BUILT FOR ZERO CANADA

MEASURING IMPROVEMENTS WITH RUN CHARTS

MAY 2019

OVERVIEW

Run charts are a powerful data visualization tool that can help Built for Zero Canada communities determine if a test of change or improvement project they introduced resulted in a desired impact (e.g. a reduction in the number of individuals experiencing chronic active homelessness). In other words, run charts can signal if the change in data was the result of **special cause variation** (shows up when some uncommon or special circumstances are introduced, such as an improvement project) or simply **common cause variation** (random, background noise).

Run charts are visualized in a BFZ-C community's Performance Management Tracker once they have at least 7 months of Basic Quality By-Name List (QBNL) data.

This document covers definitions of run charts, trends, shifts, and other relevant key concepts. It also provides detailed information on how to analyze run charts, as well as how to interpret the findings.

MEASURING IMPROVEMENTS WITH RUN CHARTS

Definitions:

Simply put, a **run chart** is a graphical display of a set of data points that are shown in the order they are collected and offer a clear view of how things are changing over time. In a run chart, the y-axis is the value of the number being reported (i.e. number of chronic active homeless) and the x-axis is the unit of time (i.e. months data reported). See Figure 1 for an example of a BFZ-C run chart.

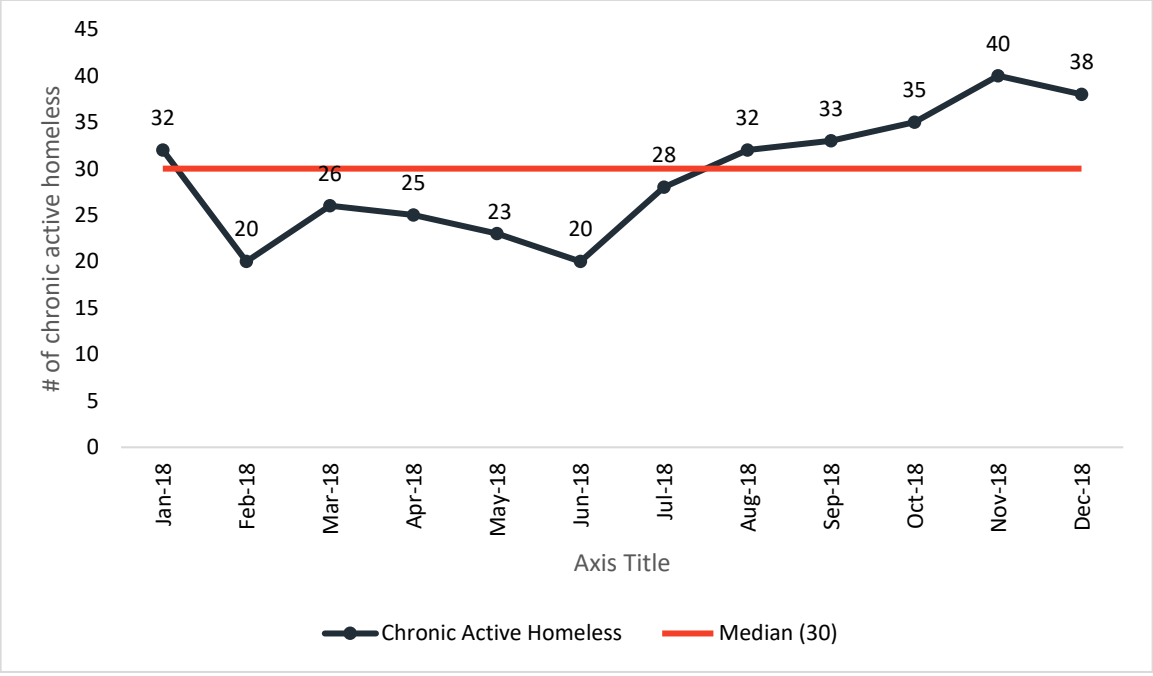

Figure 1: Run Chart Example

BFZ-C supports communities to monitor run charts for shifts and trends. A community must have at least 10 QBNL data points AND the last month of reported data must be within the last three months before a trend or shift can be achieved.

