

Selecting Improvers & Shining Stars G-Charts & Funnel Plots

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Learning Objectives

- Develop an understanding of G-charts including:
 - How they differ from P-charts and Funnel plots
 - When and how they allow for earlier and/or real time identification of improvement
 - Potential shortcomings/limitations
- Describe how we selected which metrics to examine and how we identified improvers/shining stars
- Discuss how to interpret de-identified G-charts
- *Note: The main focus of this session is to learn additional QI methods rather than focusing on data and individual center improvement. Improvers and shining stars will be shared in the Learning Session intro.*

How did we get here?

- In Phase II, we have primarily used P-charts and Funnel plots to identify improvement and have been primarily looking at collaborative level data
- More recently, we have reached sufficient patient numbers (>3900) to evaluate and detect improvement at the individual center level
- We can now identify and celebrate individual centers who have excelled/shown improvement, focusing on data relevant to ongoing collaborative-wide improvement projects

What is a G-chart

- A “geometric” chart is an alternative way to look at data when the incident of interest is relatively rare and some determination of opportunity (improvement) can be tracked
- Improvements are indicated by more patients reaching the desired outcome between patients experiencing the undesired outcome

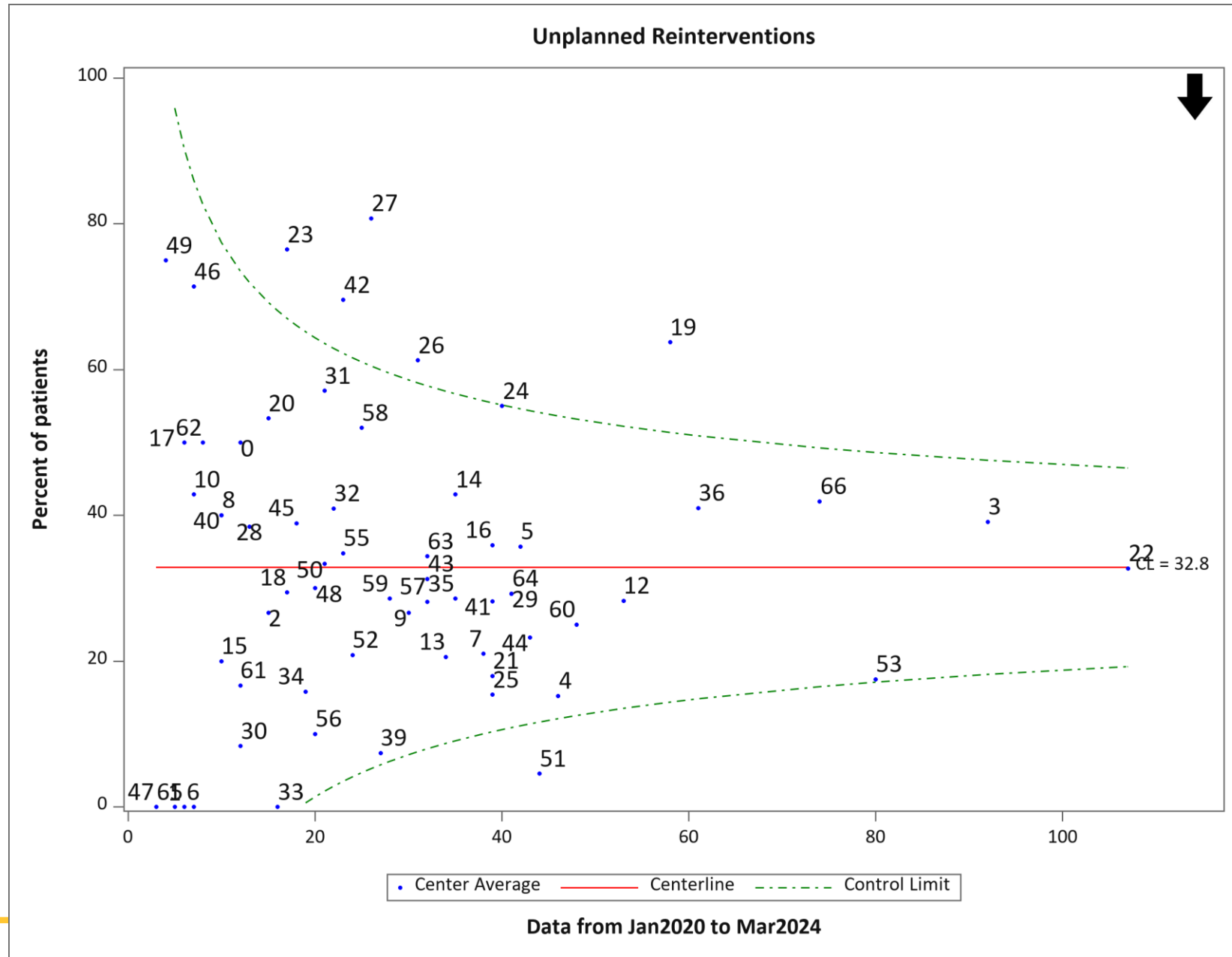


♥ Sensitive Material ♥

The content that is about to be shared might be considered sensitive for some members of the community.

Please feel free to take a break or step away, if needed.

