Quality Improvement Community of Learning

April 3, 2023
2:00 – 4:00 pm ET
Welcome!

Thank you for joining the call! We will get started shortly.

- You may be muted upon entry to the call so please unmute yourself to talk
- We encourage you to listen, ask hard question, share information, speak your truth, stop blaming, and surface mistakes for learning.
  - Source: Beyond Measure: The Big Impact of Small Changes (2015)

This presentation will be recorded
Tell us where you’re from!

• Take a moment to find the “annotate” button on your zoom tool bar

• Now, locate the “stamp” feature

• Pick your favorite stamp and let us know where you’re joining from!
The NICHQ Team

Stacey C. Penny, MSW, MPH
Senior Project Director

Callie Rowland, MPH
Project Manager

Rinka Murakami, MPH
Analyst, Applied Research & Evaluation

Sue Butts-Dion
Improvement Advisor

Jane Taylor, EdD
Improvement Advisor

The faculty have nothing to disclose.
Objectives of the 4 QI Workshops

Support those new to quality improvement (QI) in:

• Laying a foundation for learning and improving
• Developing improvement capability for PQC, and other state or hospital-based teams
• Creating the environment for and leading quality improvement
• Applying QI principles to your existing projects
Methods: What to Expect from this Community of Learning Series

• Four Workshops
• Pre-work assignments for next workshop for action learning
• Action learning to make learning practical and concrete
• Use of SharePoint and Jam Board for shared learning
Before we move on . . .
Pre-work

• Plan for a PDSA and execute if you are able
  • Post to the Shared Drive
• Time permitting, consider a driver diagram for your work
  • Go on a search to see if one already exists

What was your experience?
| **PDSA Worksheet** | **Team Name:**
|-------------------|-----------------------
| **Objective of this cycle:** | **Date:**
| **PLAN:** Describe the change you are testing: | 
What questions does this test seek to answer?
Plan for the test: who, what, when, where
| | 
| Data collection plan to learn if the test is successful: who, what, when, where
| | 
| What do you predict the result will be?
| | 
| What tasks are needed to prepare for and carry out the test?
| | 
| **DO:** Report what happened when you carried out the test. Describe observations, findings, problems encountered, special circumstances.
| | 
| **STUDY:** Compare your results to your predictions. What did you learn? Any surprises?
| | 
| **ACT:** What will you do next? Adopt, adapt, or abandon the change?
What it looks like...

- Plan-Do-Study-Act (PDSA) cycles are a disciplined inquiry and learning approach about how these changes will work in your state.

- How a state customizes good ideas, ready for use to their unique context.

Note: Some driver diagrams may go directly from primary drivers to changes, depending on complexity of the system.
Today’s Discussion Questions

As we move through the workshop today, please consider and participate in discussing these questions:

1. How can I set up a useful set of measures for my project or improve upon an existing set of measures; make them more sensitive to change?
2. How could putting my data on a run chart be more useful than looking at my data in a table?
3. What is the right action to take based on what patterns I am seeing in my data?
<table>
<thead>
<tr>
<th>Session Title</th>
<th>Date and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality Improvement: What and Why?</strong> Foundations of Improvement</td>
<td>Tuesday, January 31(^{st}) 1:00 – 3:00 PM ET</td>
</tr>
<tr>
<td><strong>Activating the How</strong> Using PDSA Cycles to Learn and Improve</td>
<td>Tuesday, February 21(^{st}) 1:00 – 3:00 PM ET</td>
</tr>
<tr>
<td><strong>Measurement for Improvement</strong> Collecting, Displaying, and Analyzing Data for Learning and Improvement</td>
<td>Monday, April 3(^{rd}) 2:00 – 4:00 PM ET</td>
</tr>
<tr>
<td><strong>Holding the Gains</strong> Sustaining Improvement and Cohort Learning</td>
<td>Monday, May 1(^{st}) 2:00 – 4:00 PM ET</td>
</tr>
</tbody>
</table>

Be sure to add all webinars to your calendar if you have not already done so!
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?

