

How can I calculate a binomial confidence interval in R?

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The process of calculating a binomial confidence interval in R involves using a statistical formula to determine the range of values within which the true probability of success for a binomial distribution is likely to fall. This interval is based on a sample size, success rate, and desired level of confidence. By using R's built-in functions and packages, users can easily input their data and generate a confidence interval that can help assess the accuracy of their results and make informed decisions.

Calculate a Binomial Confidence Interval in R

A confidence interval for a binomial probability is calculated using the following formula:

$$\text{Confidence Interval} = p \pm z \cdot (\sqrt{p(1-p)} / n)$$

where:

p: proportion of "successes"
z: the chosen z-value
n: sample size

The z-value that you will use is dependent on the confidence level that you choose. The following table shows the z-value that corresponds to popular confidence level choices:

Confidence Level	z-value
0.90	1.645
0.95	1.96
0.99	2.58

For example, suppose we want to estimate the proportion of residents in a county that are in favor of a certain law. We select a random sample of 100 residents and find that 56 of them are in favor of the law.

This tutorial explains three different ways to calculate a confidence interval for the true proportion of residents in the entire county that support the law.

Method 1: Use the `prop.test()` function

One way to calculate the 95% binomial confidence interval is to use the `prop.test()` function in base R:

```
#calculate 95% confidence interval
```

```
prop.test(x=56, n=100, conf.level=.95, correct=FALSE)
```

1-sample proportions test without continuity correction

data: 56 out of 100, null probability 0.5

X-squared = 1.44, df = 1, p-value = 0.2301

alternative hypothesis: true p is not equal to 0.5

95 percent confidence interval:

0.4622810 0.6532797

sample estimates:

p

0.56

The 95% C.I. for the true proportion of residents in the county that support the law is .

Method 2: Use the binconf() function

Another way to calculate the confidence interval is to use the binconf() function from the Hmisc package:

```
library(Hmisc)
```

```
#calculate 95% confidence interval
```

```
binconf(x=56, n=100, alpha=.05)
```

```
PointEst Lower Upper
```

```
0.56 0.462281 0.6532797
```

Notice that this confidence interval matches the one calculated in the previous example.

Method 3: Calculate the Confidence Interval Manually

```
#define proportion
```

```
p <- 56/100
```

```
#define significance level
```

```
a <- .05
```

```
#calculate 95% confidence interval
```

```
p + c(-qnorm(1-a/2), qnorm(1-a/2))*sqrt((1/100)*p*(1-p))
```

```
0.4627099 0.6572901
```

Learn more about the `qnorm()` function here: [A Guide to `dnorm`, `pnorm`, `qnorm`, and `rnorm` in R](#)