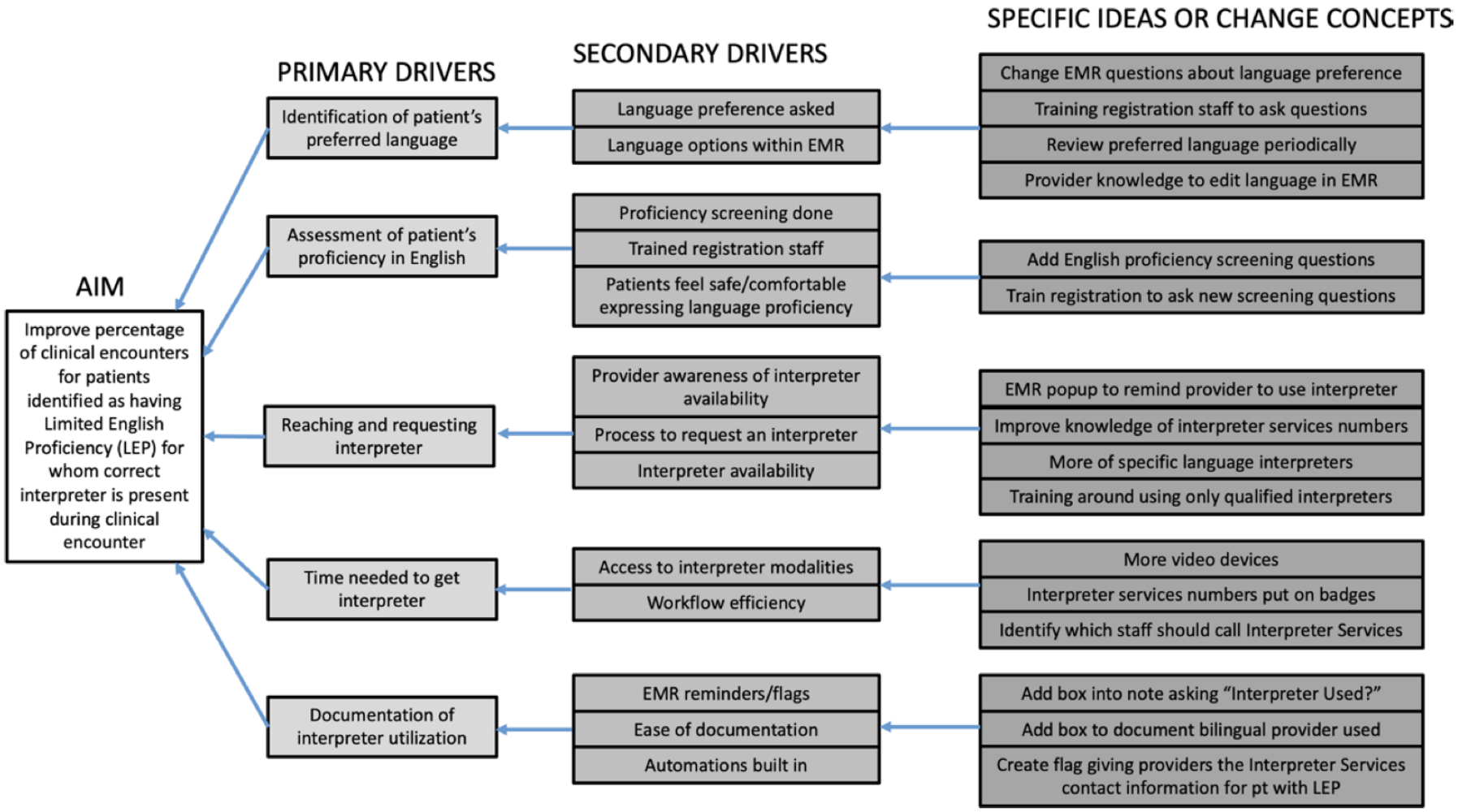


Fig. 1. Driver diagram.