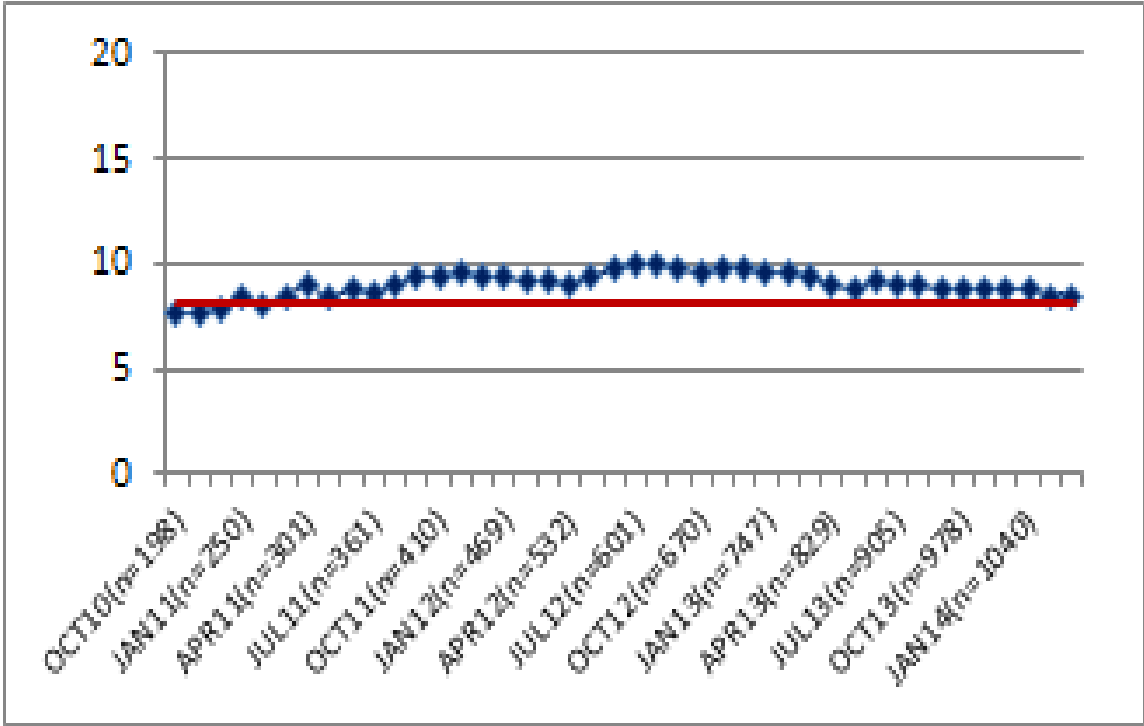
Funnel Plot



Phase 1 mortality P-chart and G-chart

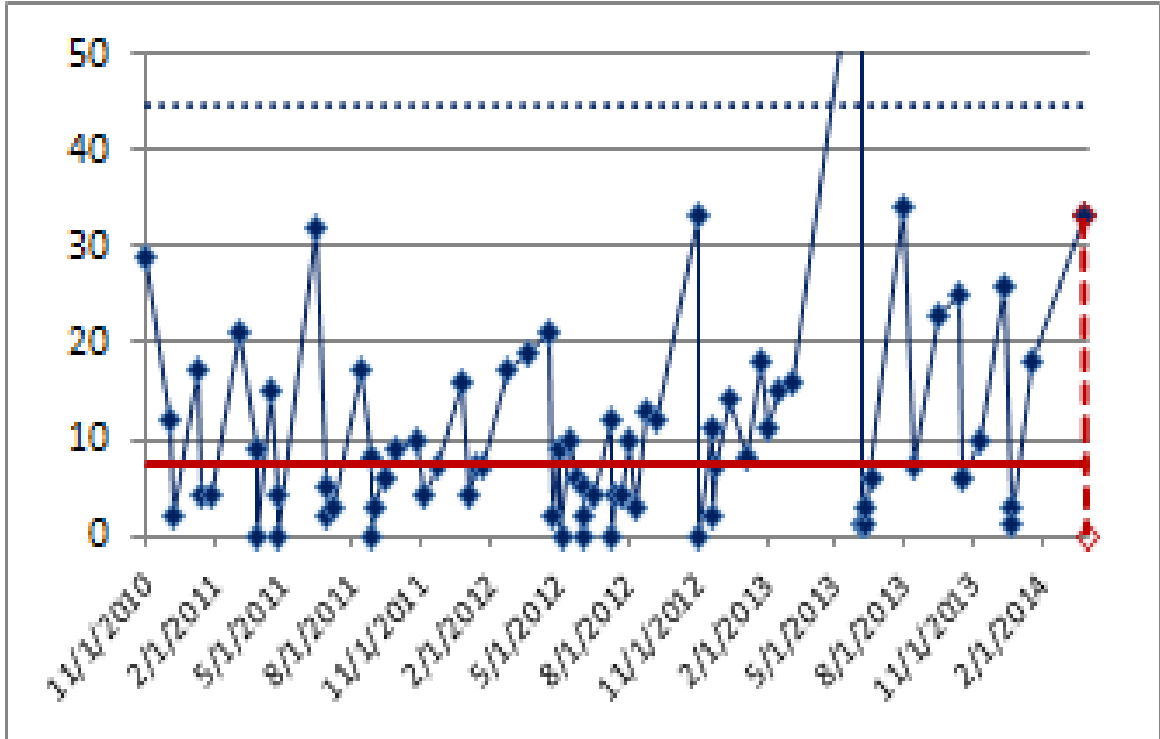
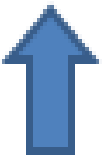
1. Mortality

Percent of patients who died out of all patients who died, had a Glenn or heart transplant



