1. OVERVIEW

Subject Area	Basic Epidemiology and Applied Biostatistics
Degree	Bachelor's Degree in Medicine
School/Faculty Year	Biomedical and Health Sciences
	2º
ECTS	10
Type Language(s)	Compulsory
Delivery Mode	Spanish
	On campus
Semester	Yearly

2. INTRODUCTION

Basic Epidemiology and Applied Biostatistics belongs to the Social Medicine, Communication Skills and Introduction to Research module. It is taught in the 2nd year and is linked to another subject in this module which is taught in the 5th year - Research Methods.

This subject aims to integrate the principles of epidemiology and biostatistics with their use in the medical field. Throughout the course, biostatistics is a tool for analysis and reaching conclusions following a scientific method. It also teaches medical matters regarding epidemiology, risk factors and the prevention of communicable and non-communicable diseases.

In an era where medicine is based on evidence, it is taken for granted that doctors are able to make clinical decisions once they have chosen, understood and analysed scientific information. Therefore, this subject develops the skills involved in this process which will be key to clinical subjects studied in subsequent years.

At the end of this course, students will understand and be able to perform statistical analysis. Even more importantly, they will be able to read and understand statistical methods used in medical studies, know how to correctly interpret the results obtained, and acquire the knowledge necessary to build a critical outlook on medical literature. They will also obtain general knowledge on epidemiology, risk factors and prevention of communicable and non-communicable diseases of greatest prevalence and/or mortality in our environment.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

CB3: Students have the ability to gather and interpret relevant information (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.

CB4: Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

CG10. Understand and recognise the causal agents and risk factors which determine health conditions and the development of a disease.

CG25. Recognise the determining factors of the population's health, including genetics and those influenced by lifestyle, demographic, environmental, social, financial, psychological and cultural factors.

CG26. Assume a role in the prevention and protection against diseases, injuries or accidents, together with the maintenance and promotion of health, both on an individual and community level.

CG28. Obtain and use epidemiological data and evaluate trends and risks to take health-related decisions.

CG34. In professional practice, maintain a critical, creative, constructively-sceptical and research-minded approach.

CG35. Understand the importance and limitations of scientific thinking in the study, prevention and

management of diseases.

CG36. Be able to formulate hypotheses, gather information and critically evaluate information to solve problems following the scientific method.

CG37. Acquire basic training in research activity.

Cross-curricular skills (CT, by the acronym in Spanish):

CT3: Teamwork: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals, evaluate and integrate contributions from the rest of the group members and create a good working environment.

Specific skills (CE, by the acronym in Spanish):

CE 2.3.1 Understand the principles of preventative medicine and apply its methods to public health. Disease risk and prevention factors. Recognise determining factors in the population's health. Health indicators. Prevention and protection against diseases, injuries and accidents.

CE 2.4.1 Understand, critically assess and know how to use clinical and biomedical information technology and sources to obtain, organise, interpret and communicate clinical, scientific and health information.

CE 2.4.2 Know the basic concepts of biostatistics and how they are applied to medical sciences. Be able to design and carry out simple studies using computer programs and interpret the results.

CE 2.4.3 Understand and interpret statistical data in medical literature.

CE 2.4.5 Independently use a personal computer. Use search and biomedical data recovery systems.

CE 2.4.6 Understand and critically interpret scientific texts. Understand the principles of the scientific method, biomedical research and clinical trials.

Learning outcomes (RA, by the acronym in Spanish):

- Know the principles and application of general and clinical epidemiology.
- Understand the basics of health demographics.
- Understand the epidemiological characteristics and main risk factors behind the most prevalent and mortal diseases.
- Know the basic concepts of biostatistics and how they are applied to medical sciences.
- Understand the principles of the scientific method and how it is applied to different models of scientific studies in biomedical research.
- Independently use a personal computer and know how to use the most common statistical programs.
- Know how to interpret the results from the most common statistical tests in scientific studies.

The following table shows how the skills developed in the course match up with the intended learning outcomes:

Skills	Learning outcomes
CB3, CB4, CG26, CG28, CG34, CE231	Know the principles and application of general and clinical epidemiology.
CB3	Understand the basics of health demographics.
CG10, CG25	Understand the epidemiological characteristics and main risk factors behind the

	most prevalent and mortal diseases.
CG37, CE242,	Know the basic concepts of biostatistics and how they are applied to medical sciences.
CG34, CG35, CG36 CG37, CE246	Understand the principles of the scientific method and how it is applied to different models of scientific studies in biomedical research.
CG37, CE245	Independently use a personal computer and know how to use the most common statistical programs.
CG37, CE241, CE243, CE246	Know how to interpret the results from the most common statistical tests in scientific studies.