The primary focus is on identifying **downward trends** and **downward shifts** to signal whether an improvement resulted in a reduction their chronic active homeless data. We also monitor other BNL data points, including chronic inflow data, to identify downward trends or downward shifts, and chronic move-in data for **upward shifts** and **upward trends,** to signal whether or not an improvement project had its desired impact.

Downward Trend: There is a downward trend in a run chart when there are at least 5 consecutive data points in a downward trajectory.

Downward Shift: There is a downward shift in a run chart when there are least 6 consecutive data points below the median.

Upward Trend: There is an upward trend in a run chart when there are at least 5 consecutive data points in a downward trajectory.

Upward Shift: There is an upward shift in a run chart when there are least 6 consecutive data points below the median.

Analyzing a Run Chart for Trends & Shifts

BFZ-C communities can analyze a run chart in their Performance Management Tracker to determine if they have achieved a trend or shift. In these data visualizations, the dark blue line represents the BNL data point (e.g. number of chronic active homeless per month), the orange line is the median, and the months reported are along the bottom. Before analyzing the visuals, you need to establish the baseline month and the median.

The **baseline month** is typically the same month that a community achieves a Quality By-Name List. A baseline month may be adjusted or updated, depending on circumstances, but should be done sparingly. Communities should always do this in consultation with a BFZ-C Improvement Advisor or Data Advisor.

The **median** is the value separating the higher half from the lower half of a data sample (or, the "middle" number). In a run chart, the median is initially based on the number of chronic active homeless for 10 months, beginning with the baseline month. This means the median will fluctuate for the first 10 months and then will remain locked in. Once a community achieves a trend or shift, the median will be re-calculated, beginning after the last data point included in the trend or shift.

The following examples demonstrate how to analyze a run chart for downward trends or downwards shifts among a community's chronic active homeless data.

Chronic Active Homeless: Analyzing A Run Chart for a Downward Trend

When analyzing for a **downward trend** we look for a run with **5 or more consecutive data points in a downward trajectory**. There are two important rules to remember when looking for a downward trend:

- The median does not come into consideration
- If the value of two or more successive points is the same, ignore one of the points when counting. Like values do not make or break a trend

In the example below (Figure 2), the community achieved a downward trend between June and November 2018. It took 6 months to show 5 consecutive data points in a downward trajectory since September and October had the same value (remember, if adjacent data points have the same value, skip one and continue counting). It's also important to note that, since 10 months of QBNL data is required, this downward trend would not be confirmed until March 2019.

