1 Paired t-test

1.1 Overview

The paired t-test is used when we want to know whether there is a difference in means between populations when the samples are 'linked' or 'dependent'. We use the t-test for dependent means when we collect data at two different times on a single sample drawn from a population, or when members of the population are sampled as pairs that are linked in some fashion. It is essentially the same as a one-sample t-test but we first take the difference between the measurements on each pair.

Here is an example of where the test is used: A dietician claims that his clients lose weight. To test this, a statistician measures 15 subjects' weight and then measures the same people again two months later. So we have two linked/dependent samples.

Another example is: A study is interested in the effect of two different energy drinks on stamina. The study recruits identical twins and gives each twin a different drink. The response is time running on a treadmill before exhaustion. The study is interested in the differences of the mean time on the treadmill between the two twins.

The assumptions of a paired t-test are:

- Random sampling from a defined population.

- Quantitative measurements.

- Population difference scores are normally distributed.

If you do not have quantitative response data, then you are in the wrong part of the flowchart and it is advised that you start again and look at the definitions for nominal, ordinal and quantitative variables.

If you do not have a categorical predictor with two dependent levels you are advised to go through the flowchart again.

If your sample size is smaller than 30 and the difference in your measurements are far from normal then it would be better to use a Wilcoxon signed-rank test.

1.2 Analysis plan

The descriptive statistics you should have calculated are: sample size, sample mean, sample variance and standard error on the differences in the measurements. To visualise the data you can draw a box plot or histogram for the differences in measurements.

A possible follow up test is to calculate a 95% confidence interval for the mean of the differences on the population.

Here are some examples of a paired t-test being carried out:
http://www.youtube.com/watch?v=vB1OmEY5Rcw   (by hand)
http://www.statstutor.ac.uk/types/teach-yourself/paired-t-tests/   (in SPSS)
http://www.ats.ucla.edu/stat/r/whatstat/whatstat.htm#pairt   (in R)