Measurement and Metrics - the Basics!

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Heather Kaplan MD MSCE is an Assistant Professor of Pediatrics in the Perinatal Institute and the James M. Anderson Center for Health Systems Excellence at Cincinnati Children's Hospital Medical Center (CCHMC). Heather is a neonatologist and health services researcher interested in enhancing care delivery and studying how systems of care can be improved using innovative approaches. She completed her neonatal-perinatal fellowship training, including earning a Master's degree of science in clinical epidemiology, at The Children's Hospital of Philadelphia/University of Pennsylvania. She joined the faculty at CCHMC in August 2007. Heather's early research focused on understanding variation in adoption of evidence-based practices in neonatal care and quality improvement as a strategy for implementing evidence in practice. With funding from the Robert Wood Johnson Foundation, she studied the role of context in the success of quality improvement initiatives and developed a model, the Model for Understanding Success in Quality (MUSIQ). MUSIQ is a tool for developing theories about which aspects of context help or hinder a specific project, and designing and implementing tests of changes to modify those aspects of context. Her current work examines the way research and improvement networks ("learning networks") can be used to improve care delivery and outcomes. She is specifically interested in scaling improvement to reach entire populations of patients and the ways technology, quality improvement methods, and N-of-1 trial methods can be combined to create a personalized learning healthcare system for the individual. Heather also has extensive experience with front-line quality improvement in perinatal care. Dr. Kaplan serves as the Improvement Advisor for the Ohio Perinatal Quality Collaborative (OPQC) neonatal improvement work. She also serves as a faculty expert for Vermont Oxford Network quality collaboratives and has been working with teams to improve their system of improvement by using MUSIQ to identify and modify key aspects of context that are affecting the success of the quality improvement projects and to help them engage with senior leadership around their improvement work.

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Objective: Compare and contrast different types of measures used for quality improvement and develop an operational definition for a measure relevant to your QI project.

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Disclosures

I have no financial disclosures related to the content of this workshop.

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Learning Objectives:

1. Identify 4 key strategies to structure your change ideas into viable quality improvement projects, using the Model for Improvement.
2. Apply the SQUIRE guidelines to design both a successful and publishable quality improvement project.
3. Write/refine a project SMART aim that is specific, measurable, attainable, relevant and time bound.
4. Develop a draft of a driver document relevant to your SMART aim.
5. Apply basic measurement tools to a quality improvement data set to create a basic run chart or statistical process control chart.
6. Critique a structured abstract for a real or "proto-type" QI project.

Take Home Points

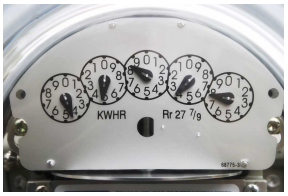
Measurement should speed improvement, not slow it down

The goal is improvement, ***not*** measurement

Measurement is meant to help you tell if the change is making an improvement

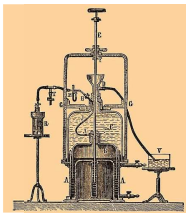
You need ***just enough*** information to help you know if changes are resulting in improvement

Types of measures



Ways to categorize measures

- What the measure is about:
  - Outcome measures
  - Process measures
- Role the measures play in a project
  - Balancing measures
  - All-or-none measures



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Types of Measures: Process

- What we do.
  - Represents the workings of the system
  - Usually "proximal" in terms of cause and effect
  - Easier to control, more sensitive
  - Examples:
    - % of Alarm Limits Set in Target Range
    - % of infants <1000 grams receiving Vitamin A
    - % infants >26 wks receiving early CPAP in the DR
    - % of deliveries <34 weeks with O2 blender set at 40%
    - Number of Ventilator Days per Month

Types of Measures: Outcomes

- What the patients experience.
  - Traditionally described as most important to patients
  - Less easy to control
  - Examples:
    - % of infants discharged with CLD
    - % of infants discharged with severe ROP
    - % of infants discharged home on oxygen
    - Number cases of VAP per 1000 ventilator days

