Root Cause Analysis *(Identifying relationships and possible causes):*
These tools are designed to assist your organization in examining the relationship of various factors to the targeted performance as well as identifying possible causes for unsatisfactory performance/outcomes.

Root Cause Analysis Tools

a) **Cause and Effect (Fishbone) Diagram**: A schematic drawn to clearly illustrate the various causes affecting a process by sorting out the causes contributing to the effect. The notation format used takes on the appearance of a fish skeleton leading to the name "Fishbone Diagram".
   - Key applications
     - Early in the performance improvement process
     - Assists in focusing on a number of possible causes
   - Benefits
     - To identify possible causes contributing to a possible problem
     - Depict the relationship between the problem and its causes

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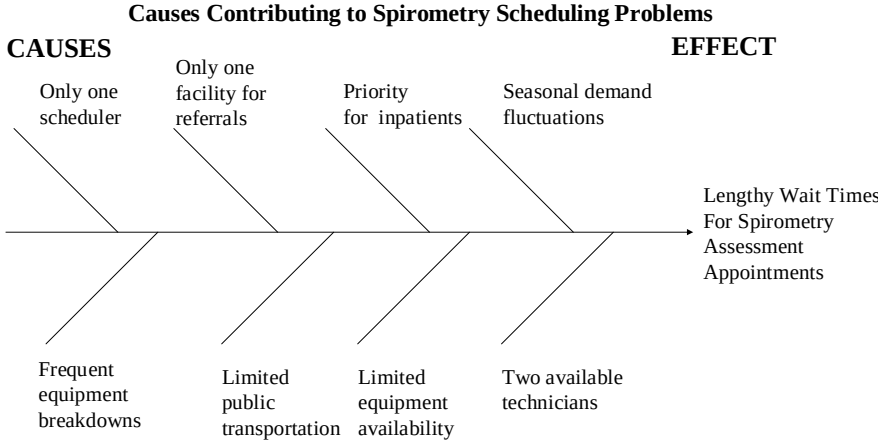
Performance Improvement in Asthma Care

Sample Cause and Effect Diagram

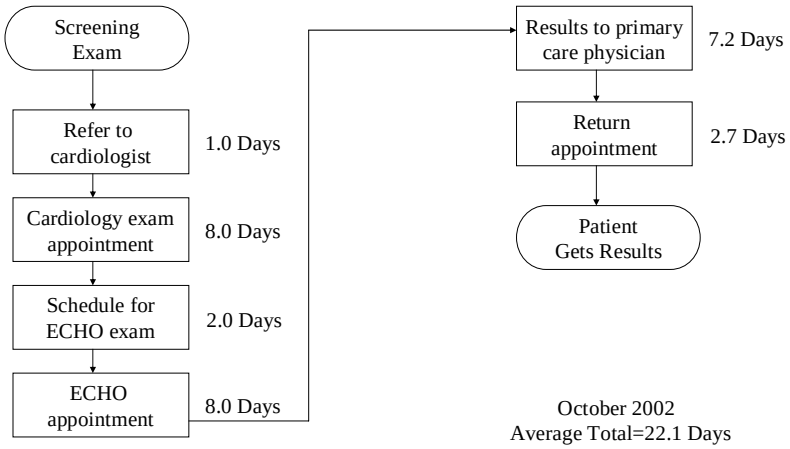


b) **Flowchart**: A diagram illustrating, through the use of common symbols (see Appendices) the step by step path a process follows. Generally a tool used in planning stages.

