

## 9.1: Nonparametric Definitions

### Learning Objectives

At the end of this section you should be able to answer the following questions:

- How would you define non-parametric methods?
- What types of assumptions are made for non-parametric methods?

### Non-Parametric Methods

What can be done when the assumptions we have discussed in past lessons (t-tests, correlation etc.) are not maintained? There are tests used when a number of assumptions are not maintained for regular tests like t-tests or correlations (e.g. nonnormal distribution or small sample sizes). These tests – called non-parametric tests – use the same type of comparisons but with different assumptions.

### Parametric Assumptions

Parametric statistics is a branch of statistics that assumes that sample data comes from a population that follows parameters and assumptions that hold true in most, in not all, cases. Most well-known elementary statistical methods are parametric, many of which we have discussed on this [webpage](#).

### Parametric Assumptions and the Normal Distribution

Normal distribution is a common assumption for many tests, including t-tests, ANOVAs and regression. Recall that parametric tests we have discussed here met the following assumptions of the normal distribution: minimal or no skewness and kurtosis of variables and error terms are independent across variables.

These assumptions allow us to infer a normal distribution in the population.

### Non-Parametric Methods

Statistical methods which do not require us to make distributional assumptions about the data are called non-parametric methods. Non-parametric, as a term, actually does not apply to the data, but to the method used to analyse the data. These tests use rankings to analyse differences. Non-parametric methods can be used for different types of comparisons or models

### Nonparametric Assumptions

1. Nonparametric tests make assumptions about sampling (that it is generally random).
2. There are assumptions about the independence or dependence of samples, depending on which nonparametric test is used, there are no assumptions about the population distribution of scores.

### Nonparametric Tests and Level of Measurement

Variables at particular categorical levels of measurement may require Nonparametric Tests

Consider variables like autonomy, skill, income. Would such variables always follow a normal distribution? It is possible that when looking at income, you would expect the data to be skewed, as there are a small minority of the population who earn extremely high salaries.

### Mean vs Median

When a distribution is highly skewed, the mean is affected by the high number of relative outliers. For example, when measuring something like income, where there are few high-income earners but many middle and low-income earners, the center of the distribution is quite skewed. This means that the median (i.e., the middle amount with 50% above and below this amount) is best used.

### Sample Size

Sample size is another consideration when deciding if one should use a parametric or nonparametric test. Often, researchers will want to run a certain type of parametric test, but might not have the recommended minimum number of participants. Additionally,

if the sample is very small, tests of normality often cannot be run. This is due to the lack of power needed to provide an interpretable result. When this is coupled with non-normal distributions of data, researchers might decide to use nonparametric tests.

## Outliers

As discussed in previous chapters, parametric tests can only use continuous data for the dependant variable. This data should be normally distributed and not have any spurious outliers. However, some nonparametric tests can use data that is ordinal, or ranked for the dependant variable. These tests may also not be impacted severely by non-normal data or outliers. Each parametric test has its own requirements, so it is advisable to check the assumptions for each test.

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