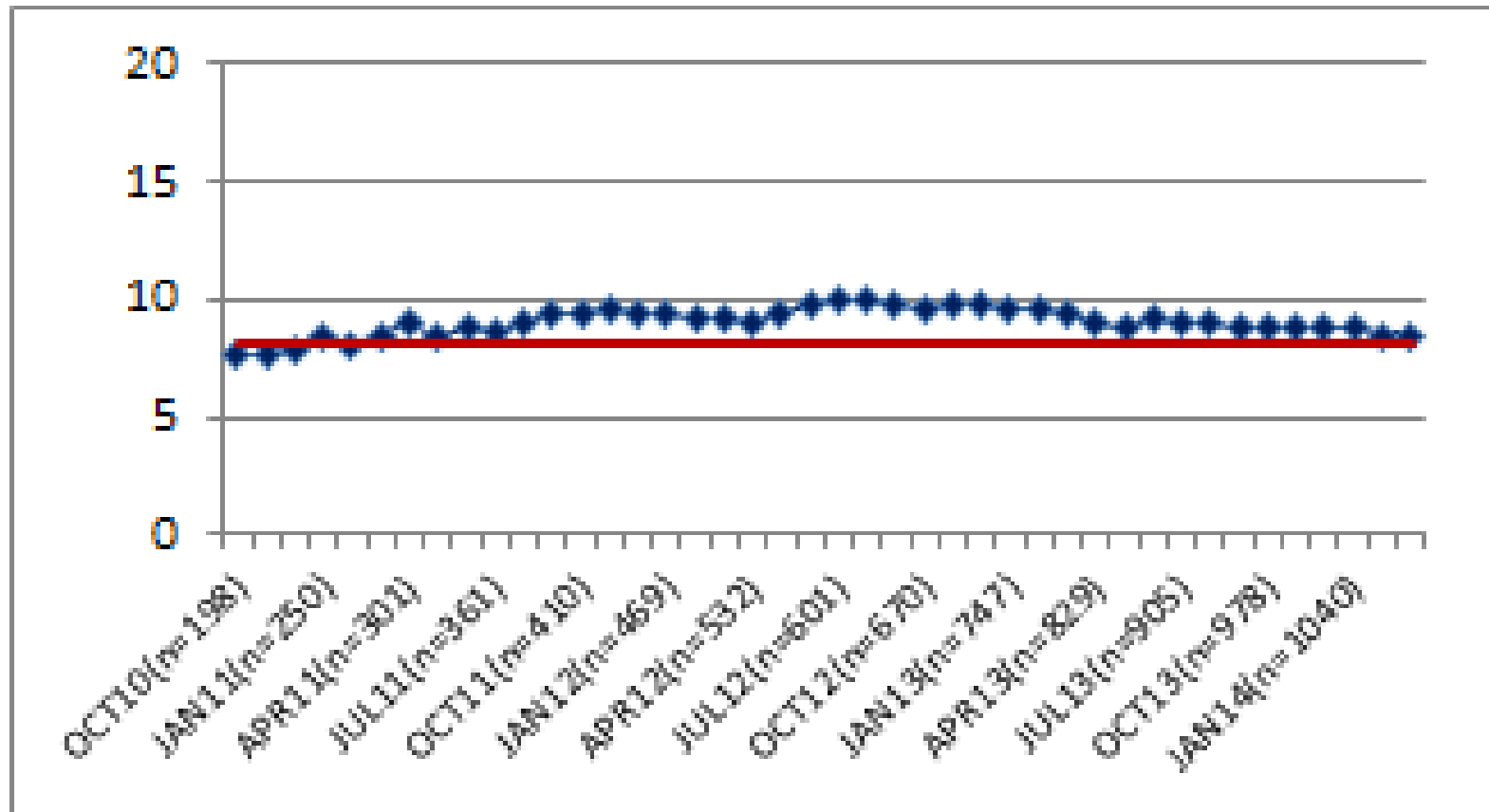
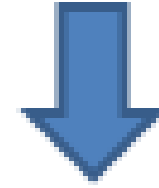
2. Mortality G-Chart

Number of patients who completed Glenn between each death. Last point is no. of patients who completed Glenn since the last death.



1. Mortality

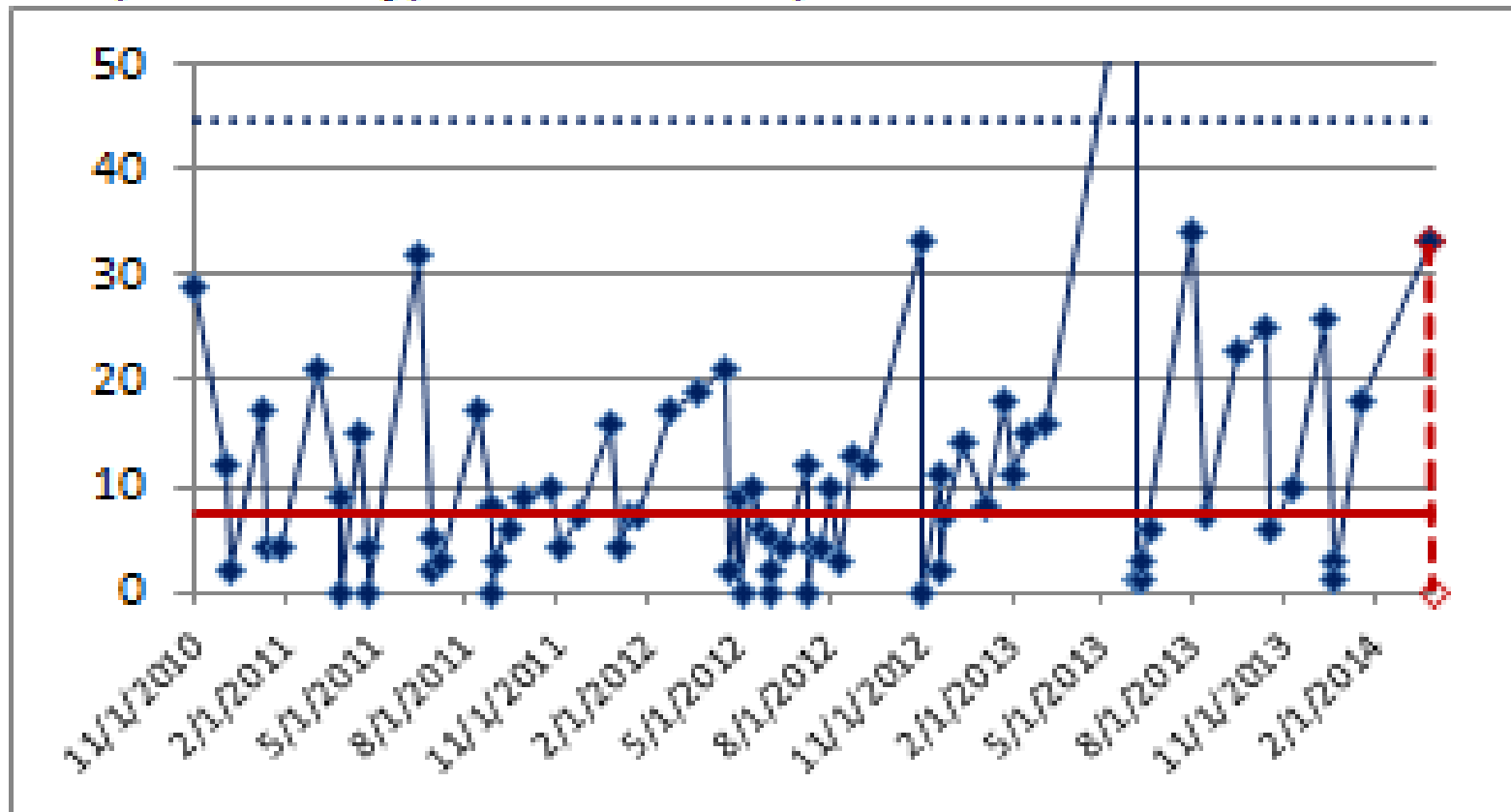
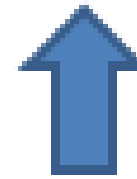
Percent of patients who died out of all patients who died, had a Glenn or heart transplant



2. Mortality G-Chart

Number of patients who completed Glenn between each death.