Cycle of Improvement
- Rapid Testing
- Think BIG and Start SMALL
Selecting Useful Measures
Measurement
The right measures are the ones derived from purpose...
What if you use the wrong measures?
What if you measure the “right” things, but in the “wrong” way?
And, what if we didn’t measure anything?
Measurement Assumptions

• All measures have limitations
  – Limitations do not negate their value

• Measures are an important “voice” of the system
  – Hearing the voice of the system gives us information on where to work and focus efforts

• Measures tell a story
<table>
<thead>
<tr>
<th>Aspect</th>
<th>Improvement</th>
<th>Accountability or Judgment</th>
<th>Clinical Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim</td>
<td>Improvement of care processes, systems and outcomes</td>
<td>Comparison for judgment, choice, reassurance, spur for change</td>
<td>New generalizable knowledge</td>
</tr>
<tr>
<td>Methods</td>
<td>Test observable</td>
<td>No test, evaluate current performance</td>
<td>Test blinded</td>
</tr>
<tr>
<td>Confounders</td>
<td>Accept consistent</td>
<td>Measure and adjust to reduce</td>
<td>Design to eliminate</td>
</tr>
<tr>
<td>Sample Size</td>
<td>“Just enough” data, small sequential samples</td>
<td>Obtain 100% of available, relevant data</td>
<td>“Just in case” data</td>
</tr>
<tr>
<td>Flexibility of Hypothesis</td>
<td>Hypothesis flexible, changes as learning takes place</td>
<td>No hypothesis</td>
<td>Fixed hypothesis</td>
</tr>
<tr>
<td>Testing Strategy</td>
<td>Sequential tests</td>
<td>No tests</td>
<td>One large test</td>
</tr>
<tr>
<td>Determining if a Change is an Improvement</td>
<td>Run charts or Shewhart control charts</td>
<td>No focus on change</td>
<td>Hypothesis, statistical tests (t-test, F-test, chi square, p-values)</td>
</tr>
<tr>
<td>Confidentiality of the Data</td>
<td>Data used only by those involved with improvement</td>
<td>Data available for public consumption</td>
<td>Research subjects’ identities protected</td>
</tr>
<tr>
<td>Frequency of Use</td>
<td>Daily, weekly, monthly</td>
<td>Quarterly, annually</td>
<td>At end of research</td>
</tr>
</tbody>
</table>

A Family of Measures for Quality Improvement

**Outcome measures**
- Did our changes impact the aim as predicted?
- Are we getting results and seeing improvement based on our aim?
- The “what” of the QI project
- Limit to a small set of measures

**Process measures**
- How did we make the changes?
- Reflects key steps required for improvement
- The “how” of the QI project
- Limit to a few measures

**Balancing measures**
- Unintended consequences of improving the system
- May be positive or negative
- May be something else your team wants to monitor
- Limit to one or two measures
Structural Measures (Donabedian)

- A measure meant to designate the conditions under which care is provided:
  - Material resources (such as equipment and facilities)
  - Human resources (such as the number, variety and qualifications of professional and support personnel—educated or not)
  - Organizational characteristics (such as the organization of the staff—staffing models, presence of teaching functions, supervision and performance review, methods of paying for care, etc.)
What directs measure development?

**Process**

- **Primary Driver**
  - **Secondary Drivers**
    - Change
    - Change
    - Change

**Outcome**

- **AIM**
  - **Primary Driver**
    - Change
    - Change
    - Change

- **Primary Driver**
  - Change
  - Change
  - Change

- **Primary Driver**
  - Change
  - Change
  - Change

- **Primary Driver**
  - Change
  - Change
  - Change

- **Primary Driver**
  - Change
  - Change
  - Change

**Plan-Do-Study-Act (PDSA) cycles are a disciplined inquiry and learning approach about how these changes will work in your state.**

**How a state customizes good ideas, ready for use to their unique context.**

Note: Some driver diagrams may go directly from primary drivers to changes, depending on complexity of the system.
Aim: By Feb. 2023, we will recognize and treat obstetric hypertension (HTN) during pregnancy and up to six weeks postpartum to reduce severe maternal morbidity (SMM) by 25% and achieve 80% or higher compliance of the HTN recognition tool and OB HTN emergency pathway.

