COURSE DATA

DATA SUBJECT

Code: 34331
Name: Biostatistics and ICT
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1208 - Degree in Podiatry	Facultat d'Infermeria i Podologia	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1208 - Degree in Podiatry	Statistics	BASIC

COORDINATION

ESTARLICH ESTARLICH MARÍA LUISA

SUMMARY

The course **Biostatistics and Information and Communication Technologies Applied to Health Sciences** is part of the **basic training** in the **Bachelor¿s Degree in Podiatry**. It is taught in the **second semester**.

The structure of the course allows it to **complement many other subjects** in the degree and makes it **essential for fourth-year subjects** and the **Final Degree Project**.

The course is organized into **four thematic blocks**:

- **Information and communication technologies**,
- **Descriptive statistics**,
- **Probability and inference**, and

- **Health demography**.

These blocks cover statistical and demographic concepts and their **application in the health sciences**.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

No prior knowledge of statistics, demography, or information and communication technologies is required, although it will be very helpful for the student to be familiar with similar content typically found in high school mathematics courses and to be accustomed to using a computer and spreadsheet software.

COMPETENCES / LEARNING OUTCOMES

-

Understand, critically asses and know how to use biomedical technology and sources of information to obtain, organise, interpret and communicate scientific and health information. Know the basic concepts of biostatistics and its application. Use search and retrieval systems for biomedical information and understand and critically interpret scientific texts. Know the principles of the scientific method, biomedical research and the clinical trial.

DESCRIPTION OF CONTENTS

1. Biostatistics

Block 1: DESCRIPTIVE STATISTICS

- Statistics and Health Sciences
- Data collection and organization. Measurement scales.

- Variables (characteristics) and modalities. Frequency, proportion, and percentage.
- Data presentation: Frequency distribution tables and graphical representations.
- Measures of central tendency and position: Mean, median, mode, percentiles.
- Measures of variability: Range, interquartile range, variance, standard deviation, coefficient of variation.

Block 2: PROBABILITY

- Introduction to probability. Definition and basic properties. Bayes' theorem. Diagnostic value of a test.
- Discrete probability distributions: Bernoulli, Binomial, Poisson, Multinomial.
- Continuous probability distributions: Normal, Student¿s t, Chi-square.

Block 3: INFERENCE

- The need for sampling. Some sampling methods: Simple random sampling, stratified sampling, systematic sampling, cluster sampling, multistage sampling.
- Parameters and statistics. Sampling distributions. Distribution of the mean. Distribution of the difference of means. Distribution of a proportion. Distribution of the difference of proportions.
- Point estimator. Properties. Point estimators of the most relevant population parameters.
- Hypothesis testing. Point estimation of the mean. Central limit theorem. Unbiasedness and precision. Likelihood function. Confidence interval.
- Point estimation of a proportion and confidence interval. Point estimation of the difference of means and confidence interval. Comparison of samples using the t-test, ANOVA.
- Point estimation of the difference of proportions and confidence interval. Comparison of two samples using the Chi-square or Fisher test.

- Type I and Type II errors. Error bounds for sample size calculation. Sample size calculation for estimating means and proportions.

2. Demography

Block 4: DEMOGRAPHY AND HEALTH SCIENCES

- The population census, municipal population registry, and natural population change. Types of population. Other relevant records.
- Ratios, proportions, and rates.
- Population structure: Classification by age groups, sex, and combinations of both. Aging index. Dependency ratio. Masculinity and femininity coefficients. Population pyramids: tables and graphical representations.
- Population dynamics: Natural growth, migratory balance, and actual growth. Evolution index and percentage change. Annual growth rate.
- Indicators of abortion, fertility, and mortality.
- Potential years of life lost.
- The problem of rate comparison. Methods for standardizing rates: standard population method (direct), standard rate method (indirect), standardized mortality ratio.

3. Practical Content ¿ Practice I1

Practice I1: DESCRIPTIVE STATISTICS
Practical sessions will involve using computers in the classroom to reinforce theoretical concepts while practicing the procedures necessary to successfully solve exercises likely to appear on the exam.

1. Each student subgroup will be given a Unicode-format dataset to load into statistical software.
2. After understanding what information each variable/column contains, students must classify

variables as qualitative (nominal, ordinal, binary) or quantitative (discrete, continuous).

3. Construct a frequency distribution table for a quantitative variable.
4. Create contingency tables by crossing qualitative variables.
5. Build class intervals for quantitative variables.
6. Calculate measures of central tendency, position, variability, and shape.
7. Create charts, contingency tables, histograms, and frequency polygons.
8. Prepare a short report as a synthetic analysis of the results obtained.

