EPI/BIOSTAT Math and R Skills Preparatory Workshop

Jessica Williams-Nguyen and Brian Williamson

22, 25, 26 September, 2017

This workshop is offered by the University of Washington School of Public Health.

Taught by

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Course Goals

Prepare participants for the UW's introductory Epidemiology and Biostatistics courses through gaining/regaining familiarity with mathematical concepts, word problems, the R programming language, and the RStudio programming environment. Specifically, we will cover:

- Core mathematical concepts (order of operations, fractions, algebra, logarithms)
- Communicating and analyzing data (graphics and word problems)
- R and RStudio basiscs, accessing R help

Cheat Sheets

RStudio.

R style guides (useful for making code easy to read): * Google's. * Hadley Wickham's.

Course Syllabus and Lecture Materials

Day 1, 22 September 2017, 8am-12pm

Lecture 0: Overview and Skills for Success, Jessica and Brian, 45 min pdf

- Introduction to the workshop, EPI/BIOST courses
- Some skills for success in graduate school

Lecture 1: Order of operations and negative numbers, Brian, 35 min pdf

- Teaser trailer: word problems
  - Example: kidney stones
  - Example: statistics in medical research
- Order of operations

- Negative numbers
- Absolute value

Lecture 2: Fractions, Percentages, and Decimals, Jessica, 60 min pdf

- Introducing proportions
- Fractions
- Other ways to represent proportions
- Proportions and other mathematical constructs in epidemiology

Lecture 3: Algebra, Jessica, 75 min pdf

- Solving for an unknown quantity
- Variables
- Weighted averages
- Cross-tabulation

Extra practice

Khan Academy offers interactive online units for most of the topics we covered today. (It may ask for a donation, but this not required to use it.) For each unit, you can take a quiz to check if you need more practice in a particular area. If so, it will direct you to areas of the site where you can review and practice those skills.

- Order of operations
- Negative numbers
- Fractions
- Decimals
- Relationship of fractions, decimals and percentages
- Algebra foundations (variables and substitution)
- Functions

Day 2, 25 September 2017, 2-5:30pm

Lecture 4: Graphs, Brian, 50 min pdf

- Slope-intercept and point slope form
- Drawing graphs based on an equation for a line
- Determining the equation from a graph
- Transformations: shifting and stretching

Lecture 5: Logarithms and Exponents, Brian, 40 min pdf

- Why transform our data?
- Exponentiation
- Logarithms
- Example: gender bias in salaries

Lecture 6: Word Problems, Jessica, 45 min pdf

- Using units

- Steps for solving word problems
- Example
- Exercises

Extra Practice

- Graphs
- Transforming functions:
- Stretching
- Shrinking
- Logarithms and exponents

Day 3, 26 September 2017, 8-10:30am

Lecture 7: Installing R and RStudio, Brian, 20 min (much live demo) pdf

Lecture 8: R and RStudio basics, Brian, 90 min (much live demo) pdf

- R interface
- RStudio interface
- R scripts
- Intro to R programming
  - Functions
  - Objects
  - Loading/saving data
  - Manipulating data (indexing, subsetting)
- R packages

Lecture 9: Accessing help, Brian, 40 min (much live demo) pdf

- Help files within R/on CRAN
- Help on the web

Recommended Reading/Browsing

R

- Lecture notes on data types and data structures (from 2016)
- Hadley Wickham's book

Reproducible Research

- Christopher Gandrud, Reproducible Research with R and Rstudio, (2015)
- Hadley Wickham, R Packages (2015)
- Yihui Xie, Dynamic Documents with R and knitr, (2015)
- Karl Broman's Tools for RR Course