**Primary Drivers**
- Assessment/Recognition
- Response/Treatment
- Clinical Collaboration to avoid 3 D's delay, deny, dismiss
- Equity in Care

**Secondary Drivers**

**Primary Drivers**

**Secondary Drivers**

**Change Ideas**
- Know risk factors
- Use proper BP technique
- Prioritize 2nd reading
- Use a timer as reminder
- Think, “This is an emergency” (like a stroke)
- Use preeclampsia early recognition tool
- Utilize blue band

- Use standing orders / HTN order sets to avoid delay
- Over-ride Pyxis for urgent HTN meds
- Make 2nd reading within 15 min after initial HTN
- Treat HTN within 15 min if BP elevation lasts 15 min or more
- Follow HTN Medication Admin Guide
- Follow OB HTN Emergency Pathways
- Use Preeclampsia VS Guide
- Use eclampsia algorithm
- Treat severe BP
- Check stat lab results
- Use and practice SBAR
- Swarm and debrief all failures, look for system and process failures
- Develop clear rapid escalation
- Implement Team-Stepps
- Drill & simulate HTN emergencies

**Equity in Care**

**At discharge**

- Schedule f/u PP visit w/in 72hrs if on meds or 3-10 days if not on medications
- Use run and control charts to analyze data monthly. Stratify by race and ethnicity Include women of color on your improvement team.
- Set universal goals and develop targeted approaches so all groups achieve universal goals
# IHI HTN Better Maternal Outcomes: Reducing Harm from Hypertension During Pregnancy  Workbook IHI.org

**Aim:** Reduce Hypertension-related severe maternal morbidity from \((x/1,000 \text{ deliveries to } y/1,000 \text{ deliveries})\) for individuals delivering in the labor and delivery unit at ABC hospital by November 1, 2021.

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>Measure</th>
<th>Measure Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td>Hypertension-related Severe Maternal Morbidity (SMM)</td>
<td></td>
</tr>
</tbody>
</table>
  - **Denominator:** All mothers during their birth admission, excluding ectopic pregnancy and miscarriages  
  - **Numerator:** Among the denominator, all cases with any non-transfusion SMM code  
  - **Stratify data by race and ethnicity and language** |
| **Process**  | Percent of delivering patients with elevated blood pressure who receive treatment within 60 minutes of elevated blood pressure reading. |  
  - **Denominator:** Number of patients with persistent (twice within 15 minutes) new-onset Severe HTN (Systolic: = 160 or Diastolic: = 110)  
  - **Numerator:** Number of patients among denominator who were treated within 60 minutes with IV Labetalol, IV Hydralazine, or PO Nifedipine  
  - **Stratify data by race and ethnicity and language** |
| **Process**  | Percent of patients who can teach back postpartum warning signs to their care team upon discharge |  
  - **Denominator:** Total number of patients delivering on the unit  
  - **Numerator:** Number of patients who, at the time of discharge, could teach back the symptoms of when they should seek postpartum emergency care  
  - **Stratify by race and ethnicity and language** |
| **Process**  | Percent of deliveries where a complication occurred that had a team debrief after the event |  
  - **Denominator:** Total number cases where a complication occurred  
  - **Numerator:** Number of cases where a complication occurred that had a team debrief within one week of the adverse event |
| **Structural** | Organization has a system in place for conducting debriefs |  
  - Yes/No  
  - Lickert Scale |
| **Balancing** | Fetal Distress (in response to medication) |  
  - **Denominator:** Total number of cases where anti-hypertensives were given  
  - **Numerator:** Number of cases where fetal distress was observed (as measured by system criteria) due to low blood pressure |
An Operational Definition...

Puts communicable meaning to a concept by specifying how the concept will be applied within a particular set of circumstances.

- It gives communicable meaning to a concept
- Is clear and unambiguous
- Specifies measurement methods and equipment
- Identifies criteria for measurement

W. Edwards Deming
Operational Definitions

What does “clean” mean?
## Organizing Your Measures Worksheet

**Topic for Improvement:**

<table>
<thead>
<tr>
<th>Aim/Driver Concept</th>
<th>Potential Measure(s)</th>
<th>Outcome</th>
<th>Process</th>
<th>Balancing</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Example

**Organizing Your Measures Worksheet**

**Topic for Improvement:** Severe Maternal Hypertension (HTN)

<table>
<thead>
<tr>
<th>Concept</th>
<th>Potential Measure(s)</th>
<th>Outcome</th>
<th>Process</th>
<th>Balancing</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harm</td>
<td>Maternal morbidity and mortality rates</td>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timely treatment</td>
<td>Percent of birthing people with severe range BP treated within 60 minutes</td>
<td></td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Readmissions</td>
<td>Percent of birthing people readmitted w/ complications from severe maternal HTN</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Staff Education</td>
<td>Percent of staff fully trained in identifying and treating severe maternal HTN</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
</tbody>
</table>

Measure Name: ________________________________________
(Remember this should be specific and quantifiable, e.g., the time it takes to..., the number of..., the percent of... or the rate of...)

