Chart, scatter chart

Description automatically generatedDiagram

Description automatically generated

Chart

Description automatically generated

* The figure number and a short title are placed under the figure. The full figure legend usually is on a separate page; if it is directly below the figure it describes, you do not need the short title.
* By convention, the independent variable(s) are displayed on the X axis, and dependent variables on the Y axis.
* A key to the symbols or colors should be included if you have multiple lines on an XY or scatter graph, or different colored bars representing different treatments. The key can be left off if you only have one type of data symbol or color on your graph.

When you are writing the figure legend:

* Provide enough explanation that a reader can understand what the figure is showing without having to read the main text of your report.
* If you are showing results of any statistical analyses, include basic statistical information like the number of replicates per group, what test was used, and the p-value.

Diagram

Description automatically generated

### Bar Graph

Bar graphs probably are the first data graph that many students make. They are very good for highlighting trends between treatment groups

Simple, Cluster, or Stacked

https://commons.wikimedia.org/wiki/File:Graph\_of\_Impervious\_Surfaces\_Coverage\_in\_the\_US.png

Chart

Description automatically generated

https://commons.wikimedia.org/wiki/File:Free\_PSA\_bar\_graph.svg

Chart, bar chart

Description automatically generated

https://commons.wikimedia.org/wiki/File:20210413\_Carbon\_capture\_and\_storage\_-\_CCS\_-\_proposed\_vs\_implemented.svg

Chart, bar chart, histogram

Description automatically generated

### Line Graph

This is an example of a line graph.

<https://en.wikipedia.org/wiki/File:ScientificGraphSpeedVsTime.svg>

Chart

Description automatically generated

Chart, line chart

Description automatically generated

https://commons.wikimedia.org/wiki/File:Huruichibashi\_sta\_graph.jpg

https://commons.wikimedia.org/wiki/File:Blood\_nicotine\_graph.jpg

Chart, line chart, histogram

Description automatically generated

### X-Y/Scatter Graph

An X-Y graph looks similar to a line graph, but is constructed and interpreted differently.

https://commons.wikimedia.org/wiki/File:Ggplot2scatter.png

Chart, scatter chart

Description automatically generated

https://en.wikipedia.org/wiki/File:Scatter\_diagram\_for\_quality\_characteristic\_XXX.svg

A picture containing indoor

Description automatically generated

### Box-and-Whisker Plot

This format is very good for summarizing a lot of data points. MS Excel cannot create box-and-whisker plots, so they are not as widely used as the other formats, but they provide readers with more information about the underlying raw data, without actually showing those data.

This is an example of a box-and-whisker plot.

https://en.wikipedia.org/wiki/File:Michelsonmorley-boxplot.svg

A picture containing shape

Description automatically generated

This map shows how the distribution of the original data is captured in the plot.

https://en.wikipedia.org/wiki/File:Boxplot\_vs\_PDF.svg

A picture containing diagram

Description automatically generated

Map of the data distribution for an idealized box-and-whisker plot element. The top panel shows the box plot element turned on its side. Each box-and-whisker element represents all of the data points collected for a treatment group, sorted from lowest to highest value. Under ideal conditions:

* The middle value in the sorted data (the median) will be the same as the mean for all data in the treatment group.
* The box shows the data range that contains 50% of all measurements. The difference between the top and bottom value in the box is the IQR (inter-quartile range).
* If we add whiskers to the box that are 1.5x the IQR, and the data are normally distributed, then ~99% of all observed data points should be inside that range.
* Ideally the median line should be right in the middle of the box. If it is not, then we know that the data are **skewed** (not smoothly distributed.)

Tables

Table

Description automatically generated

* The table number and short title go at the top of the table.
* Keep the column titles short. If needed, use 1-2 word column titles in the table, then explain the column titles further in the table legend.
* A few footnotes can go under the last row of the table, but longer footnotes should go in the table legend.
* A table legend is like a figure legend in it explains details of the table that had to be left out to maximize legibility.

Table 1. Descriptive and Summary Statistics

|  |  |  |
| --- | --- | --- |
| Tool or Test | Example | When Used |
| Arithmetic Mean |  |  |
| Median |  |  |
| Standard Deviation |  |  |
| Distribution |  |  |

Table 2. Comparisons and Hypothesis Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tool or Test | Example | How Is It Used? | # Categor. Variables | # Measure Variables |
| One-sample t-test |  |  |  | 1 |
| Two-sample t-test | Comparing the mean heavy metal content of clams collected in Nova Scotia vs. New Jersey | Tests a null hypothesis that the means of a measurement variable are the same in two groups. | 1 | 1 |
| Paired t-test | Compare cholesterol level in blood of people before vs. after switching to a vegetarian diet. | Test a null hypothesis that the means of the measurement variable are the same before vs. after a treatment. | 2 | 1 |
| ANOVA | Compare blood cholesterol levels of male vegetarian, female vegetarian, male omnivorous, and female omnivorous students. | Test a null hypothesis that 3+ different groups have the same means for the measurement variable. | 1+ | 1 |
| Chi-square goodness of fit | Count number of red, pink, white flowers in a genetic cross, test fit to expected 1:2:1 ratio, total sample >1000 | Test a null hypothesis that observed frequencies are not different from expected frequencies | 1 |  |
| Chi-square independence | Compare the proportion of HIV patients who get worse after taking a new drug to the proportion who get worse after taking a placebo | Test null hypothesis that proportions are same in different groups | 2 |  |

Table 3. Statistical Modeling

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tool or Test | Example | When Used | # Categor. Variables | # Measure Variables |
| Correlation | Measure salt and fat intake in different people’s diets, to see if people who eat a lot of fat also eat a lot of salt | See whether two variables are related to each other | 0 | 2 |
| Linear regression | Measure chirping speed in crickets at different temperatures, & test whether chirping speed varies with temperature | See if changes in an independent variable predict changes in a dependent variable. | 0 | 2 |
|  | Estimate air temperature based on chirping speed of crickets | Estimate the value of one unmeasured variable corresponding to a measured variable |  |  |