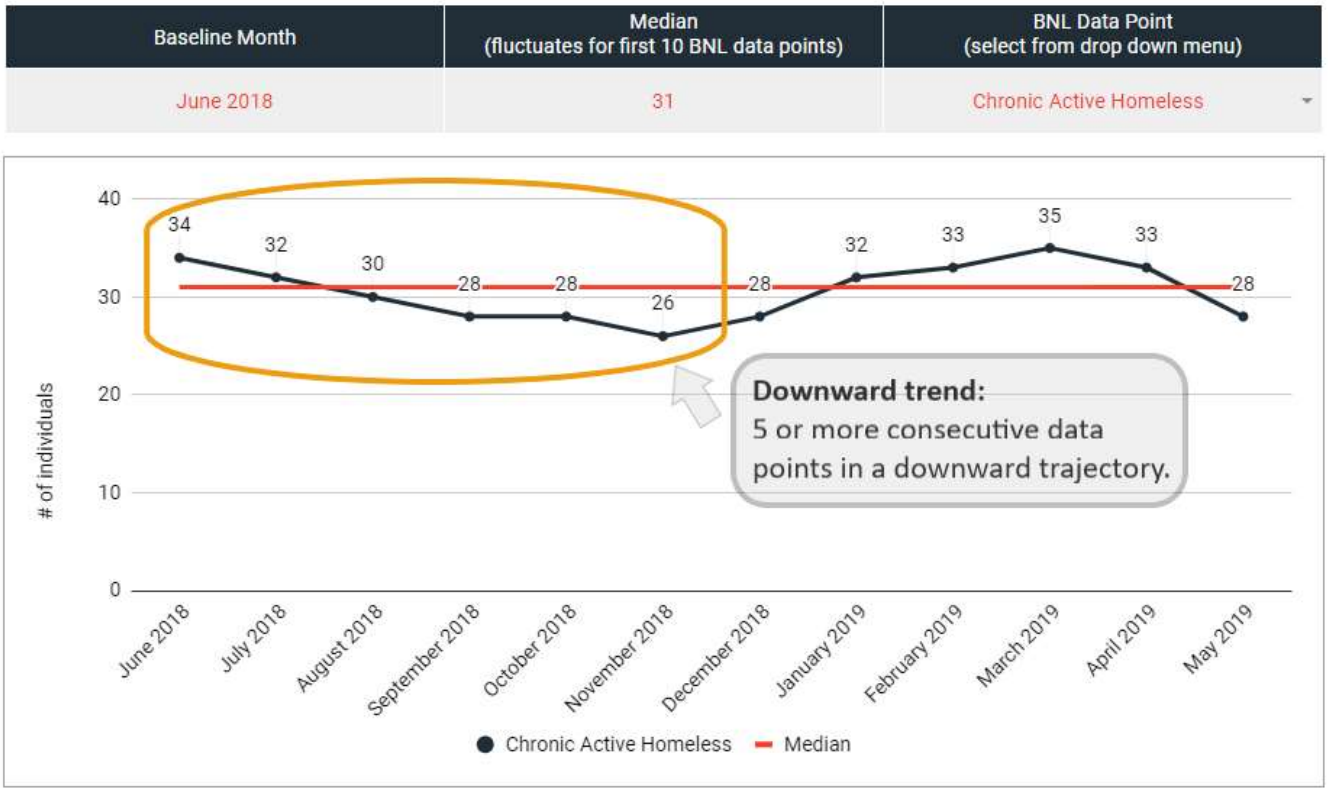

Figure 2: Downward Trend Example

Chronic Active Homeless: Analyzing A Run Chart for a Downward Shift

When analyzing for a **downward shift** we look for a run with **6 or more consecutive data points below the median**. There are two important rules to remember when looking for a downward shift:

- Values that fall on the median do not add to nor break a shift. Skip values that fall on the median and continue counting.
- Values that fall *above* the median break a downward shift. If this occurs, you must start counting again for 6 *consecutive* data points.

In the example below (Figure 3), the community achieved a downward shift between November 2018 and April 2019 with 6 consecutive data points below the median (27).