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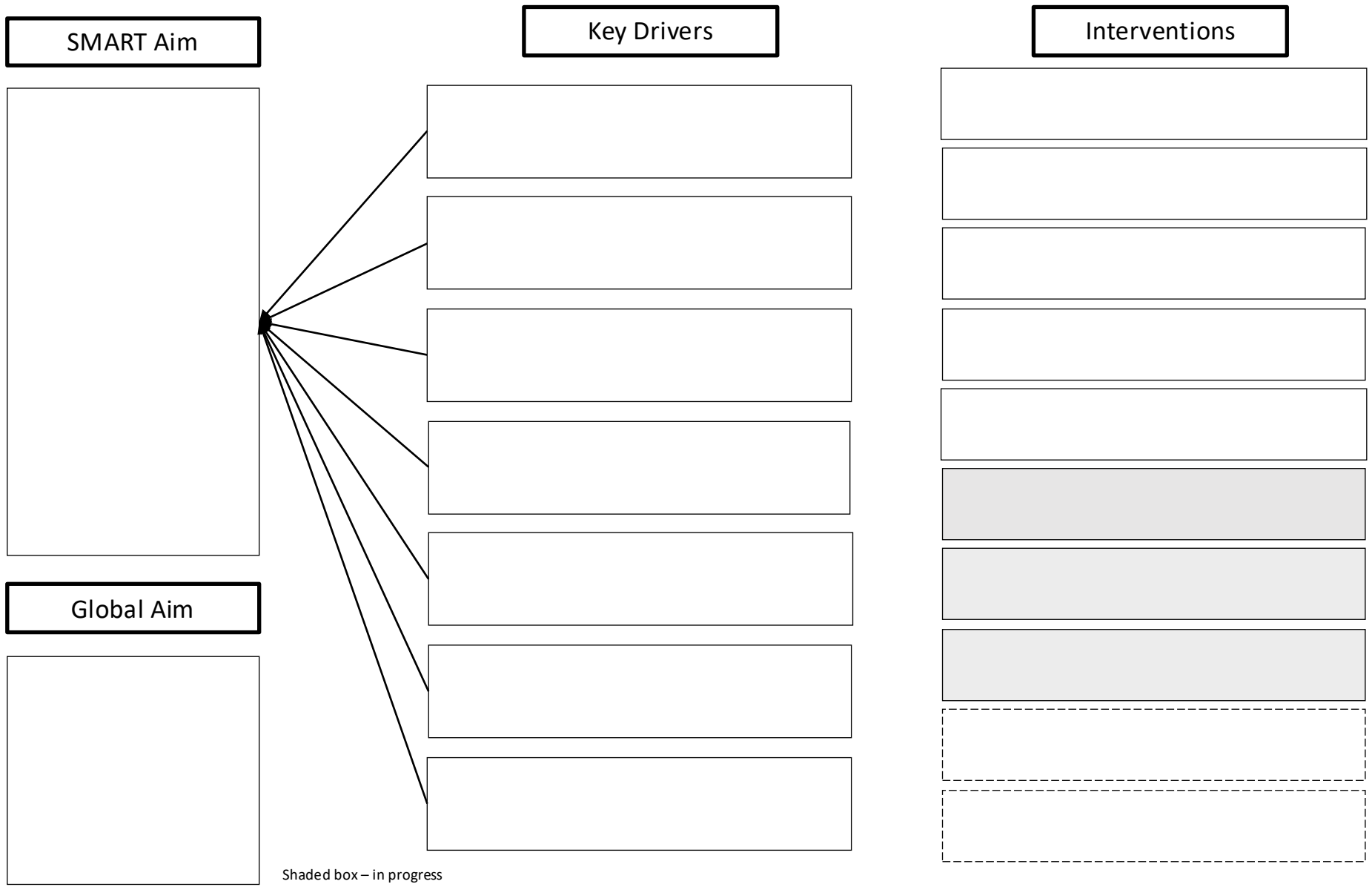
Project Title

Version: ___ Date: _____



Thank you!

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References

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