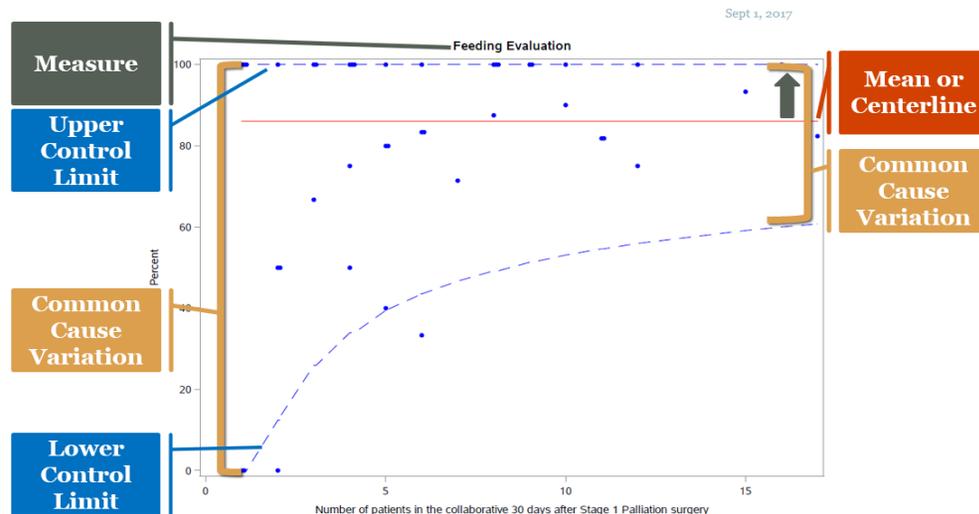


How in the world do you read a funnel plot?

For all of us non-data experts, here is what we hope is an easy to understand yet ever so accurate (thanks to our data team friends who reviewed it!) overview of funnel plots – what they show, how to interpret them, and how to be careful not to misinterpret them when it comes to our NPC data.



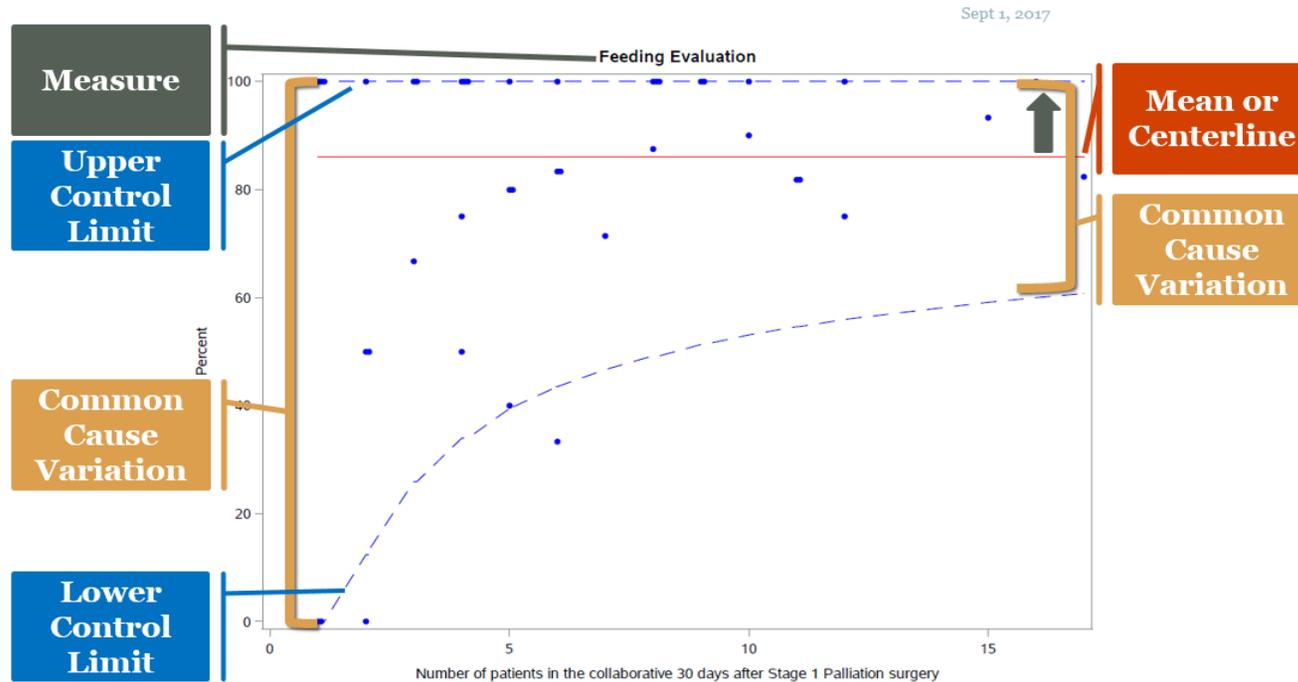
Funnel plots show variation within a system – or, in this case, within our Collaborative