Operational Definition
Define the specific components of this measure. Specify the numerator and denominator if it is a percent or a rate. If it is an average, identify the calculation for deriving the average. Include any special equipment needed to capture the data. If it is a score (such as a patient satisfaction score) describe how the score is derived. When a measure reflects concepts such as accuracy, complete, timely, or an error, describe the criteria to be used to determine “accuracy.”

Can you develop good Operational Definitions?
<table>
<thead>
<tr>
<th>Measure Name</th>
<th>Is Stratification appropriate? If Yes, list the levels of stratification</th>
<th>Will you use sampling? If Yes, describe the sampling method you will use</th>
<th>Frequency of data collection (e.g., hourly, daily weekly?)</th>
<th>Duration of data collection (i.e., how long do you plan to collect the data?)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measure Name</th>
<th>Operational Definition</th>
<th>Data Collection Plan</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Be sure to indicate if it is a count, percent, rate, days between, etc.)</td>
<td>(Define the measure in very specific terms. Provide the numerator and the denominator if a percentage or rate. Be as clear and unambiguous as possible)</td>
<td>(How will the data be collected? Who will do it? Frequency? Duration? What is to be excluded?)</td>
<td></td>
</tr>
</tbody>
</table>

Case Study: You be the “Measure Developer”

Background: A friend has come to you and asked you to help develop measures to track progress of the group she is working with

- They have a driver diagram
- Group Aim: The aim of the improvement project is for participants to lose weight. **She wants to tell how group is doing—not just each individual**
- With your group, develop a Family of 5 measures that could be **reported each week** for the project:
  - Outcome Measures – 1 measure
  - Process Measures – 2 measures
  - Balancing Measures – 1 measure
  - Structure Measure – 1 measure
- Use the worksheet that is provided in your Jamboard area
- Get as far as you can in 15 minutes
What directs measure development?

**Process**

- **Primary Driver**
  - Secondary Drivers
  - Change
  - Change
  - Change

- **Primary Driver**
  - Change
  - Change
  - Change

- **Primary Driver**
  - Change
  - Change
  - Change

- **Primary Driver**
  - Change
  - Change
  - Change

**Outcome**

- AIM

**Note:** Some driver diagrams may go directly from primary drivers to changes, depending on complexity of the system.

- Plan-Do-Study-Act (PDSA) cycles are a disciplined inquiry and learning approach about how these changes will work in your state.

- How a state customizes good ideas, ready for use to their unique context.
Group will lose a total of 150 pounds by July 1, 2023.

Aim

Exercise

Primary Drivers

- During work

Secondary Drivers

- Off work

Specific Changes to test

- Walking meetings
- Timed stretch breaks
- Try group fitness class
- Climb steps at home 5x a day on purpose

Process Measures

- Macros management

Outcome Measures

- At home & work
  - Pre-package meals
  - Use My Fitness Pal (or other app) to track
  - Focus on proteins during day
  - Review menu and plan before going out

- Eating out

<table>
<thead>
<tr>
<th>Type</th>
<th>Name of Measure</th>
<th>Definition, how to collect data (e.g., frequency, who: source numerator/denominator, etc.)</th>
<th>Weekly summary statistic (e.g., rate, %, count)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome Measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balancing Measure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Breakout Logistics and Links

• We will place you in random breakout groups

• Join the Jamboard that corresponds with your breakout group number (1 join Jamboard 1; 2 join Jamboard 2, etc.)

- Group 1: https://jamboard.google.com/d/15t2H56TiacIE89SZvB2SrDgUpzLOiov16BnU8mzJq1k/edit?usp=sharing
- Group 2: https://jamboard.google.com/d/1ZZUtE9WR6D7YP9e-KCCebrrBELMEvYT2p12QRo7pfVc/edit?usp=sharing
- Group 3: https://jamboard.google.com/d/1r6a-Il_wz2ygFM02Xnc2f7bsl2X27WCQLEJ2SjkIQ_E/edit?usp=sharing
- Group 4: https://jamboard.google.com/d/1XYs8lVpE5ti_ct4lzJK7juPKDrJhCgNvZBXp4ky1cE/edit?usp=sharing
- Group 5: https://jamboard.google.com/d/11FxGuUtR0bZp9NeMSXVNeRs4wZoX367-7xbn8325r8/edit?usp=sharing
- Group 6: https://jamboard.google.com/d/1oUXsNuhKzLPMzDlhphCGiDGfmmw46PMpHmvvDhBKSdLQ/edit?usp=sharing
- Group 7: https://jamboard.google.com/d/1vxo4Va90w0hgmE3THExig8msHdyYE0d3qMuacKMSruYM/edit?usp=sharing
- Group 8: https://jamboard.google.com/d/1iwGch12PpsPSpSH5BCPjwTuEUfoP5_O_Tj2LENI57Y/edit?usp=sharing
- Group 9: https://jamboard.google.com/d/1DYLYtvtnrNXkaQclyB0nSIGsLNUUptwgaMJw-ee1c/edit?usp=sharing
- Group 10: https://jamboard.google.com/d/1G1O16sPYviK0ZWswwAnIVkByG6bMYX5cIISChxM7xrE/edit?usp=sharing
Data is not just numbers, or “quantitative data”, but “qualitative data” as well. More on qualitative data at next session.

