

Non-parametric statistical tests

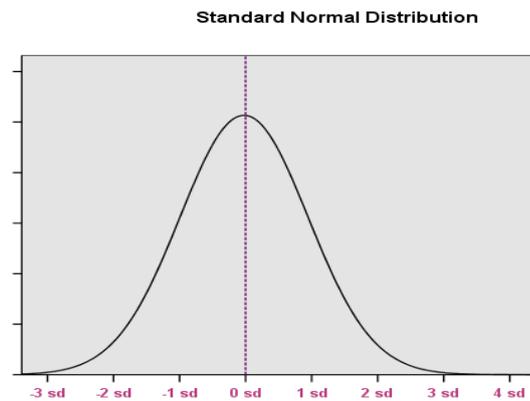
When should non-parametric tests be used?

- When testing nominal or ordinal variables
- The assumptions of parametric test have not been met

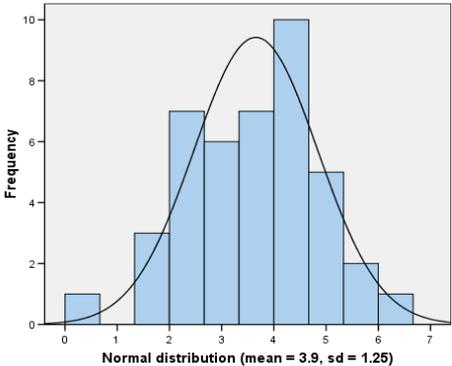
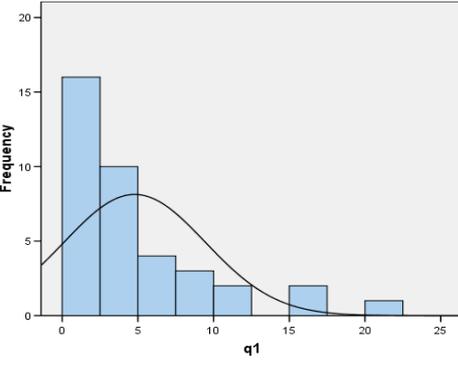
Non-parametric tests are also called distribution free tests. The main assumption for parametric tests is that the data is normally distributed.

What is normally distributed data?

The normal distribution curve is like a very smooth histogram which peaks in the middle and is symmetrical about the mean. The mean and median are the same for the normal distribution and 95% of the distribution lies within two standard deviations of the mean.



Plotting a [histogram](#) of the variable of interest will give an indication of the shape of the distribution. It is very unlikely that a histogram of sample data will produce a perfectly smooth curve like the one above, especially if the sample size is small. As long as the data is approximately normally distributed, a parametric test can be used. Data has to be very skewed to classify as not normally distributed.

Example of approximately normally distributed data	Example of skewed data
<p data-bbox="236 1594 687 1615">Histogram of normal distribution with mean = 3.9 & sd = 1.25</p>  <p data-bbox="643 1928 746 1966">Mean = 3.6542 Std. Dev. = 1.18548 N = 42</p> <p data-bbox="268 1989 560 2007">Normal distribution (mean = 3.9, sd = 1.25)</p>	<p data-bbox="970 1594 1305 1615">Histogram of non-normally distributed data</p>  <p data-bbox="1329 1921 1433 1960">Mean = 4.787 Std. Dev. = 4.6611 N = 38</p> <p data-bbox="1082 1977 1102 1995">q1</p>

The histogram gives a rough idea of whether a variable is normally distributed but there are also specific methods for testing normality. The Kolmogorov-Smirnov test or the Shapiro-Wilks' W test will test to see if the underlying distribution is normal. The Kolmogorov-Smirnov test is the standard goodness of fit test but Shapiro-Wilk test is more suitable when the sample size is relatively small ($n < 50$) or when there are outliers as the Kolmogorov-Smirnov is sensitive to outliers. A full guide to tests to check the normality of your data in SPSS can be found [here](#).

Why use parametric tests?

Although the non-parametric tests require fewer assumptions and can be used on a wider range of data types, **parametric tests are preferred** because non-parametric tests tend to be less sensitive at detecting differences between samples or an effect of the independent variable on the dependent variable. In other words, the power efficiency of the nonparametric test is lower than its parametric counterpart. This means that to detect any given effect at a specified significance level, a larger sample size is required for the non-parametric test than the parametric test (Robson, 1994). Some people also argue that non-parametric methods are most appropriate when the sample sizes are small. However, when the data set is large, (e.g. $n > 100$), the central limit theorem can be applied, so often it makes little sense to use non-parametric statistics.

There are other assumptions specific to individual tests. For example, when comparing the means of two independent samples, the variances of the two distributions should be approximately equal. This is also known as the assumption of homogeneity of variance.

References:

Plonsky, M., 1997-2011. *Psychological Statistics: An Online Hypertext*. Available at:

<http://www4.uwsp.edu/psych/stat/14/nonparm.htm> .

Weaver, B., 2002. Nonparametric Tests. [PDF] Available at:

<http://www.angelfire.com/wv/bwhomedir/notes/nonpar.pdf> .

Robson, C., 1994. Experiment, Design and Statistics in Psychology, CH7 Parametric and nonparametric tests. [PDF]

Available at: <http://www.blackwellpublishing.com/robson/pdfs/EDAC07.pdf> .

STATISTICA Data Analysis Software and Services. StatSoft Electronic Statistics Textbook: Nonparametric Statistics.

Available at: <http://www.statsoft.com/textbook/nonparametric-statistics/>.