Last point is no. of patients who completed Glenn since the last death.



What is a G-chart?

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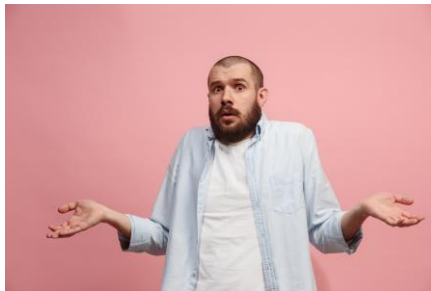




Polling Question

How comfortable are you with G charts?

1. No idea what's going on
2. Have seen them, but never used them
3. Basic understanding of the G chart
4. Can interpret most G charts with minimal assistance
5. Create my own G charts for fun on the weekends



G Chart - Introduction

- SPC Charts allow us to measure changes in our system; creating a centerline based on average values of data.
- Often these data are measured as percent of total events (P charts) or number of events per a denominator (U charts).
- When the standard attribute charts cannot be used due to rare events, a G-chart can be used in its place.

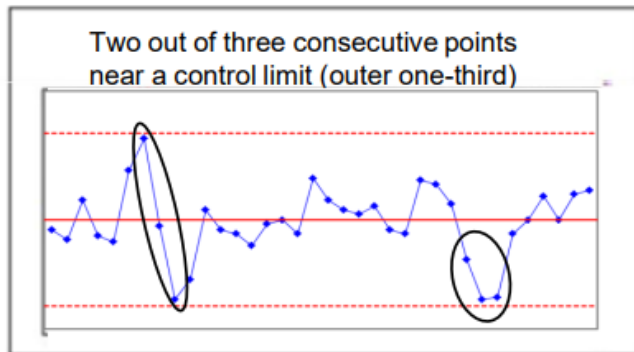
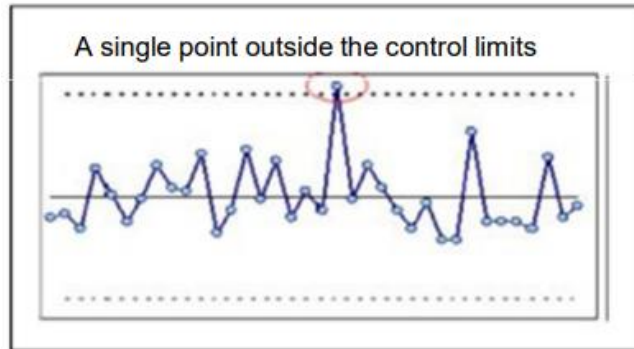


G Chart Advantages

- Allows for measuring improvements in a quicker timeframe than with other attribute charts
 - Does not require bucketing data into months or other time blocks
- Removes the effect rare events can have on typical attribute SPC charts (i.e. sufficient sample size)
 - P charts require a certain number of events per month to calculate
 - For instance, measures that have centerlines at 10% would require at least 14 patients per month.
 - Rarer events would require an even larger number of patients per month.

Provost LP, Murray SK. The Health Care Data Guide – Learning From Data for Improvement. 2nd Ed. Hoboken, NJ: John Wiley & Sons, Inc.; 2022.

G Chart Disadvantages



Disadvantages:

- Difficulty in interpretation as many of the chart elements are modified from typical attribute charts
 - Why we are here today
- No LCL is available for measuring change
 - Other special cause rules can still be used
- Small numbers can still be an issue with collecting enough data to interpret

Template maintained by The James M. Anderson Center for Health Systems Excellence at Cincinnati Children's Hospital Medical Center.

