COURSE DETAILS

"INTEGRATED COURSE OF MEDICAL STATISTICS AND INFORMATICS"

SSD MEDS-24/A *

DEGREE PROGRAMME: MEDICINE AND SURGERY

ACADEMIC YEAR2024-2025

GENERAL INFORMATION–TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THECOURSE

TEACHINGLANGUAGE: ENGLISH
YEAR OF THE DEGREE PROGRAMME(I, II, III): I
SEMESTER (I, II, ANNUAL): I
CFU: 5

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")

there are no required preliminary courses

PREREQUISITES (IF APPLICABLE)

Basic mathematics. Functions and their graphic representation.

LEARNING GOALS

The course aims at providing students with the ability to understand the essential concepts of medical statistics and epidemiology and efficiently adopt statistical methods and terminology in order to enhance their skillset to produce their own research and interpret the published evidence.

The students will:

- Gain competence in reading, interpreting, and understanding the core statistical methods and results commonly reported in clinical trials
- Learn to produce tabular or graphical statistical descriptions of real and simulated medical data
- Interpret and generate probabilistic statements regarding medical and epidemiological hypotheses
- Evaluate and state the precision of the estimates of therapeutic or risk effects, investigated by themselves or others.
- Understand and formulate simple statistical models, to explain the relationships between several prognostic or therapeutic variables and clinical outcome.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student will have to demonstrate knowledge, competency and ability to discuss the main biostatistical aspects that characterize clinical trials and observational studies. In particular, they must be able to recognize the main statistical methodologies used in the studies, discuss their limitations and their implications in terms of the clinical relevance of the results obtained.

Applying knowledge and understanding

The student must be able to formulate an elementary statistical research plan concerning a clinical trial and/or an observational study through, in the first case, the calculation of the sample size and the definition of strategies of randomization and of the statistical plan, and, in the second, of the tools to limit the phenomenon of confounding. They will need to be able to perform descriptive statistics and use elementary statistical tests with the aid of software.

COURSE CONTENT/SYLLABUS

- The scientific method and approach, the quantitative paradigm of Evidence Based Medicine, study design
- Introduction to Measure Theory, graphical and tabular data representations
- Measures of central tendency and dispersion
- Introduction to Probability Theory
- Measures of diagnostic accuracy (sensitivity, specificity, AUC, PPV, NPV)
- Measures of association (OR, RR)

- Introduction to Statistical Inference (concepts of Population, Random Sample, sampling theory and sampling distributions)
- Theory of Random Variables
- Central limit theorem
- Introduction to discrete and continuous random variables,
- Theory of Point estimation (with a particular focus on Unbiasedness, Efficiency and Consistency)
- Theory of Interval Estimation (concepts of random and confidence intervals, relationship between confidence, precision and sample size)
- Hypothesis Testing (probabilistic structure of a statistical test, power and significance of a test, criteria to obtain the best decision rule, p-value)
- Correlation
- Linear Regression models
- Introduction to logistic regression model
- Multiple regression models and interactions
- Introduction toSurvival Analysis
- The Kaplan Meier estimator
- The Cox proportional hazards model.

READINGS/BIBLIOGRAPHY

Supporting didactic material available at the website (https://www.docenti.unina.it/daniela.pacella)
Suggested books:
- Biostatistics: A Foundation for Analysis in the Health Sciences (Wiley Series in Probability and Statistics) Wayne W. Daniel, Chad L. Cross
- An Introduction to Medical Statistics (Oxford Press) Bland Martin

TEACHING METHODS

The theoretical coverage of all topics will always be supplemented by substantial practical applications. All topics covered will be applied during exercise sessions that will aim to consolidate and summarize the knowledge and competencies acquired during the course.
Classes/lectures will cover about 75% of the lectures. The remaining 25% of the hours will be dedicated to exercises on all the topics covered.

EXAMINATION/EVALUATION CRITERIA

a) Examtype:

Examtype	
writtenandoral	x
onlywritten	
onlyoral	
project discussion	
other	

In case of a written exam, questions refer to: (*)	**Multiple choiceanswers**	
	Open answers	x
	Numericalexercises	x

(*) multiple options are possible

Written examination: 10 questions to be answered in 100 minutes. 3 points maximum per question.

b) Evaluation pattern:

The exam will consist of a written and oral examination and both are mandatory.
The oral examination will follow the written examination only if the written is passed with a minimum vote of 18/30.
The written examination consists of open-ended numerical exercises and questions.
The oral examination will consist in theoretical questions and new exercises.