There are many different data sets that the hospitals within our Collaborative collect and submit to NPC in order to identify best practices and improve outcomes across all centers. The funnel chart is a modified version of control charts in that it has a centerline, an upper and a lower control limit. It differs from control charts in that this method accounts for sample size of individual clinics. The data are displayed in an increasing order of sample size: the clinics with fewer patients are presented first (on the

left side of the x-axis). Because small sample sizes have the largest variability, the control limits are wide on the left side and get narrower toward the right, as sample size increases. Funnel plots are developed to show the variation in outcomes within the Collaborative and to identify if clinics deviate from the collective average. For centers that are substantially different from the average (far above or below the centerline), we would want to take action: we would want to learn the unique best practices of centers with measures substantially better than the average, and identify opportunities for improvement for the centers with measures substantially worse than the average. Centers with worse outcomes may want to learn from centers with better outcomes.

It is important to note that funnel plots show a **snapshot of the Collaborative**, and not how data is changing over time, as we are used to learning from Run/Control Charts in our Collaborative Learning Labs. For this reason, the funnel plot should indicate over what time period the data is summarized.

Parts of a Funnel Chart



- Measure = The specific data set with a defined measure being examined, such as growth outcomes
- Upper Control Limit = Upper boundary to identify if there is any data point above it which can be due to special cause.
- Lower Control Limit = Lower boundary to identify if there is any data point below it which can be due to special cause.
- Centerline/Mean = representing the average of the collaborative
- Common Cause Variation = Data points plotted within the upper and lower control limits are due to normal variation/situation. It is the area on the chart where we can't conclude that differences in the clinic results are important/due to special cause.

Changing Arrow Directions

Depending on the data that is being represented in the funnel plot, falling outside the upper control limit may be “bad” or falling outside the lower control limit may be “bad”. Use the desired direction arrow (in orange circles below) to take your queue on what is “good” or “bad”. The arrow always points to the improvement direction. If the arrow is down, for the values that fall above the upper control limit, statistics indicate that the results of those clinics are less desirable and for the values that fall below the lower control limit, statistics indicate that the results of those clinics are more desirable. (Image 1) If the arrow is pointed up, the opposite is true: for the values that fall above the upper control limit, statistics indicate that the results of those clinics are more desirable and for the values that fall below the lower control limit, statistics indicate that the results of those clinics are less desirable (Image 2).

IMAGE 1

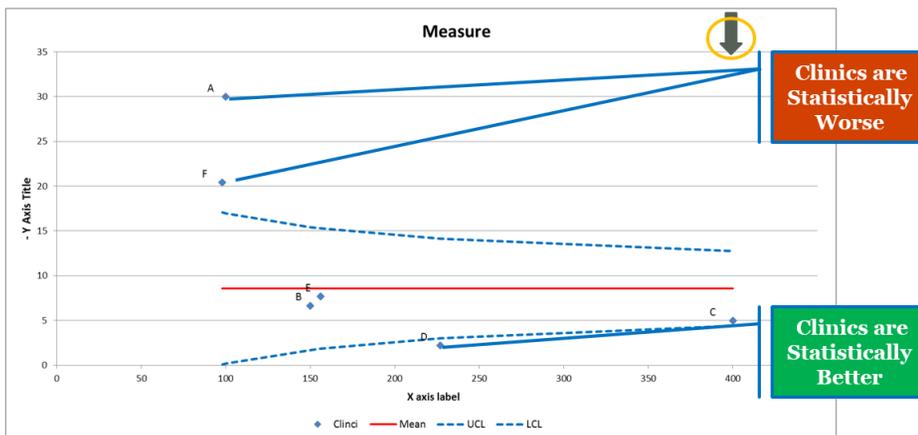
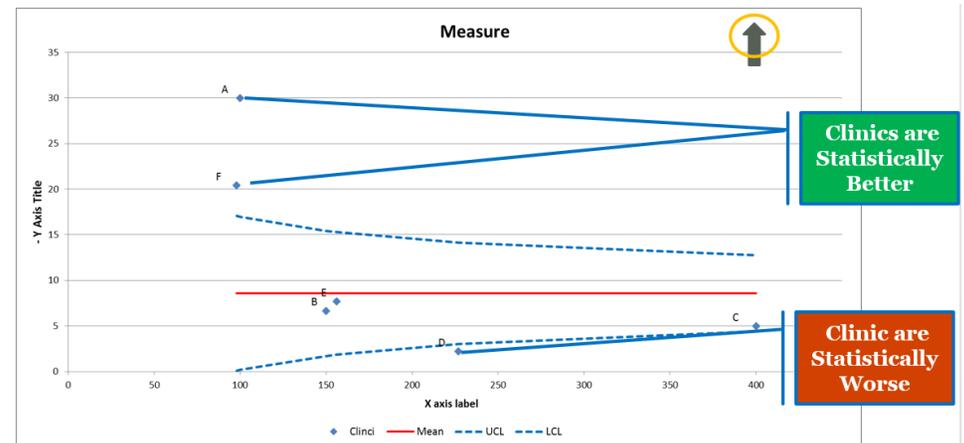


