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Improvement Cymru Academy Toolkit Guide

Pareto Charts

What is Pareto analysis?

Pareto analysis is a simple technique that helps us to focus efforts on the problems that offer the greatest potential for improvement.

What is a Pareto Chart?

A Pareto chart is a cause analysis tool designed to help you choose an impactful improvement.

It is an ordered bar graph which visually demonstrates individual values in descending order as bars - with longest bars on the left and the shortest to the right. It is a useful tool to identify the most frequent defects.

A Pareto chart contains both bars and a line graph, where individual values are represented in descending order by bars and the cumulative total is represented by the line. It is a useful tool to identify the most frequent defects or causes, or any other factor you can count and categorise.

Rationale

The Pareto chart follows the 80/20 principle which suggests that usually roughly 80% of the effects come from 20% of the causes. This allows you to focus on improvement projects that are needed most, with the biggest potential impact.

Pareto chart is ideal to use when there are many possible problems/ causes, and you wish to focus on the most significant. The combination of ordered bar chart and cumulative percentage line allows you to analyse where the most impact can be made.

Background

A Pareto chart was named after the Italian economist Vilfredo Pareto who developed the 80/20 principle which the Pareto chart follows.

When to use?

Pareto charts help improvers focus on the parts of their process that, if improved will have the most beneficial effect. They may also identify the events/incidents which warrant the most attention. This allows teams to concentrate on the factors that will

have the greatest impact and helps them to have and communicate a strong rationale for focusing on certain areas. This can ensure that resources are directed appropriately.

How to use?

1. Initially you will need to identify the possible causes or events for your identified problem.
2. You will need to collect this data in a simple table, listing the contributing causes/events and the magnitude of each, for example the frequency of their occurrence or cumulative amount of time spent by all patients at this stage.
3. Order the causes, from largest (left) to the smallest (right). You may group insignificant factors together and label as 'other' for ease, but these should still be plotted to ensure the right cumulative percentage is calculated.
4. Calculate the percentage of the total that each cause represents. For example, (number of times a certain error occurred last year ÷ the total number of errors last year) * 100.
5. Working from the largest category to the smallest, calculate the cumulative percentage for each category until you reach 100%.
   The cumulative percentage for an item is the sum of that item's percentage of the total and that of all the other items that come before it in the ordering by rank.
6. Create your chart using the values to create the bar chart and the cumulative percentage to create the line graph.

How to draw a Pareto Chart (example): Causes for late arrival to work

1. Identify the problem and the causes or events
   - the problem is a late arrival
   - the causes are family problems, waking up late, taking the bus, traffic tie-up, being sick and bad weather
2. Measure for comparing items:
   - Often it occurs – frequency
   - Chosen timeframe -In this case 73 days
   - For each cause/ event, count how often the events/ cause occur and determine the grand total.

Table 1

Causes for late arrival	Number of occasions
Family problems	8
Woke up late	20
Had to take the bus	4
Traffic tie-up	32
Sick	6
Bad weather	3
Total	**73**

3. Order the table from largest to smallest

Table 2

Causes for late arrival (decreasing order)	Number of occasions
Traffic tie-up	32
Woke up late	20
Family problems	8
Sick	6
Had to take the bus	4
Bad weather	3
Total	**73**

4. Calculate the percentage for each event/ cause in the grand total. Take the sum of the cause divide by the grand total and multiple by 100.

Table 3

Causes for late arrival (decreasing order)	Number of occasions	Percentage
Traffic tie-up	32	44 ((32/73=0.44) *100=44)
Woke up late	20	27 ((20/73=0.27) *100=27)
Family problems	8	11 ((8/73=0.11) *100=11)
Sick	6	8 ((6/73=0.08) *100=8)
Had to take the bus	4	6 ((4/73=0.06) *100=6)
Bad weather	3	4 ((3/73=0.04) *100=4)
Total	**73**	**100**

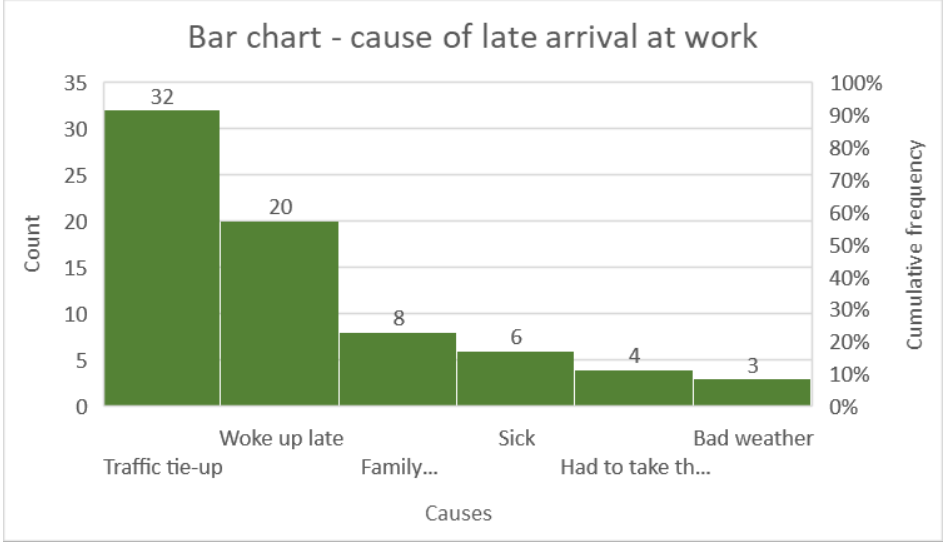
5. Calculate the cumulative percentage from largest to smallest by adding up the percentage field up to that row