**Model for Improvement**

- **Act**
- **Plan**
- **Study**
- **Do**

**Cycle of Improvement**
- Rapid Testing
- Think BIG and Start SMALL
Enumerative (Static) Statistics
Analytic Statistics…
Displaying Data
Over Time rather than Before/After

% treated w/in 60 minutes

Month/Year

Series1
Series2

Month

% treated

April 2020
Mar 2021

% treated w/in 60 minutes

April 2020
May 2020
June 2020
July 2020
August 2020
September 2020
October 2020
November 2020
December 2020
January 2021
February 2021
March 2021
Two key tools help us to uncover and understand variation in our data

- Can be for any type of data
- No calculations are required.
- Can easily make by hand
- Show behavior at-a-glance
- They are easily understood
- 3 Elements: Measurement, Time, & Median

- Center Line = Median

- Adds limits (4th element)
- More sensitive
- Center Line = Mean
- But more complex
- Need software
Run Charts

Finding the story in our data...
Elements of a Run Chart

The centerline (CL) on a Run Chart is the Median

The centerline (CL) on a Run Chart is the Median
Median vs. Mean

Median = Middle value of ordered data
Mean = Arithmatic average of data

- 8,10,11,14,16,18,20
  Mean = 13.8
  Median = 14

- 8,10,11,14,16,18,20,35
  Mean = 16.5
  Median = 15
Frequently Asked Questions

1. Why do we use run charts for improvement projects?

Photo by Museums Victoria on Unsplash
1. Make process performance visible

3. Determine if we are holding the gains

2. Determine if a change is an improvement
2. How many data points do we need for a run chart?
• **Ideally** you should have between 10 – 15 data points before constructing a run chart.
• May start a line graph with just two points

10 – 15 patients
10 – 15 days
10 – 15 weeks
10 – 15 months
10 – 15 quarters

• If you are just starting to measure, plot the dots and make a line graph.

• Once you have 8-10 data points make a run chart, that is add in median
Practically, you can . . .

- Just start; plot the dots
- Add a “temporary” or “provisional” median
- Freeze median after 10-12 points
- Apply rules, redraw as needed when suggested by rules and you understand changes that led to improvement
3. How often should we collect data for improvement?
Measure Frequency-Monthly Minimum (Mock Data)

Aggregate Average % patients with Individualized Inpatient Care Plan-Monthly
Jan 2019-November 2019

Aggregate Average % patients with Individualized Inpatient Care Plan-Quarterly
February-November, 2019

Aggregate Average % patients with Individualized Inpatient Care Plan-Weekly
Jan 2019-November 2019

Source: Butts-Dion Consulting, Inc.
Percentage treated within 60 minutes

Lapsed minutes between first and second

% with HTN Disorder d/c with blood pressure cuff

Lapsed minutes between confirmation and treatment

Family of Measures for HTN

Compliance with OB HTN Pathway – “All Entries”
Now What?

Using Run Chart Rules to Analyze the Story in Our Data and to Inform Action
Using Run Charts to Understand Variation

A: Create Chart  B: Apply the 4 Rules  C: Analyze Results  D: Identify Strategies

1. **Shift**? (6 or more in a row all above or all below median, use 8 or more points if you have > 20 points, values on the median do not break a shift)

2. **Trend**? (5 or more in a row all going up or down, use 6 or more if you have > 20 data points, consecutive like values are counted as one)

3. **Number of Runs**? (Too many? Too few? Just enough?)
   A. Count the number of runs on the chart (a run consists of one or more consecutive points on the same side of the median)
   B. Count the total number of useful observations (data points not sitting on the median)
   C. Consult Number of Runs Table (Identify the range – Too Few? Too Many? Just Enough?)