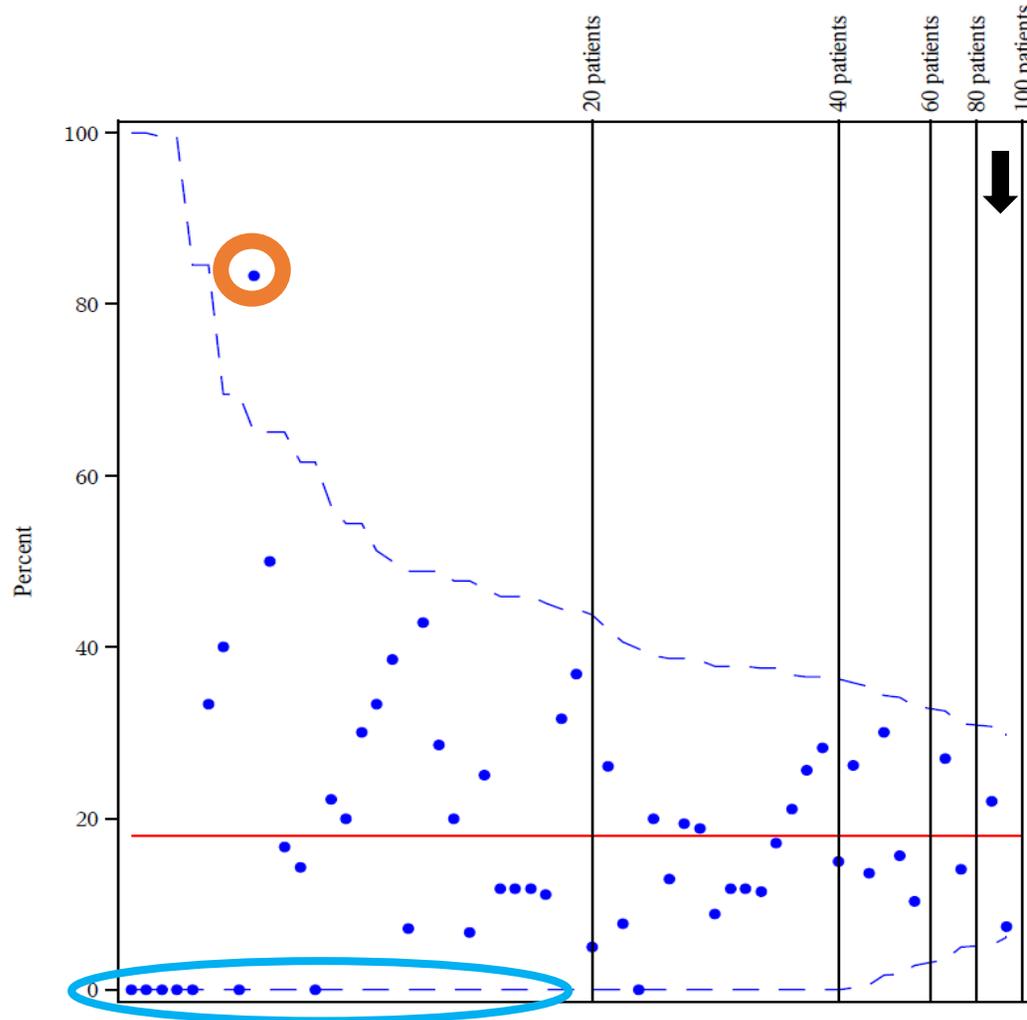
IMAGE 2



Okay, got it. Now how do I read one?

