STAT 8020 R Lab 13: Inference for Proportions

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Contents

Cancer treatment survival rate

Researchers in the development of new treatments for cancer patients often evaluate the effectiveness of new therapies by reporting the *proportion* of patients who survive for a specified period of time after completion of the treatment. A new genetic treatment of 870 patients with a particular type of cancer resulted in 330 patients surviving at least 5 years after treatment. *Estimate* the proportion of all patients with the specified type of cancer who would survive at least 5 years after being administered this treatment.

```
n = 870; x = 330
# point estimate
phat <- x / n
phat
```

```
## [1] 0.3793103
```

```
# 95% CI for p
library(fastR)
wald.ci(x, n, conf.level = 0.95)
```

```
## [1] 0.3470683 0.4115524
## attr(,"conf.level")
## [1] 0.95
```

```
# 99% CI for p
wald.ci(x, n, conf.level = 0.9)
```

```
## [1] 0.3522519 0.4063688
## attr(,"conf.level")
## [1] 0.9
```

Bird flu example

Among 900 randomly selected registered voters nationwide, 63% of them are somewhat or very concerned about the spread of bird flu in the United States.

- What is the point estimate for p, the proportion of U.S. voters who are concerned about the spread of bird flu?
- Construct a 95% CI for p

```
n = 900; x = 900 * .63
# point estimate
```

```r
phat <- x / n
phat
```

```
## [1] 0.63
```

```r
# 95% CI for p
wald.ci(x, n, conf.level = 0.95)
```

```
## [1] 0.5984574 0.6615426
## attr(,"conf.level")
## [1] 0.95
```

Sample size calculation example

A researcher wants to estimate the proportion of voters who will vote for candidate A. She wants to estimate to within 0.05 with 90% confidence.

```r
# True proportion is .9
p = 0.9; alpha = 1 - 0.9
n = p * (1 - p) * (qnorm(1 - alpha / 2) / 0.05)^2
n
```

```
## [1] 97.39956
```

```r
# True proportion is .6
p = 0.6
n = p * (1 - p) * (qnorm(1 - alpha / 2) / 0.05)^2
n
```

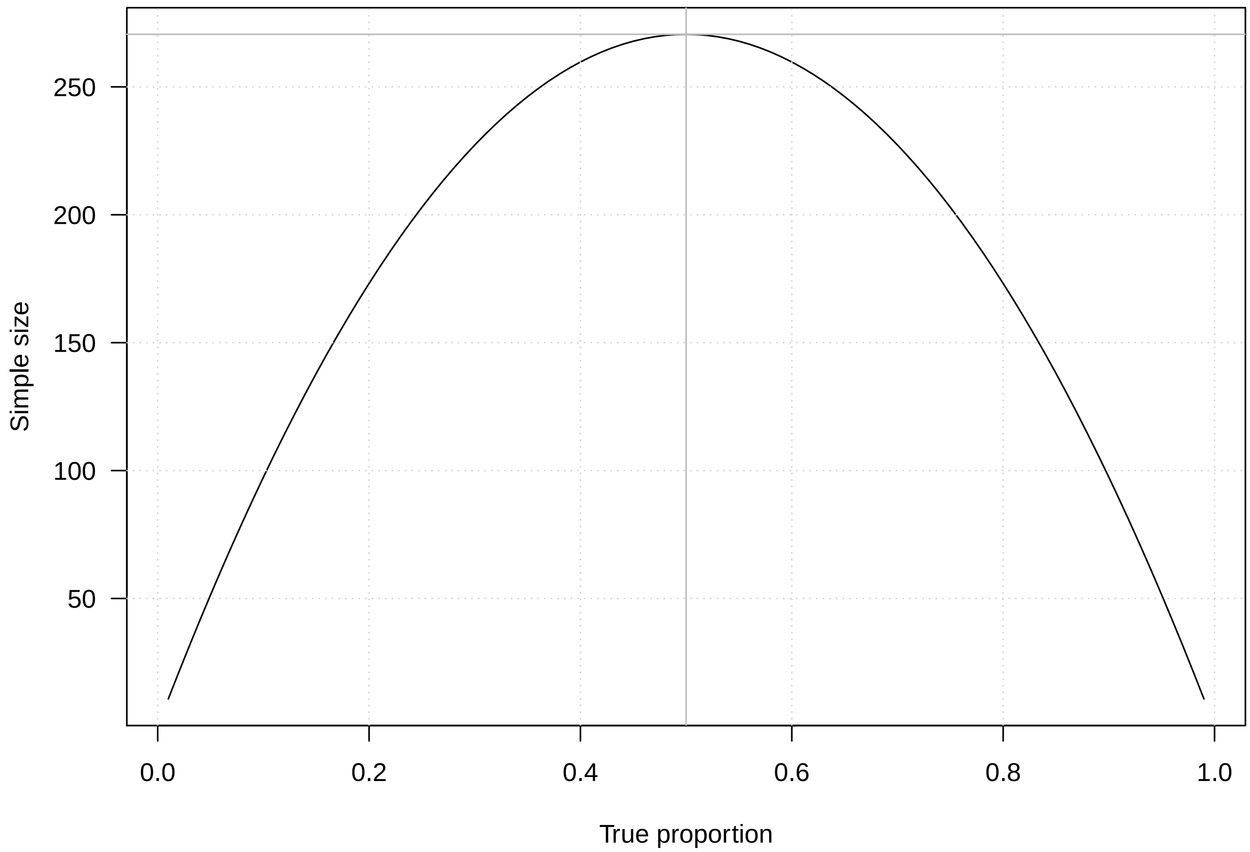
```
## [1] 259.7322
```

```r
# True proportion is .5
p = 0.5
n = p * (1 - p) * (qnorm(1 - alpha / 2) / 0.05)^2
n
```

```
## [1] 270.5543
```

```r
# Just for fun
p <- seq(0.01, 0.99, 0.01)
n = p * (1 - p) * (qnorm(1 - alpha / 2) / 0.05)^2

plot(p, n, type = "l",
     xlab = "True proportion",
     ylab = "Simple size",
     las = 1)
abline(v = 0.5, col = "gray")
abline(h = max(n), col = "gray")
grid()
```