4. **Astronomical Point(s)**? (extreme points far beyond data range, all agree)

4 Run Chart Rules are used to identify non-random signals

- Rule 1: A Shift
  - Median
  - 6 (8 > 20)

- Rule 2: A Trend
  - Median
  - 5 (6 > 20)

- Rule 3: Too many or too few runs
  - Median

- Rule 4: An astronomical data point (s)

Adapted from The Data Guide by L. Provost and S. Murray, Austin, Texas, 2011, page 78
Rule 3: Counting the Number of Runs (Fluctuation Around Mean)
Too Many Runs? Too Few Runs? Just enough?)

A. **Count the number of runs on the chart** (a run consists of one or more consecutive points on the same side of the median) There are two ways to count runs:

1. Draw a circle around each run and count the number of circles you have
2. Count the number of times the line crosses the median and add “1”

B. **Count the total number of useful observations** (data points not sitting on the median).

C. **Consult Number of Runs Table** (ID range for number of useful observations) Too many runs? Too few runs? Just enough?

Consulting Number of Expected Runs Table

### Expected Runs Table

**Count Useful Observations Only – Ignore Points on Median!**

<table>
<thead>
<tr>
<th>Useful Obs</th>
<th>Lower # Runs</th>
<th>Upper # Runs</th>
<th>Useful Obs</th>
<th>Lower # Runs</th>
<th>Upper # Runs</th>
<th>Useful Obs</th>
<th>Lower # Runs</th>
<th>Upper # Runs</th>
<th>Useful Obs</th>
<th>Lower # Runs</th>
<th>Upper # Runs</th>
<th>Useful Obs</th>
<th>Lower # Runs</th>
<th>Upper # Runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3</td>
<td>9</td>
<td>23</td>
<td>7</td>
<td>17</td>
<td>36</td>
<td>13</td>
<td>25</td>
<td>49</td>
<td>19</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>10</td>
<td>24</td>
<td>8</td>
<td>18</td>
<td>37</td>
<td>13</td>
<td>25</td>
<td>50</td>
<td>19</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td>11</td>
<td>25</td>
<td>8</td>
<td>18</td>
<td>38</td>
<td>14</td>
<td>26</td>
<td>51</td>
<td>20</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>11</td>
<td>26</td>
<td>9</td>
<td>19</td>
<td>39</td>
<td>14</td>
<td>26</td>
<td>52</td>
<td>20</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>12</td>
<td>27</td>
<td>10</td>
<td>19</td>
<td>40</td>
<td>15</td>
<td>27</td>
<td>53</td>
<td>21</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5</td>
<td>12</td>
<td>28</td>
<td>10</td>
<td>20</td>
<td>41</td>
<td>15</td>
<td>28</td>
<td>54</td>
<td>21</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>13</td>
<td>29</td>
<td>10</td>
<td>20</td>
<td>42</td>
<td>16</td>
<td>28</td>
<td>55</td>
<td>22</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>13</td>
<td>30</td>
<td>11</td>
<td>21</td>
<td>43</td>
<td>16</td>
<td>28</td>
<td>56</td>
<td>22</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>6</td>
<td>14</td>
<td>31</td>
<td>11</td>
<td>22</td>
<td>44</td>
<td>17</td>
<td>29</td>
<td>57</td>
<td>23</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>6</td>
<td>15</td>
<td>32</td>
<td>11</td>
<td>23</td>
<td>45</td>
<td>17</td>
<td>30</td>
<td>58</td>
<td>23</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>6</td>
<td>16</td>
<td>33</td>
<td>12</td>
<td>23</td>
<td>46</td>
<td>17</td>
<td>31</td>
<td>59</td>
<td>24</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>7</td>
<td>16</td>
<td>34</td>
<td>12</td>
<td>24</td>
<td>47</td>
<td>18</td>
<td>31</td>
<td>60</td>
<td>24</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>7</td>
<td>17</td>
<td>35</td>
<td>12</td>
<td>24</td>
<td>48</td>
<td>18</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table is based on about a 5% risk of failing the run test for random patterns of data. Adapted from Swed, Feda S. and Eisenhart, C. (1943). “Tables for Testing Randomness of Grouping in a Sequence of Alternatives.” Annals of Mathematical Statistics. Vol. XIV, pp.66 and 87, Tables II and III.