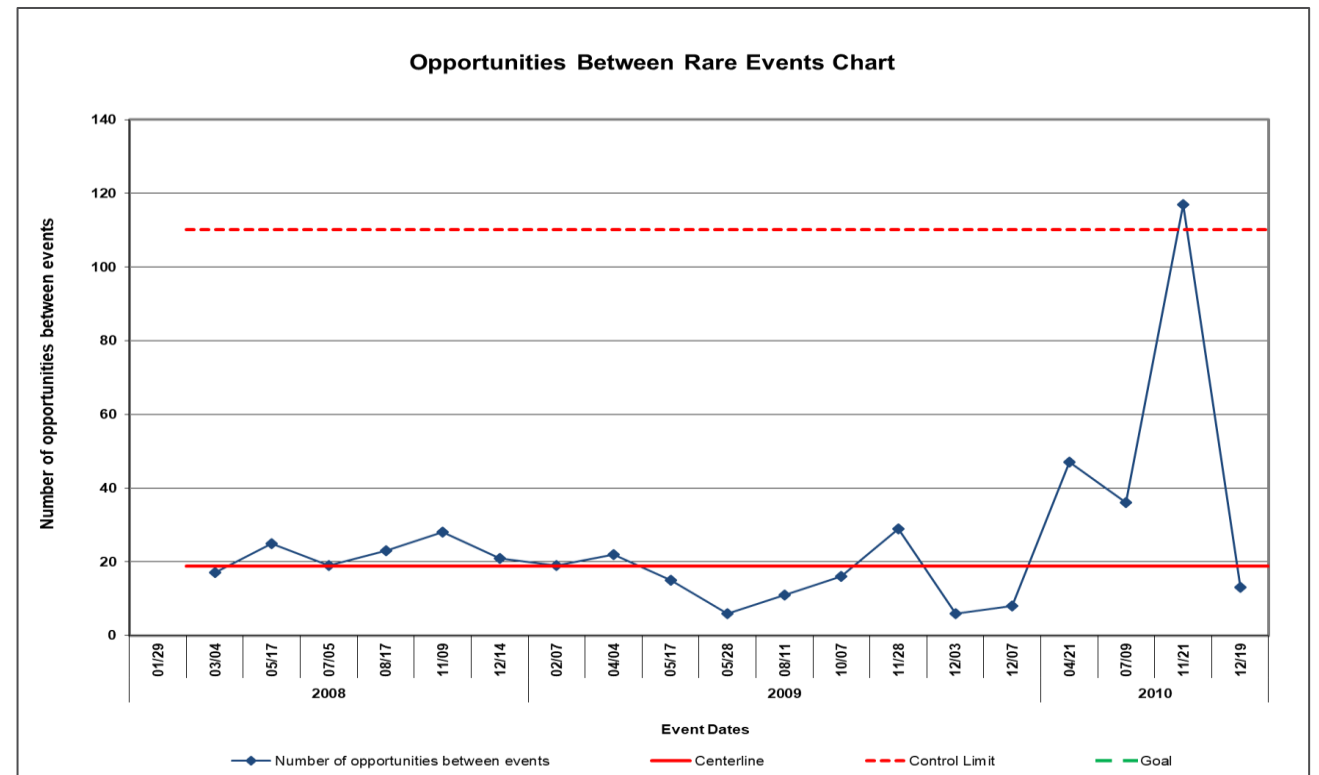
Organizing the data

- Data for C, U, and P charts are typically organized by various date buckets (i.e. # or rate of some outcomes per month).
- Data for G charts are aggregated by number of successful events between non-conforming events.
- In the table to the right, we can see how the data are calculated for both a C and G chart.

Data for C Chart		Data for G Chart	
Month	Number of Readmissions	Date of Readmission	Consecutive Admissions Since Last Readmission
1/1/2008	1	1/29/2008	
2/1/2008	0	3/4/2008	17
3/1/2008	1	5/17/2008	25
4/1/2008	0	7/5/2008	19
5/1/2008	1	8/17/2008	23
6/1/2008	0	11/9/2008	28
7/1/2008	1	12/14/2008	21
8/1/2008	1	2/7/2009	19
9/1/2008	0	4/4/2009	22
10/1/2008	0	5/17/2009	15
11/1/2008	1	5/28/2009	6
12/1/2008	1	8/11/2009	11
1/1/2009	0	10/7/2009	16
2/1/2009	1	11/28/2009	29
3/1/2009	0	12/3/2009	6
4/1/2009	1	12/7/2009	8
5/1/2009	2	4/21/2010	47
6/1/2009	0	7/9/2010	36
7/1/2009	0	11/21/2010	117
8/1/2009	1	12/19/2010	13

Anatomy of a G chart: What am I looking at?

- G charts use many of the same elements that are used on various SPC charts, they are just modified to represent that data differently:
 - Title and labels
 - X-axis
 - Y-axis
 - Plotted values
 - Upper control limit (UCL)
 - Centerline (CL)



For those centers wanting more:

Below are the key elements and formulas used in creating G charts:

- Number of opportunities between = g
- Number of subgroups = k
- Average = $\bar{g} = \sum g/k$
- Centerline = $0.693 \bar{g}$
- Upper Confidence Limit = $\bar{g} + 3\sqrt{\bar{g}(\bar{g} + 1)}$

Provost LP, Murray SK. The Health Care Data Guide – Learning From Data for Improvement. 2nd Ed. Hoboken, NJ: John Wiley & Sons, Inc.; 2022.

Selection Criteria

- During the Learning Session, a list of improvers and shining stars will be shared.
- These centers were chosen using the following criteria:
 - **Shining stars** – Outside the funnel plot in a favorable direction for the measure from January 2020 through February 2024
 - **Improvers** – a point above the upper control limit (UCL) in G chart measure during January 2022 – February 2024

Understanding G charts: Interactive Exercises

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Dipping our toes in....together

Date of Patient's first birthday	100% Oral feeds at 1st birthday
6/27/2017	Success
7/28/2017	Failure
9/22/2017	Success
10/11/2017	Success
11/29/2017	Failure
2/18/2018	Failure
3/11/2018	Failure
7/10/2018	Failure
7/13/2018	Failure
10/2/2018	Success
1/23/2019	Failure
3/13/2019	Success
5/25/2019	Success
5/29/2019	Success
6/3/2019	Failure