4. CONTENTS

PART I: FUNDAMENTALS OF EPIDEMIOLOGY AND APPLIED BIOSTATISTICS

1. Concept of health and determining factors in health.

-Concepts of health, public health and community health

-Determining factors in human health

-Concepts of epidemiology and biostatistics applied to medical epidemiology

2. Concept and uses of epidemiology.

-Concept and history of medical epidemiology

-Uses of epidemiology in medicine

-The epidemiological method applied to medical epidemiology

-Descriptive, analytical and inferential concepts of epidemiology

3. Classification and characteristics of epidemiology studies.

-Classification of epidemiology studies used in medicine

-Observational studies

-Experimental studies Clinical trials

-Metaanalysis and review articles

-Advantages and disadvantages of different designs

4. Measuring of health and disease phenomena (descriptive epidemiology)

-Concept of a variable and types of variables

-Frequency measurements for qualitative data

-Absolute values and values relative to the population size

-Incidence and prevalence

5. Measures which summarise quantitative data. (Descriptive epidemiology)

-Measures of central tendency

-Measures of dispersion

-Measures of position

-Use of epidemiology in each of the measures

-Tabulation and graphic representation of the data

6. Introduction to probability.

-Concept and use of probability in medicine

-Random events and operations with events

-Conditional probability Bayes' theorem

7.- Probability: Applications in medical epidemiology and associated topics

-Evaluation of diagnostic tests: Sensitivity and specificity

-Concepts of population and sample

-Sampling techniques and calculating the sample size

-Concept of estimation and confidence intervals

-Risk

-Risk factors, markers and indicators

-Association and independence in epidemiology

-Types of association -Statistical significance

-Causality and causal models

8. Probability distributions.

-Use of probability distributions in medical statistics

-Binomial distribution and Poisson distribution

-Normal distribution and standard normal distribution

9.-Inferential epidemiology I.

-Estimation of parameters: inference of average and inference of proportion

10.-Inferential epidemiology II.

-Contrast hypothesis

-Types of errors in contrast hypothesis

-Parametric and non-parametric hypothesis testing

11.-Inferential epidemiology III.

-Application of contrast hypothesis in epidemiological studies

12. Quality of medical epidemiological studies

-Types of errors in epidemiological studies (bias)

-Validity and reliability of epidemiology studies

-Evidence-based medicine

13. Health demographics

-Concept of health demographics

-Use of demographics in medical epidemiology

-Methods used in health demographics and their interpretation

PART II. EPIDEMIOLOGY, RISK FACTORS AND PREVENTION OF DISEASES WITH GREATEST PREVALENCE AND/OR MORTALITY.

14. General characteristics and epidemiology of communicable diseases.

15. Prevention and control of communicable diseases.

16. **Active and passive immunisation. Vaccination programmes.**
17. **Epidemiology, risk and prevention factors of cardiovascular diseases.**
18. **Epidemiology, risk and prevention factors of cancer.**
19. **Epidemiology, risk and prevention factors of chronic respiratory disorders.**
20. **Epidemiology, risk and prevention factors of obesity.**
21. **Epidemiology, risk and prevention factors of diabetes.**
22. **Epidemiology, risk and prevention factors of mental disorders.**

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Theory classes
- Learning based on epidemiological case simulations and data analysis
- Biostatistics problem sessions applied to medical epidemiology
- Elaboration and presentation of a specialised group work on epidemiology of communicable and non-communicable diseases.
- Specialised seminars: literature research and debate on scientific data

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus

LEARNING ACTIVITIES	HOURS
Theory/practical learning activities	114
Directed learning activities	28
Self-study	75
Tutorials	30
Knowledge tests	3
TOTAL	250

7. ASSESSMENT

The assessment methods, plus their weighting in the final grade for the course, are as follows:

On campus:

Assessment system	Weighting
Tests (including problem solving)	64%
Assessment of specialised work and literature session	14%
Assessment of epidemiological simulation activities and analysis of scientific articles	11%
Assessment of a database analysis and presentation of results	11%

The tests include an assessment of theoretical content (44%) and skills acquired during the directed practical work and activities (20%).

The assessment of the specialised work and literature session, simulation and analysis of epidemiological problems and database analysis all include assessment of student skills and attitude (36%).

8. BIBLIOGRAPHY

The recommended bibliography is indicated below:

Part I:

- Celentano DD, Szklo M. Epidemiología (Gordis) 6ª ed. Elsevier. 2020
- Dawson B, Trapp RG. Bioestadística Médica. 4 ed. Manual Moderno. 2005.
- Greenberg RS, Daniels SR et al. Epidemiología médica. 4 ed. Manual Moderno. 2005.
- Milton JS. Estadística para Biología y Ciencias de la Salud. 3 ed. MacGraw-Hill-Interamericana. 2007.
- Goldberg M. La Epidemiología sin esfuerzo. 2 ed. Díaz de Santos. 1994
- Fletcher RH. Epidemiología Clínica: aspectos fundamentales. 2 ed. Masson. 2003.
- Unidad de Bioestadística Médica del Hospital Ramón y Cajal. Material Docente. http://www.hrc.es/bioest/M_docente.html

Part II:

- Celentano DD, Szklo M. Epidemiología (Gordis) 6ª ed. Elsevier. 2020
- Piédrola Gil . Medicina Preventiva y Salud Pública. 12 ed. Elsevier Masson. 2015.