

Paired samples t-test

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LOGO

Dependent T-Test for Paired Samples

◆ What does this test do?

The dependent t-test (also called the paired t-test, paired-samples t-test or related t-test) compares the means of two related groups to detect whether there are any statistically significant differences between these means

Dependent T-Test for Paired Samples

◆ What variables do you need for a dependent t-test?

You need one dependent variable that is measured on an interval or ratio. You also need one categorical variable that has only two related groups.

Dependent T-Test for Paired Samples

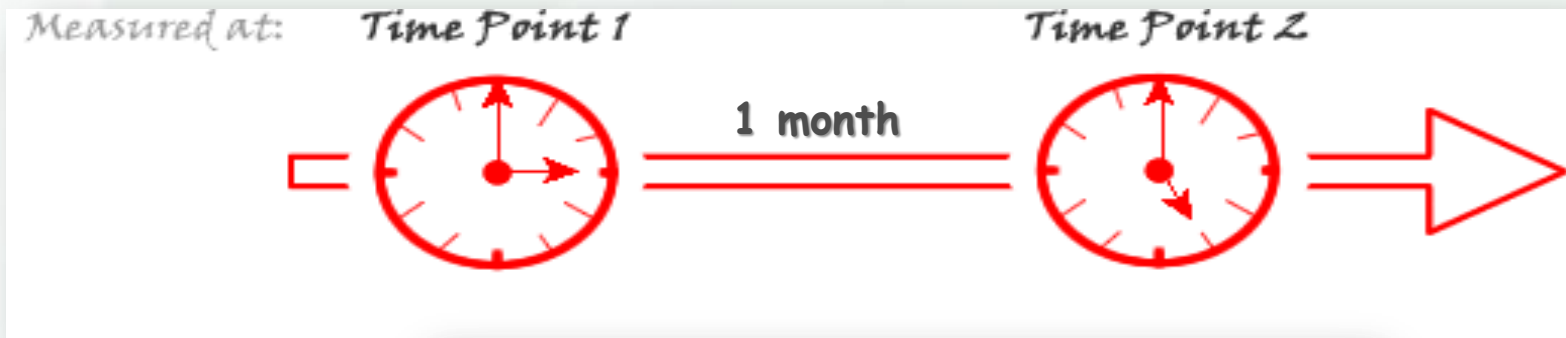
◆ What is meant by "related groups"?

A dependent t-test is an example of a "**within-subjects**" or "**repeated-measures**" statistical test. This indicates that the same subjects are tested more than once. Thus, in the dependent t-test, "related groups" indicates that the same subjects are present in both groups. The reason that it is possible to have the same subjects in each group is because each subject has been measured on two occasions on the same dependent variable.

Dependent T-Test for Paired Samples

◆ What is meant by "related groups"?

For example, you might have measured the weight of 20 individuals(subjects) before and after a specific regime program.



Dependent T-Test for Paired Samples

◆ What hypothesis is being tested?

The dependent t-test is testing the null hypothesis that there are no differences between the means of the two related groups. We can express this as follows:

$$H_0: \mu_1 = \mu_2$$

$$H_A: \mu_1 \neq \mu_2$$

If we get a significant result, we can reject the null hypothesis that there are no significant differences between the means and accept the alternative hypothesis that there are statistically significant differences between the means.

Dependent T-Test for Paired Samples

Patient	Drug	Placebo	Difference (z)
1	7	4	3
2	5	3	2
3	2	1	1
4	8	6	2
5	3	2	1
6	4	4	0
7	10	9	1
8	7	5	2
9	4	3	1
10	9	8	1

Dependent T-Test for Paired Samples

$$\sigma_d^2 = \frac{\sum d_z^2}{n-1}$$

$$\sigma_n = \frac{\sigma_d}{\sqrt{n}}$$

$$t = \frac{\bar{z}}{\sigma_n}$$

Paired t-test is equivalent to On sample t-test with $\mu_1 = 0$!!!!

Dependent T-Test for Paired Samples

- ◆ What is the advantage of a dependent t-test over an independent t-test?

$$\bar{D} = \frac{1}{n} \sum_i (Y_{i2} - Y_{i1}) = \frac{1}{n} \sum_i Y_{i2} - \frac{1}{n} \sum_i Y_{i1} = \bar{Y}_2 - \bar{Y}_1,$$

$$\begin{aligned} \text{var}(\bar{D}) &= \text{var}(\bar{Y}_2 - \bar{Y}_1) \\ &= \text{var}(\bar{Y}_2) + \text{var}(\bar{Y}_1) - 2\text{cov}(\bar{Y}_1, \bar{Y}_2) \\ &= \sigma_1^2/n + \sigma_2^2/n - 2\sigma_1\sigma_2\text{corr}(Y_{i1}, Y_{i2})/n, \end{aligned}$$

Dependent T-Test for Paired Samples

◆ How do I report the result of a dependent t-test?

You need to report the test as follows:

$t(19) = -4.773, P < 0.0005$

Labels and arrows in the diagram:
- **t-statistic** points to the **t** in $t(19)$.
- **t-value** points to **-4.773**.
- **degrees of freedom (df)** points to **(19)**.
- **p-value** points to **P < 0.0005**.

where df is $N - 1$, where N = number of subjects.

In SPSS

Thank You