Sort for Failures
→

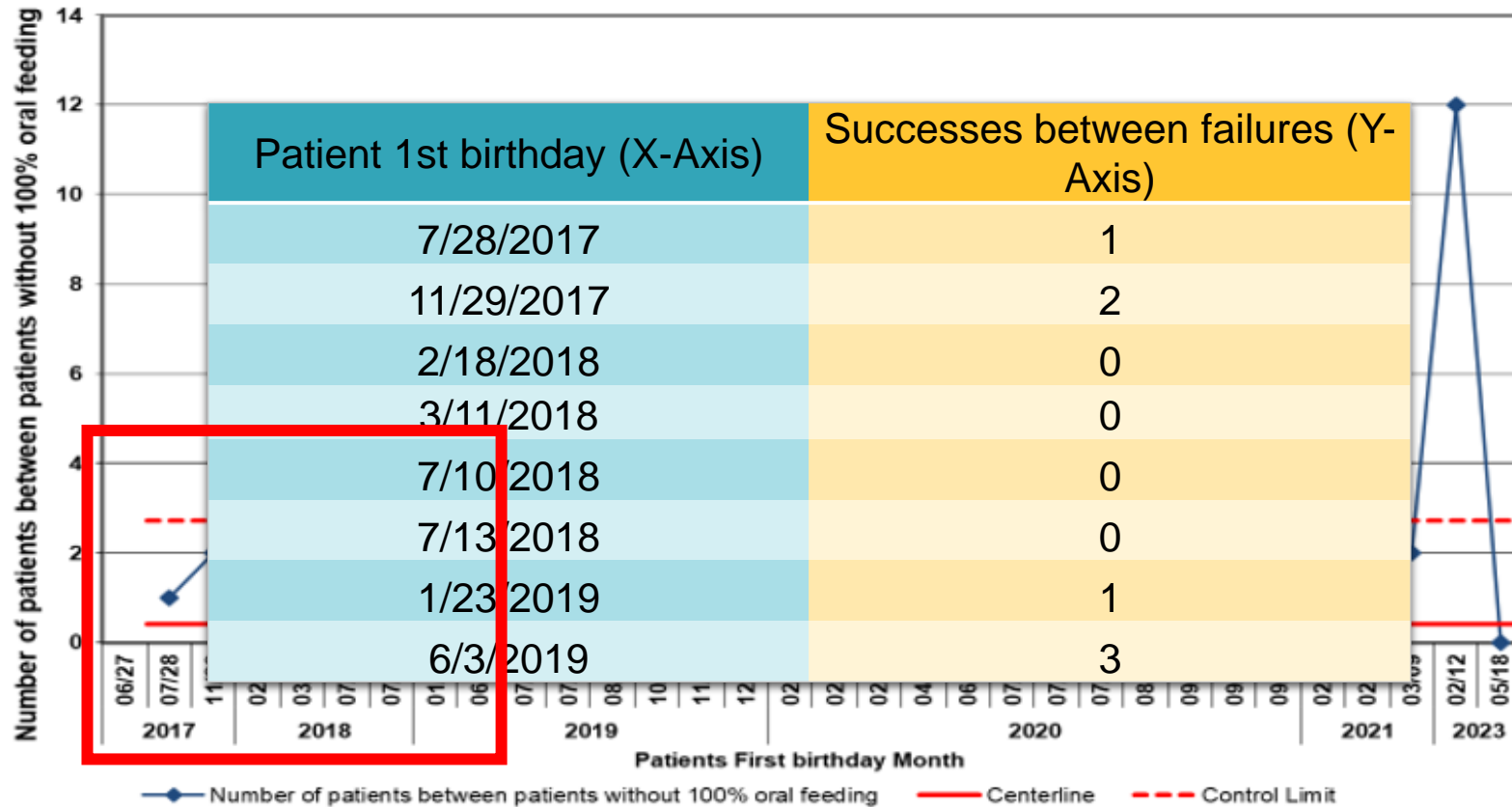
X-axis

Y-axis

Date of Patient's first birthday	100% Oral feeds at 1st birthday	Successes between failures
7/28/2017	Failure	1
11/29/2017	Failure	2
2/18/2018	Failure	0
3/11/2018	Failure	0
7/10/2018	Failure	0
7/13/2018	Failure	0
1/23/2019	Failure	1
6/3/2019	Failure	3

Dipping our toes in....together

Number of consecutive patients with 100% Oral feeds between the patients without 100% Oral Feeds at 1st Birthday



Show us what you can do

Date of Admission	Prenatal Support
1/18/2020	Yes
3/2/2020	No
3/29/2020	No
4/1/2020	Yes
5/19/2020	Yes
6/4/2020	No
6/29/2020	No
7/11/2020	Yes
8/3/2020	No
9/23/2020	Yes
9/31/2020	Yes
10/27/2020	No
11/3/2020	No
11/31/2020	Yes
12/22/2020	No

Sort for Failures
→

Date of Admission	Successes between
3/2/2020	1
3/29/2020	0
6/4/2020	2
6/29/2020	0
8/3/2020	1
10/27/2020	2
11/3/2020	0
12/22/2020	1

Questions for consideration:

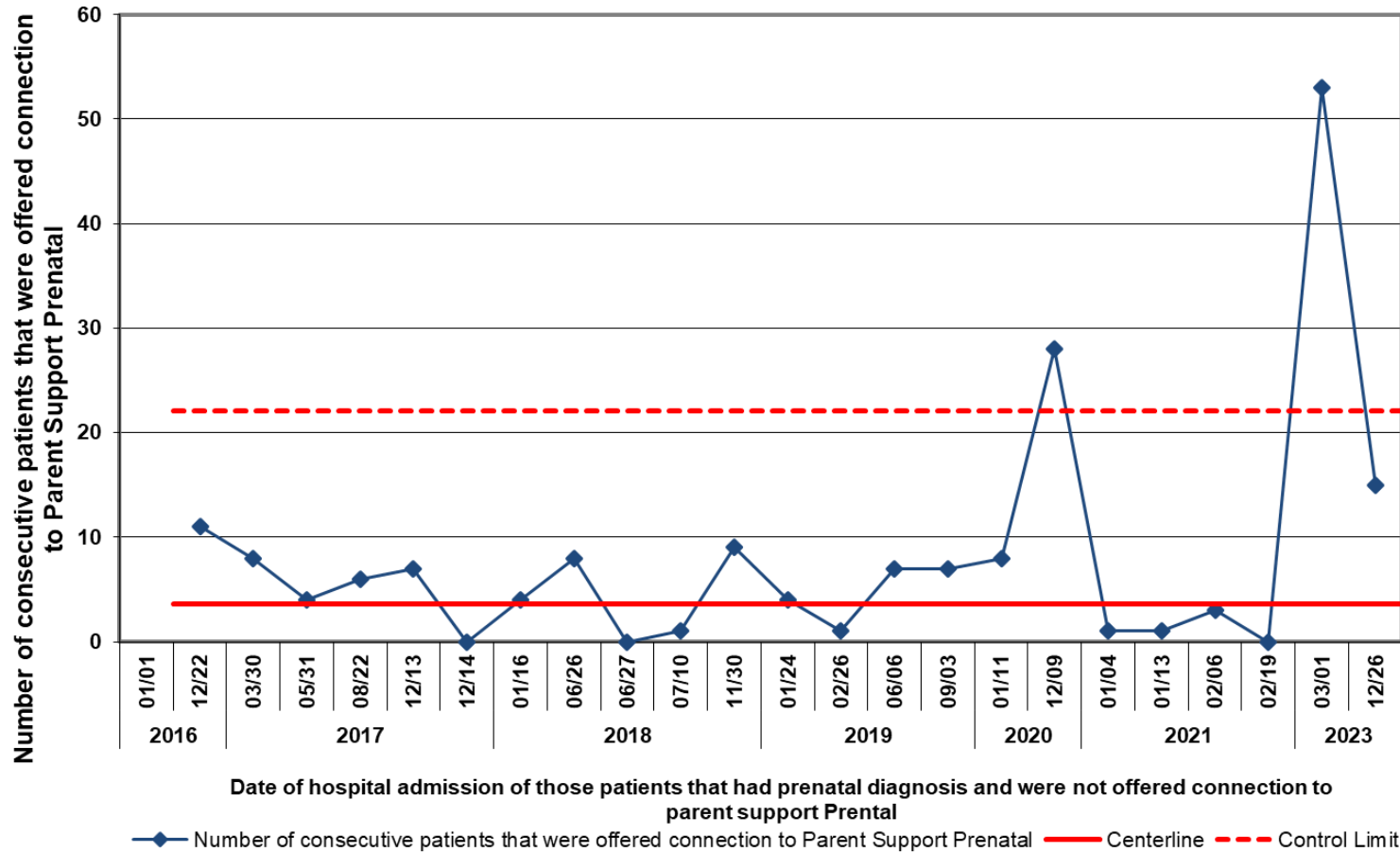
- *What are considered the non-conforming events?*

