Ph.D. in "Life Course Research" – Biomedical curriculum
Academic Year 2024-2025
Course: **Medical Statistics**
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Objectives:

The course aims to present and introduce the basics of medical statistics; reporting the main index, distribution, and test available to analyse clinical data. Starting from descriptive statistic, the course will then illustrate different approaches for making inferential assumptions, concluding with notions regarding odds ratio, relative risk and pills of linear regression, logistic regression and Cox model.

Program:
Lesson 1:

Descriptive statistics: study of the characteristics of a sample extracted from a population. In this section will be provided notions of synthetic indices used to summarize information about the sample

- Central tendency indexes
- Variability indexes

Sample means: in this section will be explained the characteristics of the sample means, the normal distribution will be also presented and the use of the standard normal distribution tables will be explained

- Distribution of sample means
- Properties of distribution of sample means
- Normal distribution and standardized normal distribution

Punctual estimation and interval estimation: difference between punctual estimate and interval estimate

- Inferential statistic
- Representativity of the sample
- Standard error
- Confidence intervals: CI for the mean, with known variance and with unknown variance
- T-student distribution

Lesson 2:

Hypothesis testing: a systematic method for making decisions about population parameters based on sample data; general characteristics and specific cases

- Region of non-rejection and rejection
- I type and II type errors
- Calculation of the non-rejection region
- Significance level and power of a test

- Unilateral and bilateral tests
- P-value

Analysis of an RCT: overview of epidemiological studies with focus on RCTs

- RCTs in general
- Internal and external validity

Comparison of means: in order to evaluate whether the differences observed between two means of two samples are too much large to be attributed only to chance. Case with two groups or with more than two groups

- T test
- One-way ANOVA: total deviance decomposition, test F (Fisher)
- Two-way ANOVA: analysis of variance based on the classification of data based on two variables, examples with and without interaction

Linear regression: general introduction to linear regression explaining parameters and assumptions

- Least squares method
- Coefficients estimation and interpretation: X continuous, dichotomous, categorical variable
- CI and hypothesis tests on the slope
- Fit of the model

Lesson 3:

- Correlation: Pearson correlation
- Multiple linear regression: general concepts, interpretation of parameters and case study examples
- Chi-square test: expected frequencies, distribution and chi-square distribution tables
- Relative risk, cumulative incidence, estimation of risk with lost cases at follow-up, density incidence
- Analysis of an observational study: cohort studies, case-control studies
- Odds and Odds Ratio
- Notions of logistic regression and Cox proportional hazards model

Suggested lecture:
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Requirement: -