Run Charts

The Qualis Health Run Chart Tool (also called line graph) allows you to track performance over time to see if you have made progress. You can apply this approach to any quality improvement project (clinical, business, satisfaction, etc.).

Plotting Data

The measure (e.g., number of patient falls, readmission rate) is shown on the vertical axis and is plotted against time on the horizontal axis.

ENTERING DATA

The first step is to download and save the tool to your computer where you can easily find it. Only enter in BLUE-SHADED cells. All other cells are locked. This tool automatically calculates rates and plots your data on the graph. Be sure to delete all the sample data that is in the spreadsheet before entering your data.

DESCRIPTION OF MEASURE, FACILITY, AIM, GOAL

Enter the measure title, facility name, aim, and numeric goal. The aim statement should be time-specific, measurable, and should define the specific population of patients affected, for example, "Reduce the percent of long-stay high-risk patient with pressure ulcers by 50% within 12 months". The numeric goal will be shown on your graph as a red dashed line and represents your target measure rate.

DATES

You decide on the frequency of the measure, for example, daily, weekly, monthly. For the graph to display properly, **always enter the following information in each table row: date, numerator, and denominator.** The multiplier only needs to be entered once (in the first row) and then will automatically be entered for you. If you are missing results for a specific time period, do not enter a date in the date column. The chart will automatically keep the dates evenly spaced.

METRIC

In this tool, measures are calculated by dividing a numerator (**Num**) by a denominator (**Den**) and then multiplying by a **Multiplier**. The mathematical formula can be written as (Num / Den) x Multiplier.

A measure may be a percentage, count, rate, average, or other statistic. Here are some examples:

Percentage: Percent of patients who fall
Num =   Number of patients who fall
Den =   Total number of patients
Multiplier =   100 (to display the measure as a percentage)

Counts: Number of positional alarms being used in the building
Num =   Number of positional alarms
Den =   1 (any number divided by 1 is equal to that number)
Multiplier =   1 (any number multiplied by is equal to that number)

Rate: Number of adverse drug events per 1000 doses
Num = Number of adverse drug events (ADEs)
Den = Number of doses
Multiplier = 1000

We often use a multiplier to convert very small rates so they are easier to understand. For example, 10 ADEs divided by 2334 doses equals 0.004284 ADEs per dose. This rate becomes 4.284 ADEs per 1000 doses when we multiply the numerator and denominator by 1000.

Average: Average hemoglobin A1c level for population of patients with diabetes
Num = Sum of all hemoglobin A1c levels for population of patients with diabetes
Den = Number of patients with diabetes
Multiplier = 1

COMMENTS
Enter comments (and comment letter) to show changes you made (e.g., pilot testing a new pain assessment protocol) or event that might impact performance (e.g., flu season or loss of nursing staff) during that time period. Comment letters will be displayed on the run chart.

MEDIAN
This tool automatically calculates and plots the median as the centerline on your run chart. The median provides the point at which half the observations are above and half are below it. You can set the range of data used to calculate the median by placing an "x" in the median column on the row for the date where you want the calculation to stop. By stopping the median calculation after the first few several data points, the median will be "frozen" in time tied to your baseline measurements. This will make it easier to interpret your future data using the rules in the next section of these instructions. The median shows on your chart as a light purple dotted line.

Interpreting Run Charts
Run charts allow us to see if changes we made to a process or system over time lead to improvement. Every measure will show some random variation over time, but may not be a trend or cycle. You also may not recognize when there really is a trend. Here are some objective guidelines to help you decide if your run chart shows improvement or merely random variation. Use the median and these rules to help you interpret your run chart:

RULE 1 – SHIFT
Six or more consecutive points *either* all above or all below the median. Skip all values that fall on the median and continue counting.

RULE 2 – TREND
Five or more consecutive points all going up or all going down. If two or more consecutive points are the same, only count the first and ignore the repeating points.

RULE 3 – NUMBER OF RUNS
A run is a series of consecutive points on one side of the median. Determine the number of runs by counting the number of times the line connecting points crosses the median and add one. Compare the number of runs to the table below. If your number of runs is less than the minimum or greater than the maximum shown, then your run chart is showing non-random variation.

Total number of data points on the run chart that do not fall on the median	Minimum	Maximum
10	3	9
11	3	10
12	3	11
13	4	11
14	4	12
15	5	12
16	5	13
17	5	13
18	6	14
19	6	15
20	6	16
21	7	16
22	7	17
23	7	17
24	8	18

RULE 4 – OUTLIER

An outlier is a point that is obviously different (very large or very small) compared to the rest of the points. It is not the same as the lowest or highest data point, which all run charts will have. An outlier might mean an event or change led to a dramatic change in your measure. It is subjective based on visual examination of your run chart.

Further reading: Perla RJ, Provost LP, Murray SK. The run chart: A simple analytical tool for learning from variation in healthcare processes. BMJ Quality & Safety. 2011 Jan;20(1):46-51

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Examples of Run Charts Showing Non-Random Variation

Rule 1 - Shift

Measure / Time / Median

Rule 2 - Trend

Measure / Time / Median

Rule 3 - Number of Runs

Number of runs = 2 which is fewer than expected for a run chart with 10 data points

Measure / Time / Median

Rule 4 - Outlier

Measure / Time / Median