Show us what you can do

Questions for consideration:

- *Where would you look first on this G chart? Why?*

Offered Connection to Parent Support - G Chart

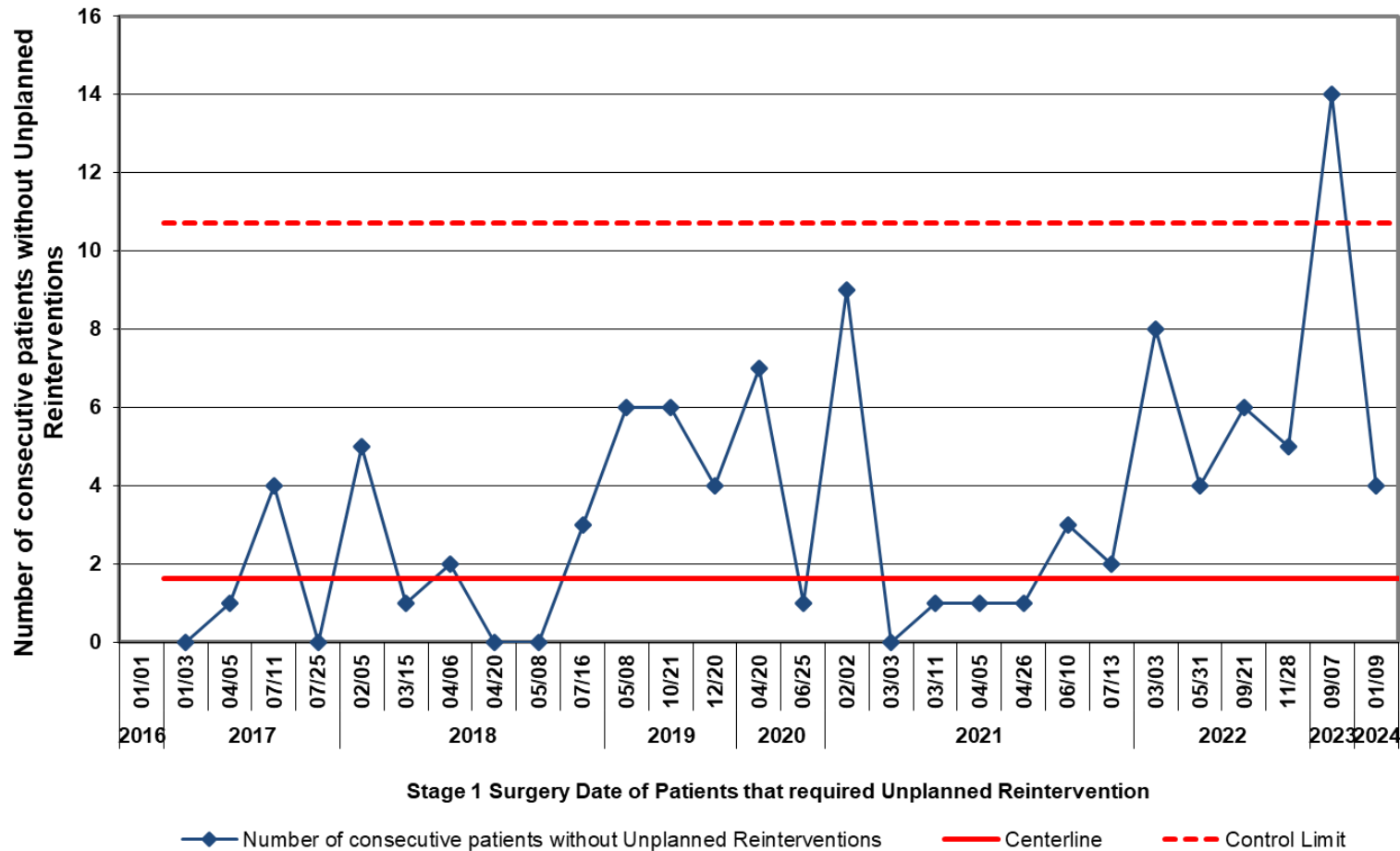


Show us what you can do

Questions for consideration:

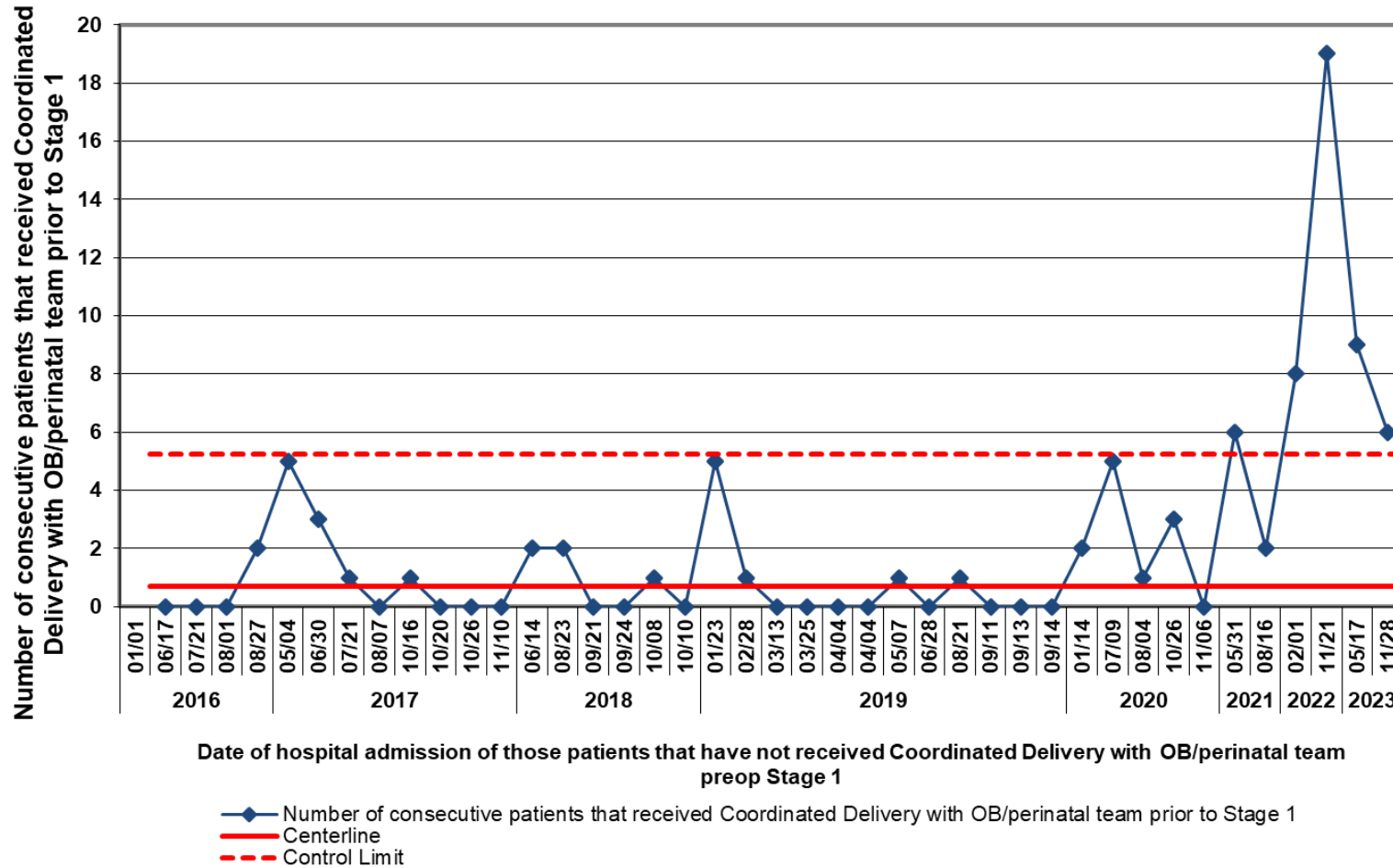
- *What does the centerline represent?*

Unplanned Reinterventions - G Chart



Show us what you can do

Coordinated Delivery - G Chart

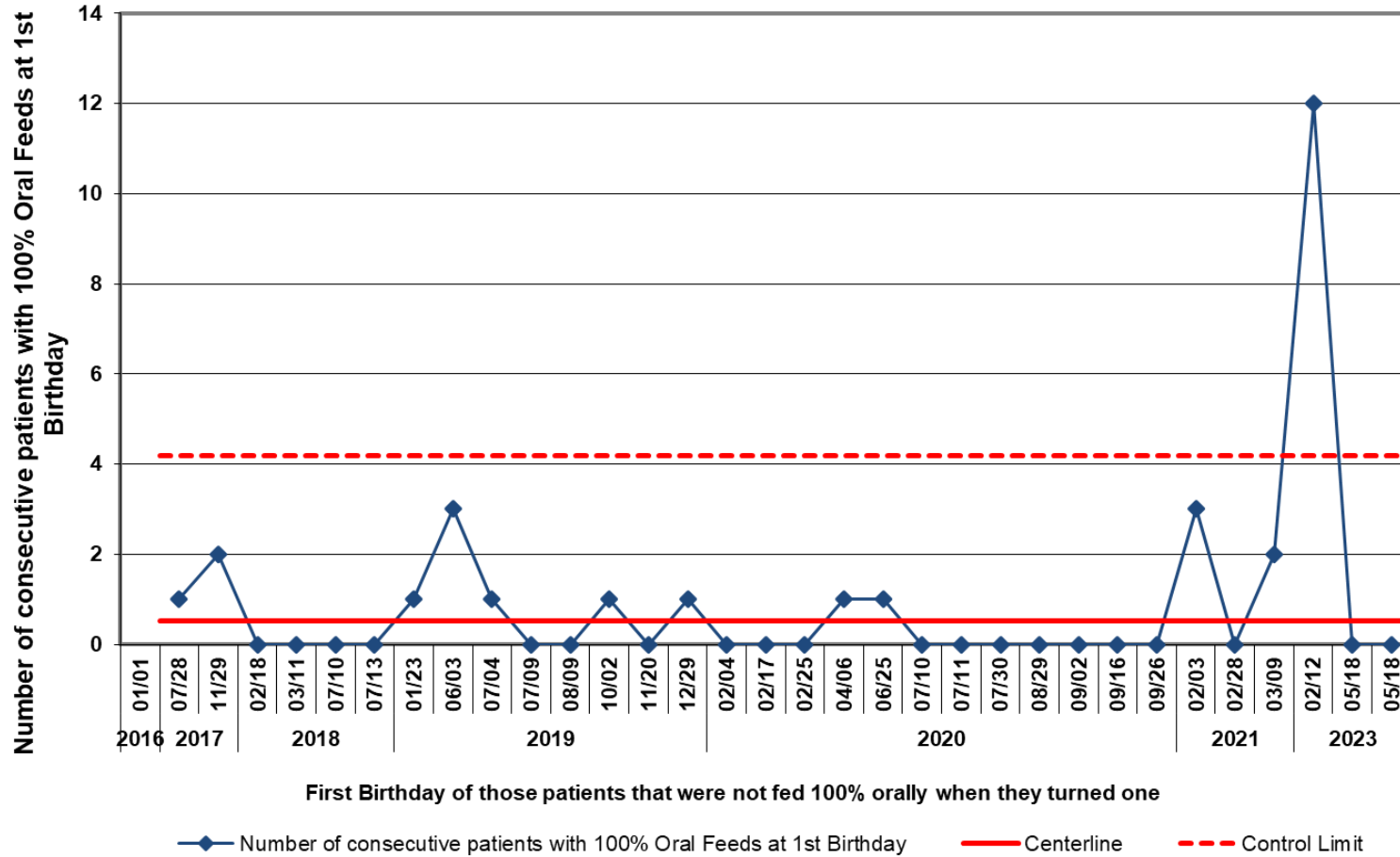


Questions for consideration:

- How would explain what this chart is showing?

Show us what you can do

All Oral Feeding at 1st Birthday - G Chart



Questions for consideration:

- How would you summarize what the chart is telling us?

Next Steps

- Continue to look at center level G-charts to identify improvers in other areas
- Continue to celebrate those centers that show improvement
- Potentially create a list of centers that have improved in certain areas to allow other centers to reach out to improvers for thoughts on how they achieved success

Questions?