Types of Measures: Balancing

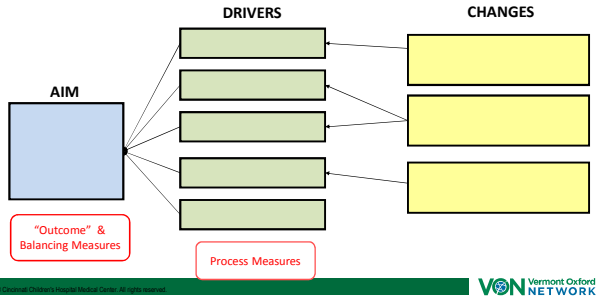
- Balancing Measures
  - Are we improving parts of our system at the expense of others?
    - Example: To increase the use of CPAP in the delivery room (and reduce the amount of surfactant used)
      - Balancing Measure=Pneumothorax: % of infants with a pneumothorax
    - Example: To increase compliance with new target oxygen saturation range of 90-95%
      - Balancing Measure=Severe ROP: % of infants with >Stage 2 ROP

Types of Measures: All or None

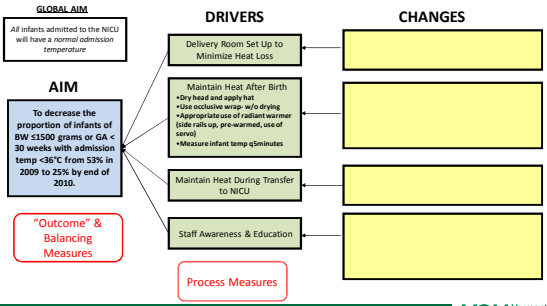
- Measure performance on multiple discrete measures for the same condition
- Best suited for process measures
- When project requires several measures all hitting certain goal
- Apply at the *patient level*, no partial credit given
- Advantages
  - Reflects the interests and desires of patients
  - Important when process components interact with each other synergistically or partial execution is insufficient
  - Quality may be an "all or none" property
  - Encourages system perspective (sequence of care)

Nolan T and Berwick DM, JAMA, 2006

A project may need several measures to tell the full story, including balancing measures



Hypothermia Key Driver Diagram



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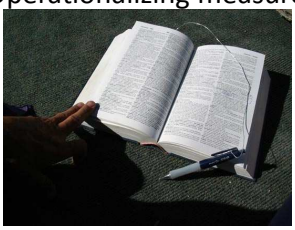
Hypothermia Measures

- Outcome
  - Percent of infants with BW<1500 gm or GA<30 weeks admitted with a temperature <36°C
- Process
  - Percent of admissions with delivery room check list completed
  - Percent of admissions with all components of the heat loss bundle completed
- Balancing
  - Percent of infants with BW<1500 gm or GA<30 weeks with admission temperature > 38°C

Operationalizing measures



"Data" vs. "Measure"

Data

- A piece of information that has no independent meaning until it is part of a measure.
- Examples:
  - ROP exam date/time
  - Infant PMA at time of ROP exam

Measure

- Designed to tell you what you want to know
- " Measures" require "data"
- Example:
  - Measure: % of infants receiving ROP exam at suggested PMA
  - Data: ROP exam date/time, PMA at time of ROP exam

Properties of useful measures

- Meaningful
  - Provide us with information and ultimately, knowledge
  - Say something useful about the system
  - Important to all stakeholders
  - Related to the project
- Can be operationalized
  - It is feasible to go from concept to detail
    - Data can be obtained with existing resources
    - Can be calculated easily

Operational Definitions

- A "concept" is not the same as a "measure"
  - Example 1:
    - Concept: "# Times Late to Work"
    - Measure: " XXX"
      - What is late? Within 5 minutes?
      - Where do you arrive? At parking garage? At desk?
  - Example 2:
    - Concept: "% Infants Discharged on Human Milk"
    - Measure: "XXX"
      - Which infants? All? VLBW?
      - How much milk? Any? >50% of feeds?

"Being free from grease is not rigorously definite; to some people it means clean enough to eat on; to the experimental physicist it may in some instances mean baked out at a high temperature under a vacuum"

--Walter Shewhart

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Operationalizing Measures

- Clearly Define:
  - What you are measuring?
  - Why you are measuring it?
  - How much data is needed (sample size)?
  - How it will be measured (numerator, denominator, definitions, sampling)?
  - How long will it be measured (project duration)?
  - Where will the data come from?
  - Who will collect the data?

