

SOURCEBOOK

R

DATA ANALYSIS

Abstract: This chapter provides step-by-step instructions on how to obtain basic statistical output using R via written instructions. Simple examples for most undergraduate-level between-subjects and within-subjects research designs are provided.

Keywords: R, directions for use

Original: March 2021

Updated: May 2025

This document is part of an online statistics sourcebook.

A browser-friendly viewing platform for the sourcebook is available:

<https://cwendorf.github.io/Sourcebook>

All data, syntax, and output files are available:

<https://github.com/cwendorf/Sourcebook>

TABLE OF CONTENTS FOR THIS CHAPTER

Frequencies	3
Descriptives	4
Transformations and Standardized Scores	5
Correlations	6
Regression	7
Confidence Interval for a Mean	8
One Sample t Test.....	9
Paired Samples t Test.....	10
Independent Samples t Test	11
OneWay ANOVA.....	12
Post Hoc Comparisons	13
Repeated Measures ANOVA	14
Factorial ANOVA.....	15

Frequencies

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Frequencies

Get the frequency distribution for the variable.

```
FrequencyTable <- table(Outcome)
FrequencyTable
prop.table(FrequencyTable)
```

Obtaining Summary Statistics

Get the percentiles for the variable.

```
length(Outcome)
summary(Outcome)
```

Descriptives

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Frequencies

Get the frequency distribution for the variable.

```
FrequencyTable <- table(Outcome)
FrequencyTable
prop.table(FrequencyTable)
```

Obtaining Descriptive Statistics

Get the sample size, mean, variance, and standard deviation for the variable.

```
length(Outcome)
mean(Outcome)
var(Outcome)
sd(Outcome)
```

Transformations and Standardized Scores

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Computing Transformations

Use a formula to calculate a new vector with the transformed scores.

```
trOutcome <- Outcome + 1
```

Create and display the data set in a frame.

```
data.frame(Outcome, trOutcome)
```

Computing Standardized Scores

Create a new variable vector containing the standardized scores.

```
zOutcome <- scale(Outcome)
```

Create and display the data set in a frame.

```
data.frame(Outcome, trOutcome, zOutcome)
```

Correlations

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the sample sizes, means, and standard deviations for the variables.

```
lapply(CorrelationData, function(x) c(length(x), mean(x), sd(x)))
```

Get the covariance and correlation matrices for the variables.

```
cov(Outcome1, Outcome2)  
cor(Outcome1, Outcome2)
```

Get the correlation matrix for the variables.

```
(CorrelationData) |> describeCorrelations()
```

Obtaining Inferential Statistics

Get the correlation, its test for statistical significance, and its confidence interval.

```
cor.test(Outcome1, Outcome2)
```

You can change the width of the confidence interval if desired.

```
cor.test(Outcome1, Outcome2, conf.level=.99)
```

Regression

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the sample sizes, means, and standard deviations for the variables.

```
lapply(CorrelationData, function(x) c(length(x), mean(x), sd(x)))
```

Get the covariance matrix for the variables.

```
cov(Outcome1, Outcome2)
```

Get the correlation matrix for the variables.

```
(CorrelationData) |> describeCorrelations()
```

Obtaining Inferential Statistics

Get the proportion of variance accounted for by the model and the model coefficients, along with statistical significance for each of them.

```
model <- lm(Outcome2 ~ Outcome1)  
summary(model)
```

Confidence Interval for a Mean

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the sample size, mean, and standard deviation for the variable.

```
length(Outcome)
mean(Outcome)
sd(Outcome)
```

Obtaining Inferential Statistics

Get the mean and its confidence interval.

```
t.test(Outcome)$conf.int
```

Also, you can change the width of the confidence interval if desired.

```
t.test(Outcome, conf.level=.99)$conf.int
```


One Sample t Test

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the sample size, mean, and standard deviation for the variable.

```
c(length(Outcome), mean(Outcome), sd(Outcome))
```

Obtaining Inferential Statistics

Test the mean difference for statistical significance and get its confidence interval.

```
t.test(Outcome, mu=7)
```

Also, you can change the width of the confidence interval if desired.

```
t.test(Outcome, mu=7, conf.level=.99)
```

Paired Samples t Test

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the sample sizes, means, and standard deviations for the variables.

```
lapply(PairedData, function(x) c(length(x), mean(x), sd(x)))
```

Obtaining Inferential Statistics

Test the mean difference for statistical significance and its confidence interval.

```
t.test(Outcome1, Outcome2, paired=TRUE)
```

Also, you can change the width of the confidence interval if desired.

```
t.test(Outcome2, Outcome1, paired=TRUE, conf.level=.99)
```

Independent Samples t Test

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the samples size, mean, and standard deviation for the dependent variable for each of the levels.

```
tapply(Outcome, Factor, function(x) c(length(x), mean(x), sd(x)))
```

Obtaining Inferential Statistics

Test the mean difference for statistical significance and get its confidence interval.

```
t.test(Outcome~Factor, var.equal=T)
```

Also, you can change the width of the confidence interval if desired.

```
t.test(Outcome~Factor, var.equal=T, conf.level=0.99)
```

OneWay ANOVA

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the grand mean for the variable and the mean and standard deviation for the dependent variable for each of the levels.

```
mean(Outcome)
tapply(Outcome, Factor, function(x) c(length(x), mean(x), sd(x)))
```

Obtaining Inferential Statistics

Get the analysis of variance source table with test of statistical significance.

```
Results <- aov(Outcome~Factor)
summary(Results)
```

Post Hoc Comparisons

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the grand mean for the variable and the mean and standard deviation for the dependent variable for each of the levels.

```
mean(Outcome)
tapply(Outcome, Factor, function(x) c(length(x), mean(x), sd(x))))
```

Obtaining Inferential Statistics

Test each pairwise comparison for statistical significance.

```
Results <- aov(Outcome~Factor)
TukeyHSD(Results)
```

Repeated Measures ANOVA

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the sample sizes, means, and standard deviations for the variables.

```
lapply(RepeatedData, function(x) c(length(x), mean(x), sd(x)))
```

Obtaining Inferential Statistics

Get the ANOVA source table with tests of statistical significance.

```
Results=aov(Outcome~factor(Factor)+Error(factor(Subject)))  
summary(Results)
```

Factorial ANOVA

Prior to the steps below, enter the data as appropriate for the analyses (described elsewhere). As always, the following commands should be typed directly in the R console window.

Obtaining Descriptive Statistics

Get the mean, sample size, and standard deviation for the dependent variable for each of the levels. Also, get the means for the main effects.

```
Results <- aov(Outcome~FactorA*FactorB)
model.tables(Results,"means")
tapply(Outcome, list(FactorA,FactorB), length)
tapply(Outcome, list(FactorA,FactorB), sd)
```

Obtaining Inferential Statistics

Get the analysis of variance source table and a test of statistical significance.

```
summary(Results)
```