MED101x
Introduction to Applied Biostatistics: Statistics for Medical Research

COURSE OVERVIEW

Want to learn how to analyze real-world medical data, but unsure where to begin? This Applied Biostatistics course provides an introduction to important topics in medical statistical concepts and reasoning. Each topic will be introduced with examples from published clinical research papers and hands-on data analysis using real-life datasets. This course also represents an introduction to basic epidemiological concepts covering study designs and sample size computation. Open-source, easy-to-use software will be used, such as R commander (Rcmdr), Easy R (EZR), and Power and Sample Size Calculation (PS) software.

LEARNING OUTCOMES

This course is a self-paced and you will be able to….

- *Understand basic statistical concepts in the medical field*
- *Select methodology of statistical testing correctly along with study design in the field*
- *Practice univariate analysis with using statistical software*
- *Interpret results of statistical analysis to be used in a real-life medical application*

COURSE LEVEL

Introductory to intermediate

PREREQUISITES

None / However, we expect that you have familiarity with basic statistics.

WEEKLY TOPICS

WEEK 1 - Basic Statistical Concepts

Introduction to basic statistical concepts such as descriptive statistics including mean, standard deviation, median, inter-quartile range, hypothesis testing, concepts of p-values and confidence intervals.

WEEK 2 - Basic Epidemiological Concepts

In order to understand medical statistics, it is essential to learn basic epidemiological concepts. You will be learning difference between experimental studies vs. observational studies, cohort studies, case-control, and cross-sectional studies. Concepts of randomization in clinical trials will be discussed with biases introduced in non-randomized studies.

WEEK 3 - Selecting Proper Statistical Tests

Students will learn how to select a proper statistical test given various scenarios defined by the following conditions (1) randomized vs observational studies, (2) detecting difference or correlation, (3) data dependence or independence, (4) outcome data type, (5) distribution of outcome data, (6) number of comparison groups in detecting differences (7) sample size.

WEEK 4 - Student's t-test, Mann-Whitney U test, Paired t-test, Wilcoxon signed-rank test

Students will learn how to compare means of continuous outcome variables between two independent groups by using Student's t-test and comparing medians of continuous outcome variables by using Mann-Whitney U test. Paired t-test and Wilcoxon signed-rank test will be also covered to compare means (or medians) of continuous outcome variable between two related groups.

WEEK 5 - Risk, Rate and Chi-square tests

When we compare a proportion of having an event (for example heart attack) in two groups of patients, ratio of two proportions provides relative risk (RR) as a measure of association between an exposure and an outcome. A similar matrix includes odds ratio (OR). In this chapter, students will learn how to compute and interpret RR and OR with a hands-on EZR computation using read data from Framingham heart study.

WEEK 6 - Sample Size and Power Analysis

When we plan a clinical study, it is highly important to estimate at least how many numbers of patients are needed in order to reach an estimated effect of an exposure of interest. Students will learn basic concepts in computing sample sizes clinical studies using PS software.