Hypothesis testing: Bird flu example

Among 900 randomly selected registered voters nationwide, 63% of them are somewhat or very concerned about the spread of bird flu in the United States. Conduct a hypothesis test at .01 level to assess the research hypothesis: $p > .6$.

```
n = 900; x = .63 * 900
p_null = .6; alpha = 0.01

prop.test(x, n, p = p_null,
          conf.level = 1 - alpha,
          alternative = "greater",
          correct = FALSE)
```

```
##
##  1-sample proportions test without continuity correction
##
## data:  x out of n
## X-squared = 3.375, df = 1, p-value = 0.0331
## alternative hypothesis: true p is greater than 0.6
## 99 percent confidence interval:
##  0.5918879 1.0000000
## sample estimates:
##    p
## 0.63
```

```
# With Yates' continuity correction
prop.test(x, n, p = p_null,
```

```r
          conf.level = 1 - alpha,
          alternative = "greater",
          correct = TRUE)
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  x out of n
## X-squared = 3.2512, df = 1, p-value = 0.03569
## alternative hypothesis: true p is greater than 0.6
## 99 percent confidence interval:
##  0.5913242 1.0000000
## sample estimates:
##    p
## 0.63
```

Proportion of CU vegetarian

```r
n = 25; x = 0
wald.ci(x, n)
```

```
## [1] 0 0
## attr(,"conf.level")
## [1] 0.95
```

```r
## Wilson score CI
library(PropCIs)
scoreci(x, n, conf.level = .95)
```

```
##
##
##
## data:
##
## 95 percent confidence interval:
##  0.0000 0.1332
```

```r
## Check
prop.test(x, n, conf.level = 0.95,
          correct = F)
```

```
##
##  1-sample proportions test without continuity correction
##
## data:  x out of n
## X-squared = 25, df = 1, p-value = 5.733e-07
## alternative hypothesis: true p is not equal to 0.5
## 95 percent confidence interval:
##  0.0000000 0.1331923
## sample estimates:
## p
## 0
```

Here the rule of three provides a quick and reasonable approximation

Inference for $p_1 - p_2$

A Simple Random Simple of 100 CU graduate students is taken and it is found that 79 strongly agree that they would recommend their current graduate program. A Simple Random Simple of 85 USC graduate students is taken and it is found that 52 strongly agree that they would recommend their current graduate program. At 5 % level, can we conclude that the proportion of strongly agree is higher at CU?

```r
x <- c(79, 52); n <- c(100, 85)
prop.test(x, n, alternative = "greater", correct = F)
```

```
##
##  2-sample test for equality of proportions without continuity
##  correction
##
## data:  x out of n
## X-squared = 7.0618, df = 1, p-value = 0.003937
## alternative hypothesis: greater
## 95 percent confidence interval:
##  0.06847019 1.00000000
## sample estimates:
##    prop 1    prop 2
## 0.7900000 0.6117647
```

```r
# With Yates' continuity correction
prop.test(x, n, alternative = "greater", correct = F)
```

```
##
##  2-sample test for equality of proportions without continuity
##  correction
##
## data:  x out of n
## X-squared = 7.0618, df = 1, p-value = 0.003937
## alternative hypothesis: greater
## 95 percent confidence interval:
##  0.06847019 1.00000000
## sample estimates:
##    prop 1    prop 2
## 0.7900000 0.6117647
```