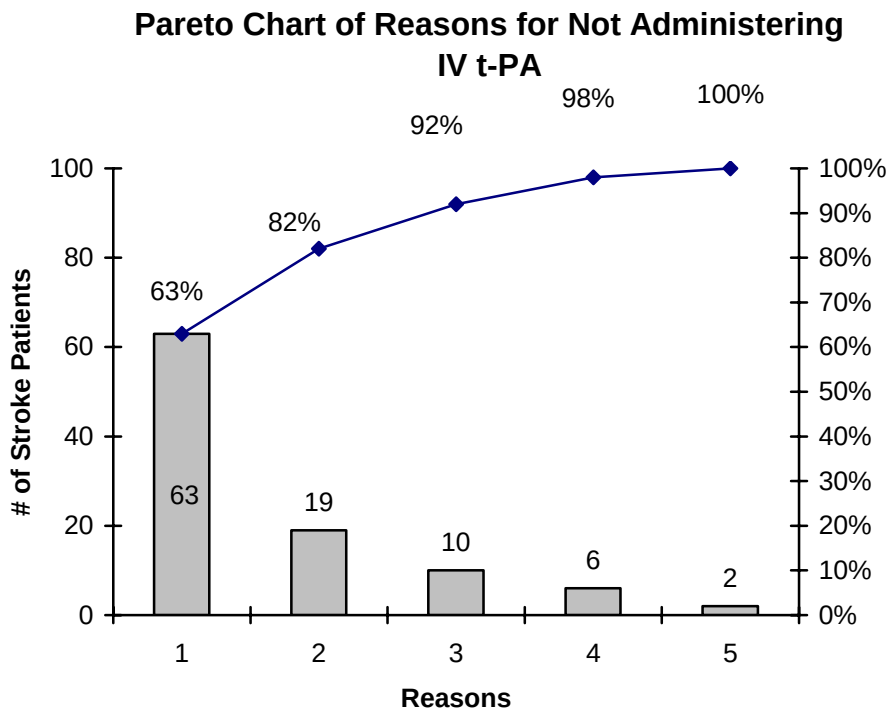
- Key applications
  - When designing new processes, identifying problems, planning solutions
- Benefits
  - Graphically presents the path a process follows, step by step
  - Helps identify inefficiencies, misunderstanding, and redundancies, while providing insight into how a given process should be performed

Performance Improvement in Heart Failure Care

Heart Failure Screening Flowchart
LVF Assessment Process
(Average Data)



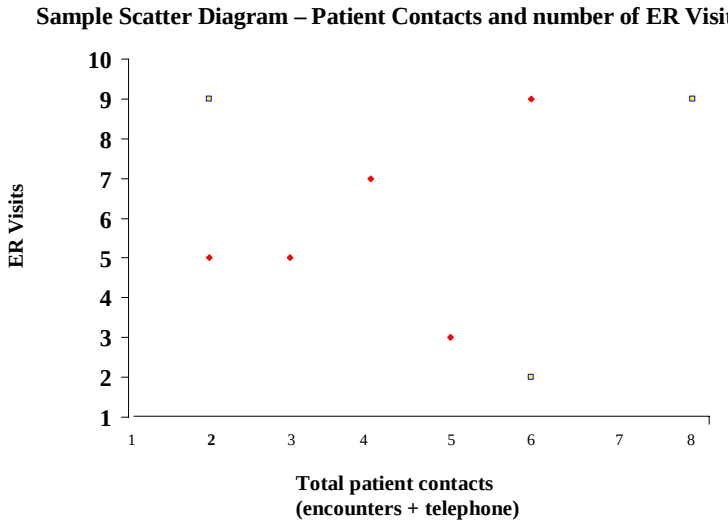
c) **Pareto Chart**: A chart displaying the causes of a problem ranked by order of occurrence. By revealing which causes have the greatest influence, priorities can be set for interventions.
- Key applications
  - Finding causes of a problem, and setting priorities for intervention-focus efforts
  - Bars in rank order of occurrence
  - Bars represent a different variable or problem
- Benefits
  - Reveals which causes of a problem are most important
  - Separate “vital few” (80/20 rule)
- Drawbacks
  - Not applicable to problems with a single cause



Key: 1= IV t-PA given at outside hospital prior to transfer
2= Elevated PTT or PT/ INR
3= History of intracranial hemorrhage
4= IV t-PA offered but patient/family refused
5= No IV access

d) **Scatter Diagram:** This tool is a graph on which variables are represented by individual points. The patterns formed by the individually plotted points reveal the relationship (or lack of) between variables. It does not establish causation but rather the correlation between two factors.

