UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biostatistics

2627-1-F0602Q077

Aims

The course aims to provide theoretical and practical skills regarding the planning of a biological study, the collection and statistical analysis of data, the interpretation and reporting of results.

Knowledge and understanding

At the end of the course the student should know the fundamental concepts of descriptive (summary and variability indexes) and inferential (hypothesis testing and confidence interval) statistics and of regression models (linear and logistic models).

Applying knowledge and understanding

The student should be able to plan a study, calculate the proper sample size and apply statistical methods for the analysis of data.

Making judgements

The student should be able to select the study design depending on the aim and to choose the proper statistical analysis method depending on the nature of data. Furthermore, the student should be able to understand and evaluate, from a statistical point of view, the solidity of findings of published studies.

Communication skills

The student will be able to correctly report the results of a study, justifying the methods used for the statistical analysis.

Learning skills

At the end of the course, the student will manage the basic concepts of statistical analysis and will be able to fully

understand the results of studies published in the biological literature.

Contents

1. Review of statistical methods for the description
2. The measurement error in biology
3. Review of elements of probability theory
4. Introduction to statistical inference
5. Regression models
6. Planning a study

Detailed program

1. Review of statistical methods for the description of biological variability

Statistical unit, sample and population, variables and data; Types of variables; Summary indexes and dispersion indexes; Graphical visualization of data.

2. The measurement error in biology

Evaluating the validity of measurement methods; sampling error and precision; systematic error and accuracy.

3. Review of elements of probability theory

The definitions of probability; Conditional probability and independence; Random variables and probability functions; The Binomial and the Gaussian distributions.

4. Introduction to statistical inference

Population parameter, estimate and standard error; Confidence interval; Introduction to hypothesis testing, significance level and power; T test, introduction to the analysis of variance (ANOVA); Chi-square test; Non-parametric tests.

5. Regression models

Correlation and linear regression; logistic regression

6. Planning a study

Observational and experimental studies; sample size calculation; control of the experimental variability; scientific reviews: introduction to meta-analysis

Prerequisites

Background. Basics of mathematics and computer science

Prerequisites. None

Teaching form

Lectures and classroom exercises supported by PowerPoint presentations (approximately 36 hours, corresponding to about 15 sessions).

Computer laboratory sessions with practical applications using the R software (approximately 12 hours, corresponding to about 4 sessions).

Textbook and teaching resource

Teaching slides

All the teaching resources will be made available through the course page on the e-learning platform

Suggested textbook

Whitlock MC, Schluter D. Analisi statistica dei dati biologici. Seconda edizione. Zanichelli, 2022.

Semester

Second semester

Assessment method

Final written examination, including:

- exercises to evaluate student’s ability to apply the concepts covered during the course
- multiple choice questions to check the level of knowledge of the student on the whole program

No mid-term examinations (in-course assessments) are scheduled.

Office hours

Upon request by email

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | LIFE ON LAND