CALENDAR of THE COURSE LESSONS

Week	Day		Timetable	Module	Topics	Teacher
1	Monday	22/10/2024	14.40 - 16.15	MedicalStatistics	Introduction to statistics, types of variables.	Pacella
	Wednesday	2310/2024	13.00 - 15.25	MedicalStatistics	Measures of central tendency and variability	Pacella
2	Monday	28/10/2024	14.40 – 16.15	MedicalStatistics	Algebra of events, Venn diagrams.	Pacella
	Wednesday	30/10/2024	13.00 – 15.25	MedicalStatistics	Theory and definition of probability, union, intersection and conditional probability.	Pacella
3	Monday	04/11/2024	14.40 - 16.15	MedicalStatistics	Measures of diagnostic performance and their probabilistic formulation, exercises.	Pacella
	Wednesday	06/11/2024	13.00 - 15.25	MedicalStatistics	ROC curve, types of study.	Pacella
4	Monday	11/11/2024	14.40 - 16.15	MedicalStatistics	Study design, concept of odd and conditional odds.	Pacella
	Wednesday	13/11/2024	13.00 - 15.25	MedicalStatistics	Measures of association and probabilistic formulation, exercises.	Pacella
5	Monday	18/11/2024	14.40 - 16.15	MedicalStatistics	Relationship between two quantitative variables, Covariance, Pearson's correlation.	Pacella
	Wednesday	20/11/2024	13.00 - 15.25	MedicalStatistics	Lin's concordance coefficient, individual exercitation on the whole descriptive statistics programme.	Pacella
6	Monday	25/11/2024	14.40 - 16.15	MedicalStatistics	Introduction to inferential statistics, Theory of random variables, discrete and continuous random variables.	Pacella
	Wednesday	27/11/2024	13.00 - 15.25	MedicalStatistics	Normal random variable and standardization.	Pacella
7	Monday	02/12/2024	14.40 - 16.15	MedicalStatistics	Theory of estimators, properties of estimator, estimator sample mean and sample proportions.	Pacella
	Wednesday	04/12/2024	13.00 - 15.25	MedicalStatistics	Using the z-table and exercises on the sample mean and sample proportion estimators.	Pacella
8	Monday	09/12/2024	14.40 - 16.15	MedicalStatistics	Concept of hypothesis testing, type I and type II error, alpha and beta.	Pacella
	Wednesday	11/12/2024	13.00 - 15.25	MedicalStatistics	Concept of p-value and formulation of the hypothesis system, exercises.	Pacella

9	Monday	16/12/2024	14.40 - 16.15	MedicalStatistics	Student's t distribution, Hypothesis testing on the difference between two means of independent populations, on the means of the differences, on the difference between proportions.	Pacella
	Wednesday	18/12/2024	13.00 - 15.25	MedicalStatistics	Hypothesis testing on the measure of association, and p-value calculation.Chi-square measure, distribution and formulation of hypothesis on the chi-square.	Pacella
10	Wednesday	08/01/2025	13.00 - 15.25	MedicalStatistics	Theory of confidence intervals and interpretation, confidence interval for the sample mean, sample proportion, for the difference between means and between proportions and for the measures of association, exercises	Pacella
11	Monday	13/01/2025	14.40 - 16.15	Informatics	Sample size calculation for the difference between means and difference between proportions. Concept of power and power analysis.	Pacella
	Wednesday	15/01/2025	13.00 - 15.25	Informatics	The linear regression model, least squares equation, interpretation of the regression coefficient	Pacella
12	Monday	20/01/2025	14.40 - 16.15	Informatics	Logistic regression model, multiple regression, concept and interpretation of an interaction.	Pacella
	Wednesday	22/01/2025	13.00 - 15.25	Informatics	Exam simulation/exercises	Pacella
13	Monday	27/01/2025	14.40 - 16.15	Informatics	The concept of time-to-event variables, censoring, the Kaplan-Meier curve	Pacella
	Wednesday	29/01/2025	13.00 - 15.25	Informatics	Survival analysis, the Cox regression model and the hazard ratio	Pacella