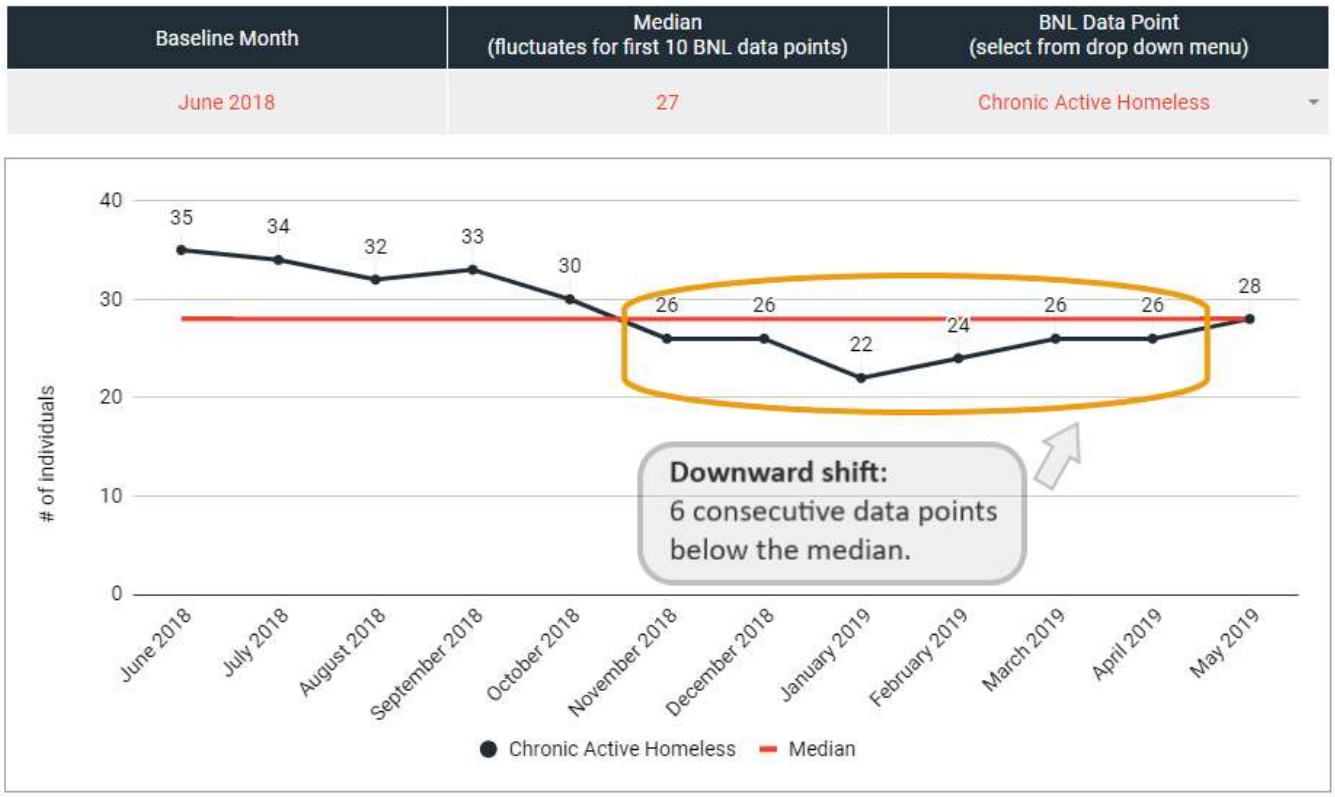

Figure 3: Downward Shift Example

Chronic Active Homeless: Interpreting Downward Trends and Downward Shifts

Downward trends and downward shifts are grounded in statistical theory. The probability of getting five data points that constantly decrease (downward trend) is the same probability as getting five heads in a row on a coin flip (or 0.031 probability). The probability of a shift occurring by chance alone when there has been no real change made to the process is less than 5% chance.

A downward trend or downward shift lets us know that special cause variation has occurred. When this happens, we need to investigate what's going on and why. More specifically, we're looking to

understand the change that was introduced that resulted in reduction in the community's chronic active homeless data. Best case scenario, the change was an improvement project that can be scaled up locally and/or replicated in another community. However, the change could be something else at play. By examining other QBNL data points in the run chart, a community can see what else might be happening within their system.

Consider this example: A community notices that there is a downward shift in their chronic active homeless data by looking at a run chart in their PMT. Upon further investigation, it's also identified that there is a steady increase in their chronic moved to inactive data. A little bit more digging, and we discover that individuals experiencing chronic homelessness are leaving the community due to lack of shelter space. Thus, the reduction in chronic active homeless may not be the result of an improvement, but rather the result of an emergency shelter issue. So, while the change may not be the *result of an improvement*, it does identify an area for *potential improvement*!

Other BNL Data Points: Analyzing and Interpreting Run Charts

While BFZ-C focuses primarily on run charts as a tool to signal improvements among chronic active homeless data, we also look for trends and shifts among other BNL data points. Communities can use the drop-down menu in their PMT Run Chart tab to select other BNL data points to investigate what is happening within their systems. For example, if a community introduces an improvement project aimed at increasing move-ins, they may look to their run chart to show an upward trend or upward shift. This would indicate that special cause variation has occurred, before declaring their improvement project a success. Similarly, if a community was focused on decreasing inflow, they may look to their run chart to demonstrate a downward trend or downward shift. Regardless of the data point, BFZ-C staff are committed to supporting communities to analyze and interpret their run charts as a powerful tool for measuring improvements.

LEARN MORE ABOUT RUN CHARTS

- Institute for Healthcare Improvement (Video): Run Charts
  - Part 1
  - Part 2

- Centre for System Improvement (Video and transcripts):
  - Part 1: Intro
  - Part 2: Variation and Trends
  - Part 3: Shifts
  - Part 4: Runs