1. **Two Sample T Hypothesis Test:**

A two-sample t-test was used to analyze the difference between two independent population means. It is used when two small samples (n< 30) are taken from two different populations and compared.

It helps to answer questions like whether the average success rate is higher after implementing a new sales tool than before or whether the test results of patients who received a drug are better than test results of those who received a placebo.

Let’s take an example of a new drug is proposed to lower total cholesterol. Let’s take 30 participants who got enrolled in the trial and are randomly assigned to receive either the new drug or a placebo. At the end of 6 weeks, each patient's total cholesterol level is measured and the sample statistics are as follows.

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Sample | Mean | Std. Deviation |
| New Drug | 15 | 195.9 | 28.7 |
| Placebo | 15 | 227.4 | 30.3 |

Now, H0: μ1 = μ2 & H1: μ1 < μ2, α=0.05

Because both samples are small (< 30), we use the t-test statistic. The ratio of the sample variances, s12/s22 =28.72/30.32 = 0.90

The degrees of freedom, df, defined as df=n1+n2-2 = 15+15-2=28. The critical value for a lower tailed test with df=28 and α=0.05 is -1.701 and the decision rule is to Reject H0 if t < -1.701.

Sp = 29.5, Now the test statistic, t = -2.92

1. **P-Value:**

The p-value is defined as the probability of obtaining a result equal to or more extreme than what was observed in the data.

We reject H0 because -2.92 < -1.701.

The p-value for the given data will be determined by conducting the statistical test. This p-value is then compared to a pre-determined value alpha. If the p-value for the test is less than alpha, we reject the null hypothesis. If the p-value is greater than or equal to alpha, we fail to reject the null hypothesis.

We have statistically significant evidence at α=0.05 to show that the mean total cholesterol level is lower in patients taking the new drug for 6 weeks as compared to patients taking placebo, p < 0.005. The clinical trial in this example finds a statistically significant reduction in total cholesterol.

**References:**

1. Masood Siddiqui (Apr 24, 2020) Hypothesis Testing in R- Introduction Examples and Case Study was retrieved from <https://www.mygreatlearning.com/blog/hypothesis-testing-in-r-with-examples-and-case-study/>
2. Chew Jian Chieh Making Sense of the Two-Sample T-Test was retrieved from <https://www.isixsigma.com/tools-templates/hypothesis-testing/making-sense-two-sample-t-test/>

I like the way you have jotted down the key points and findings. I would like to add a few points to this.

Assumptions of Two Sample T Hypothesis Test

* The sample should be randomly selected from the two population
* Samples are independent of each other
* A variance of two populations is equal
* Data should be continuous

If t-calc > t-critical then there is a statistically significant difference (≠, > or <) between the mean of sample a and sample b

If t- calc < t-critical there is insufficient evidence that the means differ.

Thanks & Regards,

Sunil Raj Thota

Hi ,

I like the way you have jotted down the key points and findings. I would like to add a few points to this.

Steps to Calculate Two Sample T Hypothesis Test

* State the claim of the test and determine the null hypothesis and alternative hypothesis
* Determine the level of significance
* Calculate degrees of freedom
* Find the critical value
* Calculate the test statistics

And also,

If the sample mean vary among the sample, then the p-value will also vary and this effect is will result in wrong conclusion based on the p-value.

Thanks & Regards,

Sunil Raj Thota