Table 4

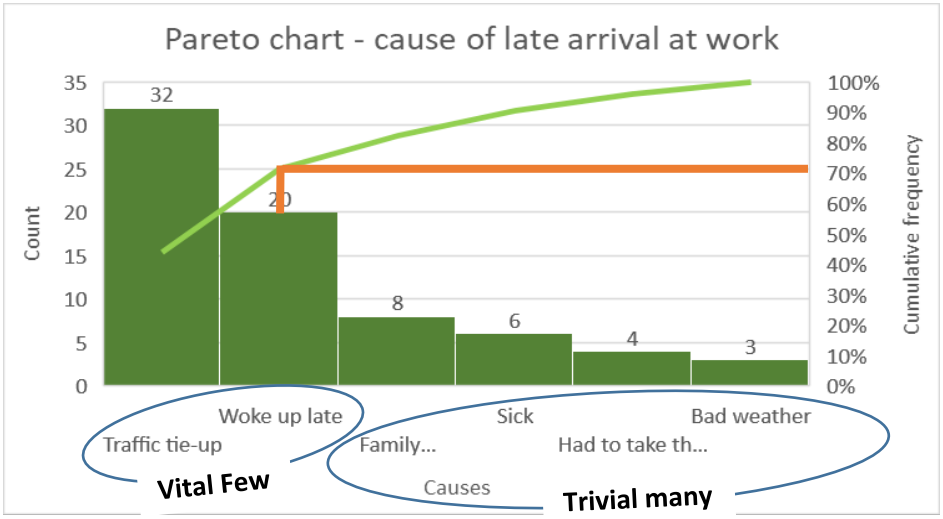
Tallying items in a compilation table			
Causes for late arrival (decreasing order)	**Number of occasions**	**Percentage**	**Cumulative %**
Traffic tie-up	32	44	44
Woke up late	20	27	71 (44+27)
Family problems	8	11	82 (71+11)
Sick	6	8	90 (82+8)
Had to take the bus	4	6	96 (90+6)
Bad weather	3	4	100 (96+4)

6. You will then need to create a bar graph.
    - List the causes/ events on the horizontal axis (x axis) of the graph. From the highest to the lowest.
    - Label the left vertical axis (primary y axis) with the numbers (frequency, cost or time).

- Label the right vertical axis (secondary axis) with the cumulative % (the cumulative total = 100%).
- Draw the bars for each cause/ event.



7. Draw a line graph of the cumulative percentages. The first point on the line graph should line up with the top of the first bar (when using excel the first point will always appear mid-way up the first bar).



Focus your efforts here for maximum return on your investment

8. Analyse the diagram.

   Identify those causes/ events items that appear to account for most of the errors. For this example the traffic and waking up late appears to account for over 80% of the problem. To identify most of the errors you will need to draw

a line from the 80% mark on the right hand Y axis across to the left until it hit's the cumulative percentage line. As shown in orange on the graph above.

Focussing on the 'vital few' (in the example above these are traffic and woke up late) rather than the 'Trivial many' (in the example above these are family problems, sick, had to take the bus & bad weather) will give you the best return on your efforts.

If there appears to be no pattern (e.g. the bars are essentially all the same height), think of some factors that may affect the outcome, such as day of week, shift, age group of patients, home village. Then, subdivide the data and draw separate Pareto charts for each subgroup to see if a pattern emerges.

Excel (Improvement Cymru Academy Toolkit Guide Pareto Charts Excel) offers simple charting tools you can use to make your graphs, or you can do them with paper and pencil.

What next?

With the identification of the 'vital few' you can now develop an action plan to focus your next steps in your improvement journey.

Helpful Tips

Creating a Pareto chart can be a useful way of communicating with a team why you have decided to work in that specific area.

Pareto charts are most effective when you have over 7-20 categories of causes. If you have less than 5 categories a simple table will usually suffice.

Additional resources

If you would like to learn more about making improvement to your workplace take a look at our website for what we offer you https://phw.nhs.wales/services-and-teams/improvement-cymru/improvement-cymru-academy/ or email us improvementcymruacademy@wales.nhs.uk to find about the improvement courses we can offer.

References

Excellence Though Quality (2021) *What is a Pareto chart?* [online] https://asq.org/quality-resources/pareto [Accessed 12 May 2022].

Noria Corporation (2018) Quality Assurance Project (QAP), funded by the U.S. Agency for International Development (USAID). *Eight easy steps to creating a Pareto chart.* [online] Available at https://www.reliableplant.com/Read/2251/pareto-chart [Accessed 12 May 2022].