How can a Repeated Measures ANOVA be performed in R?

Authored by

stats writer

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Repeated Measures ANOVA (Analysis of Variance) is a statistical test used to compare the means of three or more groups that are measured multiple times. This test is commonly used in research studies to determine if there is a significant difference between the means of the groups over time. In R, a Repeated Measures ANOVA can be performed by using the "aov" function and specifying the within-subjects factor. This function calculates the F-statistic and p-value, which can be used to determine the significance of the results. Additionally, the "emmeans" package can be used to obtain post-hoc tests and contrast comparisons. By performing a Repeated Measures ANOVA in R, researchers can effectively analyze the data and make informed conclusions about the differences between the groups over time.

Perform a Repeated Measures ANOVA in R

A repeated measures ANOVA is used to determine whether or not there is a statistically significant difference between the means of three or more groups in which the same subjects show up in each group.

This tutorial explains how to conduct a one-way repeated measures ANOVA in R.

Example: Repeated Measures ANOVA in R

Researchers want to know if four different drugs lead to different reaction times. To test this, they measure the reaction time of five patients on the four different drugs. Since each patient is measured on each of the four drugs, we will use a repeated measures ANOVA to determine if the mean reaction time differs between drugs.

Use the following steps to perform the repeated measures ANOVA in R.

Step 1: Enter the data.

First, we'll create a data frame to hold our data:

```
#create data
df <- data.frame(patient=rep(1:5, each=4),
drug=rep(1:4, times=5),
response=c(30, 28, 16, 34,
14, 18, 10, 22,
24, 20, 18, 30,
38, 34, 20, 44,
26, 28, 14, 30))

#view data
df

patient drug response
1 1 1 30
2 1 2 28
3 1 3 16
4 1 4 34
5 2 1 14
```

6 2 2 18

7 2 3 10

8 2 4 22

9 3 1 24

10 3 2 20

11 3 3 18

12 3 4 30

13 4 1 38

14 4 2 34

15 4 3 20

16 4 4 44

17 5 1 26

18 5 2 28

19 5 3 14

20 5 4 30

Step 2: Perform the repeated measures ANOVA.

Next, we will perform the repeated measures ANOVA using the aov() function:

```
#fit repeated measures ANOVA model
model <-
aov(response~factor(drug)+Error(factor(patient)), data =
```

df)

#view model summary
summary(model)

Error: factor(patient)
Df Sum Sq Mean Sq F value Pr(>F)
Residuals 4 680.8 170.2

Error: Within
Df Sum Sq Mean Sq F value Pr(>F)
factor(drug) 3 698.2 232.7 24.76 1.99e-05 ***
Residuals 12 112.8 9.4

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Step 3: Interpret the results.

A repeated measures ANOVA uses the following null and alternative hypotheses:

The null hypothesis (H0): μ1 = μ2 = μ3 (the population means are all equal)

The alternative hypothesis: (Ha): at least one population mean is different from the rest

In this example, the F test-statistic is 24.76 and the corresponding p-value is 1.99e-05. Since this p-value is less than 0.05, we reject the null hypothesis and conclude that there is a statistically significant difference in mean response times between the four drugs.

Step 4: Report the results.

Here is an example of how to do so:

A one-way repeated measures ANOVA was conducted on five individuals to examine the effect that four different drugs had on response time.

Results showed that the type of drug used lead to statistically significant differences in response time (F(3, 12) = 24.76, p < 0.001).

Repeated Measures ANOVA: Definition, Formula, and Example

How to Perform a Repeated Measures ANOVA By Hand

How to Perform a Repeated Measures ANOVA in Python

How to Perform a Repeated Measures ANOVA in Excel

How to Perform a Repeated Measures ANOVA in SPSS

How to Perform a Repeated Measures ANOVA in Stata