- Key applications
  - Determines whether a correlation exists between two variables: Is variable A related to or affecting variable B?
  - Chart facilitates searching for possible cause and effect relationship (e.g. education accompanied by written instructions with improved self-management)
- Benefits
  - Quick, easy and certain
- Drawbacks
  - Requires a large set of data
  - Indicates a relationship, but not causation



Analysis – Display

These tools are useful for assessing your data. As part of data assessment, analysis tools support sorting, organizing, and aggregating data as well as displaying patterns/trends in performance. These tools provide the keys to unlocking what the data mean and they support accurate interpretation. Analysis can vary in complexity making the selection of techniques and tools an important consideration. It is also important to consider organizational expertise and resources (human and technological), and thoughtfully match the tools with the type and volume of data. The quality improvement professional at your organization is a valuable resource and, if available, should be consulted early and often. Fortunately, there are also many publications now available that provide "how to" guidance that demystifies data analysis and interpretation. Please see the suggested references at the end of this section for the names of a few.

When examining the data collected for the purpose of studying performance it is important to recognize that some variation will exist. For example, if the sales figures at a department store were examined monthly from October to January it would not be surprising to see a steady rise for October to December with a noticeable drop in January. This would be expected due to holiday shopping and would not necessarily mean that there was a problem requiring changes in operations. On the other hand, if sales fell between October and December, there may be some unusual cause; perhaps road construction diverted shoppers to another mall. The patterns of variation in healthcare performance are also subject to normal and unusual variation and therefore it is important to use techniques to understand the variation in a process before taking any action. It should be remembered that these tools will help discern processes that are in *statistical control* (normal variation) versus *out of*

statistical control (special causes of variation). It does not mean that the performance is satisfactory. Using the store example, sales could be in statistical control but be extremely low leading to bankruptcy. Several of the tools reviewed here are designed to help discern between these types of variation.

Common cause variation: Normal variation in any process; not indicative of a process that is out of statistical control.

Examples:

- Number of ambulatory patients seen daily
- Varying levels of patient acuity
- Percentage of incomplete records

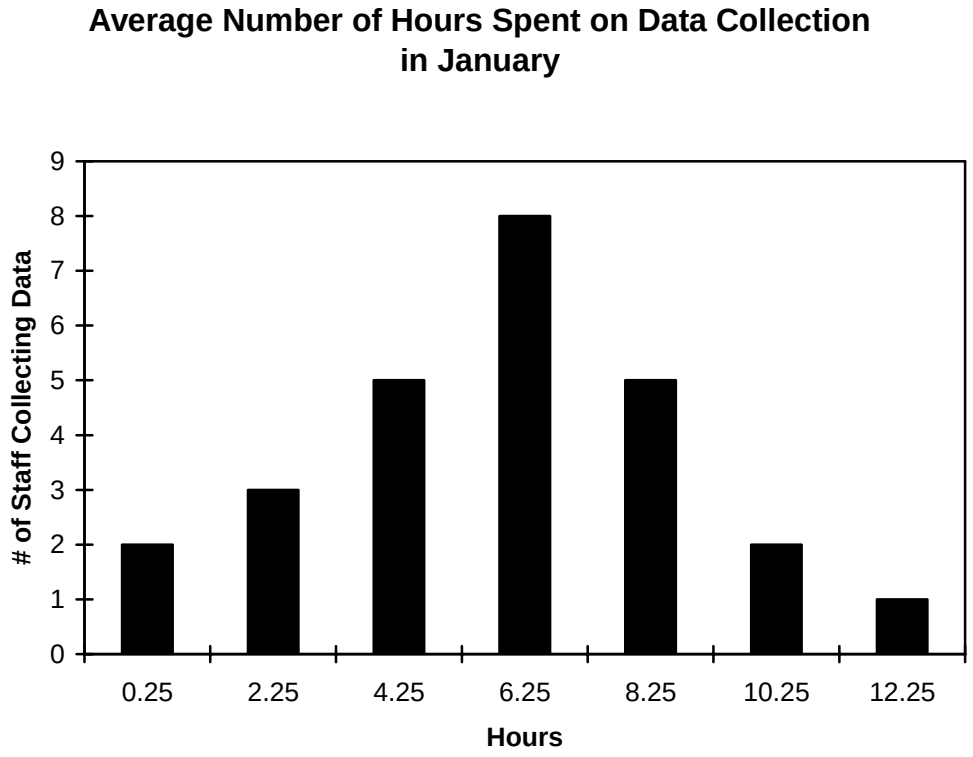
Special cause variation: A factor that intermittently and unpredictably induces variation over and above that inherent in the system. When viewing a control chart, it often appears as an extreme point, such as the point beyond the control limits or as one of several defined patterns in the data.

