UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Introduction To Inference in Biostatistics

2223-1-F8203B039

Learning objectives

Aim of the course is to introduce students to the principles of statistical inference with applications in medicine and epidemiology. Basic statistical conceps will be formally presented, together with a intuitive approach based on simulation. Each topic will be therefore reviewed using examples in biomedical research. Practicals will be handed out and both individual and group homework will allowed. **In particular, the course is addressed to students with no previous background in statistics.**

Knowledge and Comprehension

This course will provide knowledge and understanding skills related to:

- basics of probability and probability distribution;

- basics of sample estimation and variability of an estimate;

- basics of confidence intervals;

- basics of statistical tests;

- basics of statistical simulation

- basics of correlation and regression

Contents

Descriptive statistics

Introduction to Probability, statistical distributions and random variables

Simulation methods

Sample estimation and variability of an estimate

Confidence Intervals

Statistical testing

Linear regression

Detailed program

Review of descriptive statistics

1.1 Types of data

1.2 Frequency distributions

1.3 Medians and quantiles

1.4 The mean

1.5 Variance and standard deviation

1.6 Applications in the biomedical field

2. **Probabilities, distributions and random variables**

2.1 Basic properties

2.2 Probability distributions and random variables

2.3 The Bernoulli and binomial distribution

2.4 The Poisson distribution

2.5 The Normal distribution

2.6 The exponential distribution

2.7 Applications in the biomedical field

3. **Simulation methods**

3.1 Importance of statistical simulations

3.2 Simulation of a discrete random variable

3.3 Simulation of a continuous random variable

4. **Sample estimate and variability of an estimate**

4.1 Sample distributions

4.2 Standard error of the sample mean

4.3 Central limit theorem

4.4 Confidence intervals

4.5 Comparison between two means

4.6 Comparison between two proportions

4.7 Applications in the biomedical field

5. **Statistical tests**

5.1 Draw a statistical hypothesis

5.2 Principles of significance tests

5.3 Levels of significance and types of errors

5.4 Statistical tests for the comparison between two means

5.5 Statistical tests for the comparison between two proportions

5.6 Multiple tests

5.7 Significance tests and confidence intervals

5.8 Applications in the biomedical field

6. **The linear Regression Model**

6.1 Model’s assumptions

6.2 Estimation and Interpretation of the regression coefficients

6.3 Statistical Inference on parameters

6.4 Model Fit

6.5 Residuals Analysis

Prerequisites

None

Teaching methods

Lectures

Compures based practicals using Stata

Assessment methods

Oral and Written exam

There will be a written and oral exam according to the guidelines from the instructors. The written exam is based on both close and open questions, aimed to assess the general knowledge of the student and his/her capacity to formulate the right statistical analyses and to interpret the results in the proper way. The written exam will be followed by an oral discussion, based on the written examination.

The written and oral exam will allow to assess the student’s knowledge on principles of statistical inference applied to the biomedical field.

Textbooks and Reading Materials

1. Principles of Biostatistics, M Pagano and K. Gauvreau. Second Edition, CRC press.

2. An Introduction to Medical Statistics, M Bland. Fourth Edition. Oxford.

3. Fundamentals of Biostatistics, Bernard Rosner. Thomson. Sixth Edition.

Semester

Semester I, Period I

Teaching language

Teaching material will be both in english and italian, lectures will be in italian.

Sustainable Development Goals

QUALITY EDUCATION