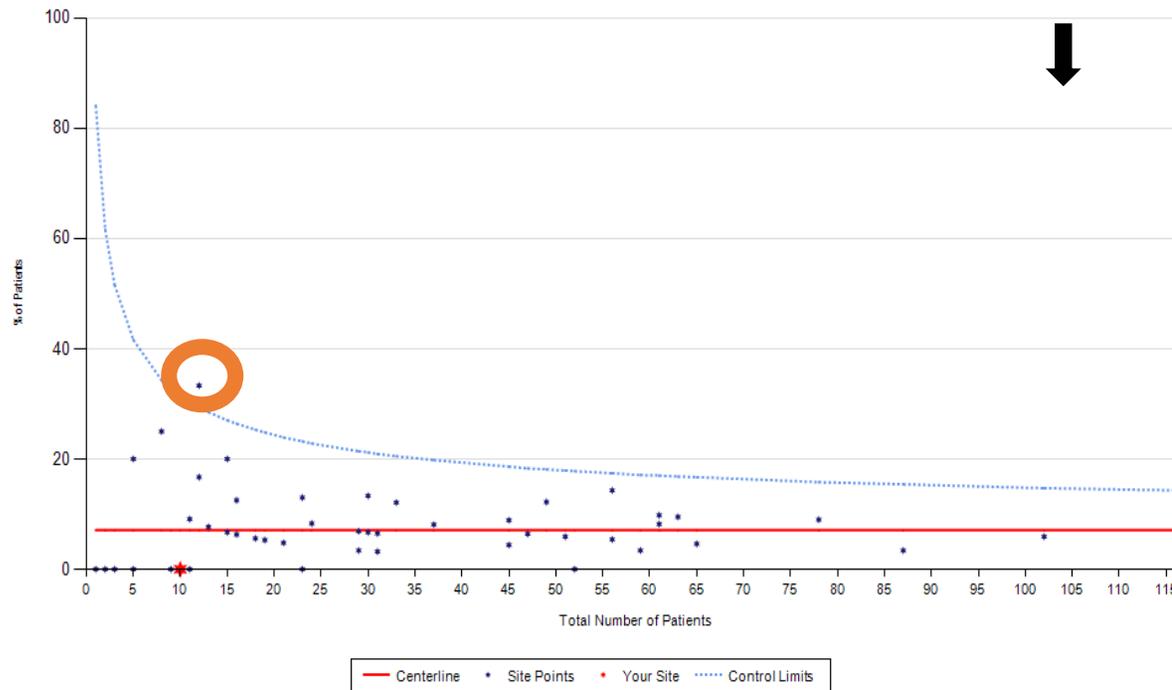
What follows are two examples from our Collaborative to help you see how the data is laid out and understand what it shows. Remember, however, that funnel plots show data as a slice in time and are continuously changing – hence, this data is not necessarily the most up to date data for these measures in the Collaborative. We provide them here merely as examples for learning.

Example 1: Growth Failure Chart for patients discharged, Phase I data



- The total number of patients entered into the interstage registry by sites is along the x axis in increasing order from left to right.
- The percent of patients discharged with Growth Failure is along the y axis. So, higher percentages indicate worse outcomes.
- Each dot represents the measure for a center, aligned to the two axes.
- We can see that all sites except one are within the control limits. One site is outside the upper control limit which means that the center performance is statistically different from the average (in orange circle). In this case, because the desired direction arrow is down, this center performs worse than the rest of the Collaborative.
- All clinics with measures within the funnel (contained between the control limits) are *not* statistically different from the collaborative average (the centerline), showing “common cause variation.”
- Note that because the lower control limit is zero for a large part of the funnel, many clinics with a zero (perfect) growth failure rate (in the blue oval) are considered as not different from the average.

Example 2: Interstage Mortality



- The total number of patients entered into the interstage registry by sites is along the x axis.
- The % of interstage patient deaths at each site is along the Y axis.
- All sites **but one** are within the control limits, suggesting there is no statistical difference among most sites in terms of mortality during the interstage for those patients in the registry. One site is outside the control limits, with a higher mortality than can be explained by common cause variation.

One more important note – this can get tricky!

For the non-data experts, it may seem logical to assume that centers above the centerline/mean are doing better than those below the mean – but that is not necessarily true. All measures that are within the funnel (between the control limits) are considered as the product of common cause variation, which means that none of them are doing statistically better or worse than the collective average.

References

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HAELO Innovation and Improvement Science Center. Understanding a Funnel Plot: <http://www.haelo.org.uk/funnel-plot/>. Accessed September 2017. IHI Open School, Control Charts (Part 1 & 2): <http://www.ihio.org/education/IHIOpenSchool/resources/Pages/AudioandVideo/Whiteboard14.aspx>. Accessed October 2017.