Examples:

- Damage to client records because of water damage from a burst pipe
- Increased volume of patients seeking laser surgery for vision correction following an extensive promotional media campaign
- Increase in telephone calls from parents to a public health department following news stories about several cases of bacterial meningitis in local children

Data Analysis/Display Tools

a) **Histogram:** A bar chart that displays the variation and the distribution of that variation for a process at a single point in time.
   - Key applications
     - Bar chart used for one variable
     - Evaluating a process at a specific point in time
     - Used when there is a wide variety of results
   - Benefits
     - Reveals whether the distribution in a process is normal and which areas are probable causes of trouble
     - Used to visualize central location, shape and spread of data
   - Drawbacks
     - Not applicable to binary (yes/no) outcomes
     - Needs a large set of data

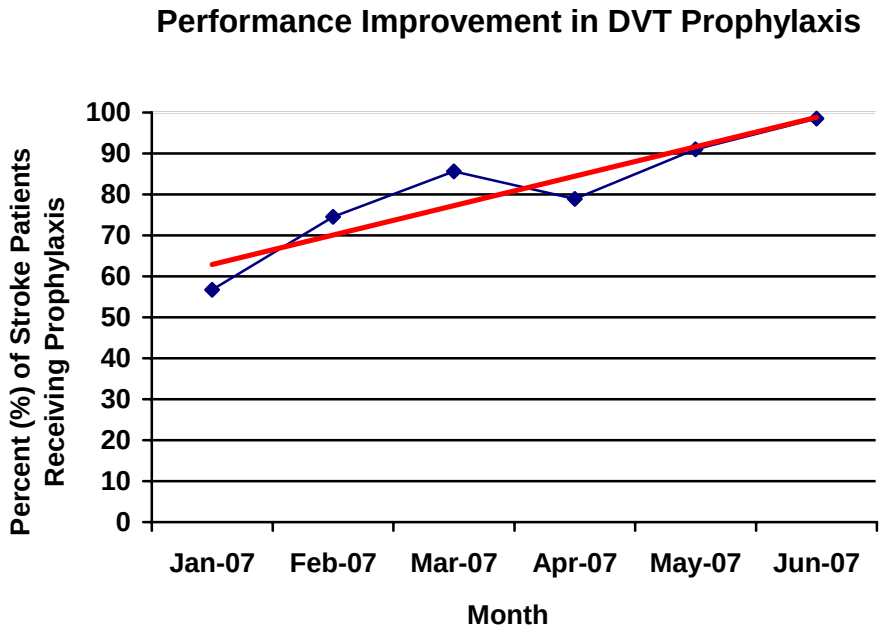


b) **Line Graph**: This is one of the simplest graphs that can be used to display measurements over specific time periods. Data are plotted and then connected with a line creating upward and downward patterns as performance varies.

- Key applications
  - Used to spot trends in a process

- Benefits
  - Quick, easy up-to-the-minute

- Drawbacks
  - Not able to show if a process is in statistical control



c) **Run Chart:** A run chart is a line chart to which a calculated median value has been drawn as a line for the full length of the X axis. Using this line as a reference, three specific tests can be used to determine if there is special cause variation present.

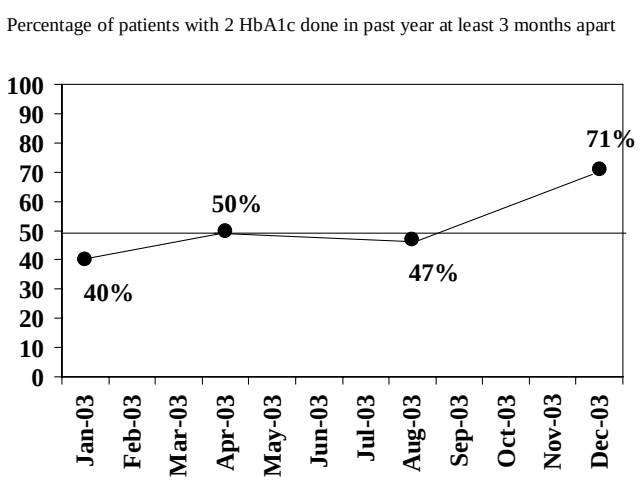
- Key applications
  - Used when analysis is required that is more sophisticated than a line graph, but simpler than a control chart