Table for Checking for Too Many or Too Few Runs on a Run Chart
4 Run Chart Rules are used to identify non-random signals

- **A Shift:** 6 (8 > 20)

- **A Trend:** 5 (6 > 20)

- **Too many or too few runs**

- **An astronomical data point**

Adapted from The Data Guide by L. Provost and S. Murray, Austin, Texas, 2011, page 78
3. Astro? ____

<table>
<thead>
<tr>
<th>Date</th>
<th>Data 1</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 1, 2023</td>
<td>784.0</td>
<td>615.5</td>
</tr>
<tr>
<td>2</td>
<td>714.0</td>
<td>615.5</td>
</tr>
<tr>
<td>3</td>
<td>711.0</td>
<td>615.5</td>
</tr>
<tr>
<td>4</td>
<td>2000.0</td>
<td>615.5</td>
</tr>
<tr>
<td>5</td>
<td>800.0</td>
<td>615.5</td>
</tr>
<tr>
<td>6</td>
<td>800.0</td>
<td>615.5</td>
</tr>
<tr>
<td>7</td>
<td>700.0</td>
<td>615.5</td>
</tr>
<tr>
<td>8</td>
<td>591.0</td>
<td>615.5</td>
</tr>
<tr>
<td>9</td>
<td>555.0</td>
<td>615.5</td>
</tr>
<tr>
<td>10</td>
<td>616.0</td>
<td>615.5</td>
</tr>
<tr>
<td>11</td>
<td>855.0</td>
<td>615.5</td>
</tr>
<tr>
<td>12</td>
<td>605.0</td>
<td>615.5</td>
</tr>
<tr>
<td>13</td>
<td>617.0</td>
<td>615.5</td>
</tr>
<tr>
<td>14</td>
<td>598.0</td>
<td>615.5</td>
</tr>
<tr>
<td>15</td>
<td>615.0</td>
<td>615.5</td>
</tr>
<tr>
<td>16</td>
<td>577.0</td>
<td>615.5</td>
</tr>
<tr>
<td>17</td>
<td>584.0</td>
<td>615.5</td>
</tr>
<tr>
<td>18</td>
<td>614.0</td>
<td>615.5</td>
</tr>
<tr>
<td>19</td>
<td>316.0</td>
<td>615.5</td>
</tr>
<tr>
<td>20</td>
<td>426.0</td>
<td>615.5</td>
</tr>
</tbody>
</table>

Aggregate Average % patients with Individualized Inpatient Care Plan-Monthly
Jan 2019-November 2019

% with Care Plan

Month (N)

Data 1  Median
Run Chart Template

v. 2.0 • 5-30-2016
Developed by Richard Scoville, PhD. (richard@rscoville.net)

<table>
<thead>
<tr>
<th>Date</th>
<th>Observation</th>
<th>Value</th>
<th>Median</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>19</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>10</td>
<td>34</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>8.5</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>12</td>
<td>15</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>13</td>
<td>12</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>17</td>
<td>19</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>18</td>
<td>14</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>19</td>
<td>18</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>20</td>
<td>14</td>
<td>15</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Don't leave any blank cells in the Date/Observation column.
Enter an 'x' into the orange column to freeze and extend the median. Enter a 'n' into the orange column to create a new median (phase).
Enter your graph title and y axis label into the cells.

Run Chart Tool | IHI - Institute for Healthcare Improvement

Graph Title
Exercise

• Join your team’s breakout room
• Select one member to share their screen
• Use the data and run chart maker worksheet (attached to the meeting invite and also in the chat) to create your run chart
  • Cut and paste the two columns of data from the “Fantasy Data” tab into columns B and C of the Run Chart tab
• Interpret your run chart using run chart rules on tab in IHI run chart maker (DON’T NEED TO APPLY RULE 3 THAT REQUIRES THE TABLE—ONLY APPLY SHIFT, TREND AND ASTRONOMICAL POINT RULES)
• Select one member of the team for brief report back on your findings and experience making the run chart
Taking Action on Variation

Random variation only, no signal (act on process/system)
  • Develop and test theories that might result in improvements to the system

Signal of non-random variation: Shift, Trend, Too Many/Few Runs, Astro (act on points)
  • If positive: Investigate and propagate
  • If negative: Investigate and eliminate
What are the two types of variation and what is the appropriate action?