A Word on Sampling…

- Why Sample?
  - Looking at ALL the data may not be possible or desirable
  - Data may be difficult to obtain
  - Cost and/or time to gather data may be too great
- Rules for Sampling
  - Sample must be representative of the entire population
  - Samples must be large enough to contain defects
- Types of Sampling
  - Random sampling
  - Systematic random sampling (at fixed interval)
  - Stratified random sampling (selecting from a predefined group)

Hypothermia Measures

- Outcome
  - Percent of infants with BW<1500 gm or GA<30 weeks admitted with a temperature <36°C
- Process
  - Percent of admissions with delivery room check list completed
  - Percent of admissions with all components of the heat loss bundle completed
  - Percent of deliveries where room temperature was measured at >77°F at the time of the delivery
- Balancing
  - Percent of infants with BW<1500 gm or GA<30 weeks with admission temperature > 38°C

Hypothermia Checklist

Delivery Room Temperature Regulation Checklist

Date:
Infant Name:
Name of Observer:
Room where delivery occurred: LDR# ____/ OR# _____

Admission Temp: _____
Thermometer Used: ☐ Welch Allyn ☐ Blue/Mask of fitness
Admission Weight: _____

Delivery Room Set Up	
Radiant warmer set up *23-29wks: suggested set point 37.5°C* *30-34wks: suggested set point 37.0°C*	Probated ☐ Yes ☐No Manual Mode ☐ Yes ☐No Servo Mode ☐ Yes ☐ No If Servo what set temp _____
Radiant Warmer side rails in up position during set up	☐ Yes ☐ No If No, Why?_____
Delivery room temperature set ≥ 77°F prior to delivery	☐ Yes ☐ No If No, Why?_____
Delivery	
Team present prior to delivery of infant	☐ Yes ☐ No
Infant switched to servo at birth with temp probe attached	☐ Yes ☐ No
Infant placed in Plastic Bag without drying	☐ Yes ☐ No ☐ Bowel Bag used ☐ Sus/Wrap used
Hat placed on infant after drying head	☐ Yes ☐ No
Radiant Warmer side rails remained in up position	☐ Yes ☐ No, head of bed down for intubation ☐ No, one or more side rails down for indication other than intubation
Skin temperature temp probe reading in DR/OR	**5 minute temp: _____**
Transport to NICU	
Transport Incubator	Set Temp: _____
Warm blankets (from L&D blanket warmer) used for transport	☐ Yes ☐ No

All-or-None Heat loss Bundle Compliance
Operational Definition

OPERATIONAL DEFINITION	
Measure Name	Percent of admissions with all components of the heat loss bundle completed
Type of Measure	Process
Included Population	Infants ≤ 1500 grams at birth <30 weeks gestation at birth Inborn Checklist completed at birth Admitted directly from LDR/OR to NICU
Excluded	Comfort care only NICU team not present at delivery

All-or-None Heat loss Bundle Compliance
Operational Definition

OPERATIONAL DEFINITION (Cont'd)	
Numerator	Number of admissions with compliance on all of the following elements of the DR checklist: • Radiant warmer pre-heated on arrival of NICU team • Radiant warmer side rails up on arrival of NICU team • Room Temp set at ≥77°F on arrival of NICU team • Unknown, blank, or Temp <77°F is non-compliant • Infant placed immediately in plastic bag • Temp probe attached and infant placed on servo within 1 min • Hat placed on infant after trying head • Radiant warmer side rails remain up until infant in transporter • Skin temp checked at 5 min and documented on checklist • Transport incubator pre-warmed to 37-37.5°C • Warm blankets in transporter prior to leaving OR/LDR
Denominator	Number of admissions with completed checklist

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All-or-None Heat loss Bundle Compliance
Operational Definition

OPERATIONAL DEFINITION (Cont'd)	
Data Collection Approach	Admit RN takes checklist from cabinet with PPE supplies Admit RN completes checklist and returns to charge RN
Data Source	DR Checklist (manual data collection)
Sampling	None (data collected on all admits) Estimated 10-30 infants per month
Data Reported As	Monthly percent compliance with heat loss bundle
Improvement Noted As	Increase in the percent

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Take Home Points

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Exercise

- Identify a group of measures (no more than 6 measures) for your QI Project including:
  - Process Measures
  - Outcome Measure(s)
  - Balancing Measure(s)
- Pick one measure and operationalize it including:
  - Population included/excluded
  - Numerator, Denominator
  - Data Source
  - Sampling plan/frequency (estimated sample size)
  - Define unit and degree of precision for all data elements (e.g., is LOS in days, hours, minutes; is pain scale whole numbers?)
  - If judgement is required (e.g., late or inappropriate), list the criteria used to make the judgement

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