

Power Analysis

Pauline I. Alvarado

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This coding exercise was from the Statistics for Public Policy course taught by Dr. Matthew Levendusky at the University of Pennsylvania. Data was provided by the instructor.

Definition

Probability to conclude that there is an effect to be found. In the real world, power analysis can help decide if the study is worth conducting. 1-power is the probability of a type II error (don't find an effect when there is an effect to found, e.g. pregnant lady getting a negative pregnancy test).

Power.t.test() function

```
# power.t.test(n = NULL,  
               # delta = NULL,  
               # sd = 1,  
               # sig.level = 0.05,  
               # power = NULL,  
               # type = c("two.sample", "one.sample", "paired"),  
               # alternative = c("two.sided", "one.sided"))
```

Problem 1a

Average 3rd grader scores 65/100 on a reading test, with a standard deviation of 12 points. An after-school tutoring program claims to boost test scores by 5 points on average. If a pilot program of $n = 10$ students is conducted, what is the probability of a type-II error ($\alpha = 0.05$ and $H_0: \mu = 0$ vs $H_A: \mu > 0$).

```
power.t.test(n = 10,  
             delta = 5,  
             sd = 12,  
             sig.level = 0.05,  
             power = NULL,  
             type = "one.sample",  
             alternative = "one.sided")  
  
# probability of a type-II error  
1 - 0.33501
```

```
##
##      One-sample t test power calculation
##
##          n = 10
##        delta = 5
##         sd = 12
##    sig.level = 0.05
##      power = 0.33501
## alternative = one.sided
##
## [1] 0.66499
```

Problem 1b

Increase sample size

```
power.t.test(n = 50,
             delta = 5,
             sd = 12,
             sig.level = 0.05,
             power = NULL,
             type = "one.sample",
             alternative = "one.sided")

# probability of a type-II error
1 - 0.8962296
```

```
##
##      One-sample t test power calculation
##
##          n = 50
##        delta = 5
##         sd = 12
##    sig.level = 0.05
##      power = 0.8962296
## alternative = one.sided
##
## [1] 0.1037704
```

Problem 1c

In order to get the standard 0.80 power, how many students should be enrolled in the pilot?

```
power.t.test(n = NULL,
             delta = 5,
             sd = 12,
             sig.level = 0.05,
             power = 0.80,
             type = "one.sample",
             alternative = "one.sided")
```

```
##
##      One-sample t test power calculation
##
##          n = 37.00253
##      delta = 5
##      sd = 12
##      sig.level = 0.05
##      power = 0.8
##      alternative = one.sided
```

Problem 2

Nonprofit program that mentors youths claims that youth spend less than 30 minutes a day doing risky activities. Evaluation study measures how many minutes per day the kids ($n = 40$) spend doing “risky activities.” The average is 25 minutes per day on risky activities with a std deviation of 12 minutes.

```
# Hypothesis:
# H0: 30
# HA: 25

# What is the power?
power.t.test(n = 40,
             delta = 5,
             sd = 12,
             sig.level = 0.05,
             power = NULL,
             type = "one.sample",
             alternative = "two.sided")

# Probability of a type II error.
1 - 0.7290392
```

```
##
##      One-sample t test power calculation
##
##          n = 40
##      delta = 5
##      sd = 12
##      sig.level = 0.05
##      power = 0.7290392
##      alternative = two.sided
##
## [1] 0.2709608
```