<table>
<thead>
<tr>
<th>Type of Variation</th>
<th>Random Variation</th>
<th>Non-Random Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate Action</td>
<td>Change the Process</td>
<td>Investigate and</td>
</tr>
<tr>
<td></td>
<td>(if improvement needed)</td>
<td>• Propagate if positive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Eliminate if negative</td>
</tr>
<tr>
<td>Inappropriate</td>
<td>Treat each (or any) data point</td>
<td>Ignore</td>
</tr>
<tr>
<td>Action</td>
<td>as a special occurrence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(aka tampering)</td>
<td></td>
</tr>
<tr>
<td>Consequences of</td>
<td>Increased variation</td>
<td>If positive – lost</td>
</tr>
<tr>
<td>Inappropriate</td>
<td>Frustration</td>
<td>opportunity</td>
</tr>
<tr>
<td>Action</td>
<td>Waste of money</td>
<td>If negative – make things</td>
</tr>
<tr>
<td></td>
<td></td>
<td>worse</td>
</tr>
</tbody>
</table>
4. What can a control chart show me that a run chart doesn’t?
What other important things might I need to know about data?
# Lead and Lag Measures

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Lag</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reflect what we want to improve Mortality and Morbidity data</td>
<td>Reflect key processes and changes that contribute to achieving the aim of a related lag measure % of those with HTN with BP cuff @d/c</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Time delay between tests of change and the desired improvement</td>
<td>Provide earlier signals of improvement when tightly linked to lag measure of improvement</td>
</tr>
<tr>
<td>Collection</td>
<td>Data may lag due to complexities related to data collection, assessment, and frequency reported</td>
<td>May be collected locally, i.e., at point of service; more frequently; more sensitive to change than a lag measure</td>
</tr>
</tbody>
</table>

Source: Jane Taylor, EdD, Improvement Advisor
% patients screened for SDoH
Aggregate and Small Multiple Run Charts
Stratification by race
Example from infant mortality data
More than 20% of data points at 0 or 100%?

- Time [days, hours, minutes] between
  
  - Number between (e.g., cases, patients, units, visits etc.)
    
    - Both use the same set of run chart rules
    - UP is the direction of goodness
Industry uses them a lot!

- Most are familiar with the time between measures...
Plotting Rare Events (over 20% of data are at zero)

• Can result in too many zeros to make run chart useful
• Makes interpretation difficult and chart of little value for learning
• Useful alternative is to chart time or cases between undesirable events
  • Up is always good for these charts
Time or Number Between Rare Events

• A time (or number) between measure is an alternative to a standard run chart when the incident of interest is relatively rare and a measurement of time (or number) between each occurrence of the incident can be obtained.

• The time (or number) between run chart allows the evaluation of each incident to be evaluated as it occurs rather than having to wait to the end of a standard time period before the data point is plotted.
Time Between Rare Events

Instead of plotting the number of incidences each month, plot the time (or number of cases, patients, visits, etc) between incidences.

Plot a point each time an incidence occurs.
Cases Between Rare Events

**FIGURE 3.28 Run Chart Resulting in Too Many Zeros**

**FIGURE 3.29 Run Chart of Cases Between Undesirable Events**

HC Data Guide: p. 92
Leaving in Action

- Practice developing a family of measures for a personal or work improvement project (or review an existing set for usefulness)
- Practice putting data in the run chart template (can be work related or personal data such as # steps/day)
- Practice applying the run chart rules to your run charts
- Based on the story in your data, what is the appropriate action?
- Upload anything you would like us to see and/or review to the Shared Folder!
Next Call & Office Hours

• Monday, May 1\textsuperscript{st}, 2023  2:00-4:00 pm EDT
  • Qualitative Data
  • Holding the Gains
  • Sustaining Improvement and Cohort Learning
Resources

- **NICHQ:**
- **The Health Care Dat Guide: Learning from Data for Improvement**, Lloyd P. Provost, Sandra K. Murray, Jossey Bass
- **Run Charts (Part 1)** | IHI - Institute for Healthcare Improvement
- **Run Charts (Part 2)** | IHI - Institute for Healthcare Improvement
- **Control Charts (Part 1)** | IHI - Institute for Healthcare Improvement
- **Control Charts (Part 2)** | IHI - Institute for Healthcare Improvement
Thank you!

We are improvers at heart.
We want to hear and learn from your experiences during these sessions.

Please take a moment to complete the brief evaluation before signing off!