- Benefits
  - Can indicate whether variation is due to a common or special cause
  - Quicker and easier to construct than a control chart

- Drawbacks
  - Not as sensitive as a control chart for diagnosing outlier data

Performance Improvement in Diabetic Care

Sample Run Chart -

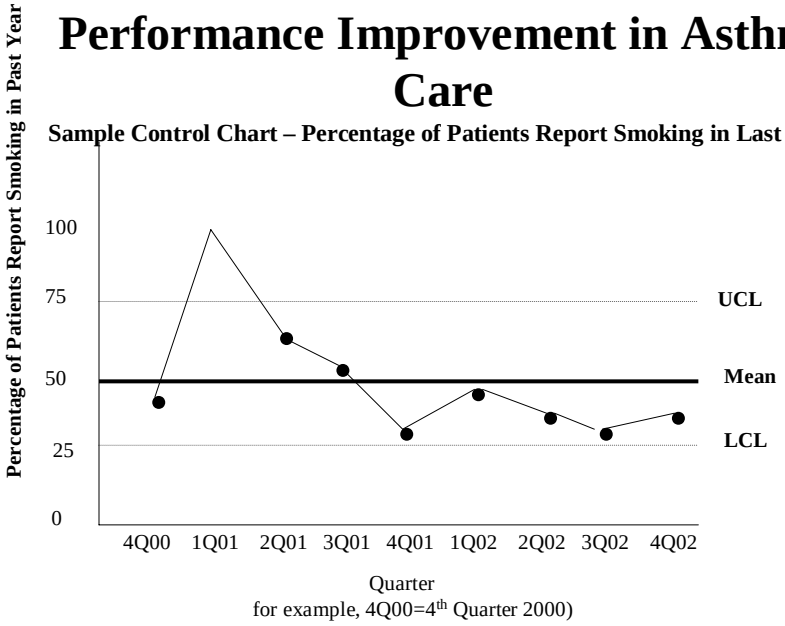


d) **Control Chart:** This is a line graph which includes a line depicting the mean. It also includes two lines, one on either side of the mean, that are referred to as the upper and lower control limits. These limits are calculated using the mean, standard deviation and the number of observations. The control chart is used to assess if a process is in or out of statistical control, through the application of a series of tests to identify patterns in data points. There are several types of control charts and choosing the correct chart is important. Factors including the type of data, type of performance measure (e.g., rate, ratio) and the size of the sample determine which control chart should be used.

- Key applications
  - To discover whether a process is in or out of statistical control

- Benefits
  - Monitor changes in performance over time
  - Ascertain causes of variation (special versus common)
  - Assist in developing change strategies
  - Demonstrate if change was an improvement
  - Provides an accurate basis for prediction

- Drawbacks
  - Not easy to construct unless using statistical process control (SPC) software
  - Requires knowledge to interpret



Data analysis can be exciting and rewarding as it begins to provide meaning to a collection of facts, measurements or observations. The tools described here will help to answer some questions but may pose many more. Most importantly, data analysis will help to dispel assumptions and conserve resources by providing a scientific basis for making decisions about performance and selecting areas for improvement.

Suggested References for Additional Reading

Framework for Improving Performance: From Principle to Practice. Joint Commission on Accreditation of Healthcare Organizations, Oakbrook Terrace, Il. 1994.

Managing Performance Measurement Data in Health Care. Joint Commission Resources, Inc, Oakbrook Terrace, Il. Joint Commission on Accreditation of Healthcare Organizations, 2001.

Measuring Quality Improvement in Healthcare: a guide to statistical process control applications. In: Quality Resources. Carey RG, Lloyd RC. ASQ Press, Milwaukee, WI, 2001

Overcoming Performance Measurement Challenges For Hospitals. Joint Commission Resources, Oakbrook Terrace, Il. 2005.