4. Practical Content ¿ Practice I2

Practice I2: PROBABILITY, RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS
Students will receive a set of exercises covering:

1. **Probability**
    - Probability and its properties
    - Conditional probability. Independence
    - Total probability theorem and Bayes¿ theorem
    - Diagnostic testing
2. **Probability Distributions**
    - Discrete variables and relative/cumulative frequency distribution
    - Binomial distribution
    - Poisson distribution

- Normal distribution
- Approximating binomial and Poisson distributions with the normal distribution

Exercises will be distributed randomly so that, in groups or individually, students solve problems related to probability and distributions. The instructor will randomly select students to present their solutions to the class.

5. Practical Content ¿ Practice I3

Practice I3: STATISTICAL INFERENCE
Students will receive a set of exercises on:

1. Statistical sampling
2. Parameter estimation
    - Median estimation
    - Proportion estimation
3. Confidence intervals
    - Confidence interval for the median
    - Confidence interval for the proportion
4. Sample size
    - Sample size for estimating medians
    - Sample size for estimating proportions
5. Comparisons
    - Comparing means using t-tests, ANOVA, or equivalent non-parametric tests

- Comparing proportions using the Chi-square test

A short report will be required, summarizing the results in a concise analysis.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	32,00
Computer classroom practice	20,00
Classroom practices	6,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	25,00
Preparation of lessons	20,00
Preparation for assessment activities	20,00
Resolution of case studies	5,00
Total hours	**90,00**

TEACHING METHODOLOGY

With the teaching-learning methodology outlined below, the goal is for students to understand the connection between theory and practice.
The use of the blackboard and audiovisual media is planned.
All these classes will present students with real-life situations in which to apply the theoretical knowledge explained. The aim is not for students to simply accumulate concepts, but to apply them to real-world situations and know how to interpret the results they obtain.

These thematic blocks are complemented by computer-based practical sessions using simple statistical and demographic analysis software. Students will also work on searching for demographic and health information online.

All instruction will be reinforced with exercises available in the Virtual Classroom.
Communication between students and faculty will primarily take place via institutional email.
Tutoring sessions may be held either in person or via email.

EVALUATION

The evaluation will consist of a theoretical part and a practical part, aimed at developing and applying the concepts covered in class:

Theoretical Part:

The theoretical part will be assessed through multiple-choice tests conducted throughout the course and a final exam:

- **Block Tests (TBi):** After completing each thematic block, a multiple-choice test will be conducted (on a date agreed upon with the students). Each test will last 1 hour. The average of the block tests will be taken to obtain TB.
- **Final Multiple-Choice Exam (TF):** This will be held on the date assigned by the academic calendar (OCA) and will last 90 minutes.

The multiple-choice exams will consist of four-option questions, with only one correct answer. The grading will be as follows:

- **Correct answers:** Score positively.
- **Incorrect answers:** Penalized by subtracting 1/3 of a correct answer.
- **Blank answers:** Do not score.

All tests will be in-person.
Maximum score: 10 points. (0 ¿ TB, TF ¿ 10)

Recovery of Block Tests:
A make-up session for block tests will be offered on the last day of class for students who missed them due to justified reasons. Each test will last 30 minutes.

Practical Part (Individual Assessment):

The practical assessment will consist of three individual in-person exercises carried out during the course (after each thematic block and on dates agreed upon with the students):

- **Practice 1 (P1):** Solving descriptive statistics exercises using a database provided by the instructor, with the software used in the course.
- **Practice 2 (P2):** Solving selected exercises from a collection proposed by the instructor. Only a formula sheet provided by the instructor may be used.
- **Practice 3 (P3):** Solving inferential statistics exercises using a database provided by the instructor, with the course software.

Maximum score for the practical part: 10 points (0 ¿ Pi ¿ 10).

Additional Exercises (PE)

Optional exercises will be offered through which students can earn up to **0.5 extra points** on the final grade.

Final Grade Calculation

The final grade (F) will be calculated as follows:

F = 0.45 × TF + 0.15 × TB + 0.10 × P1 + 0.15 × P2 + 0.15 × P3 + PE

To pass the course, the following conditions must be met simultaneously:

- **F ¿ 5**, **TF ¿ 5**, and **Pi ¿ 5** for i = 1, 2, 3

If the course is not passed, the transcript will reflect:

- The **numerical grade** obtained using the formula above, if the result is below 5.

- A grade of **4**, if the overall result is ¿ 5 but one or more of the mandatory minimums was not met.

Second Exam Session

In the second call, the following rules apply:

- Grades from block tests (TBi) completed during the course or on the recovery day will be retained.
- Grades from practices (Pi) with scores **¿ 5** will be retained.
- The final test score (TF) will be retained if **¿ 5**.

Students must:

- **Retake the final test** if the score was below 5.
- **Recover only** the failed practices.
- Students who did **not take** the block tests during the course **or** on the make-up day (due to justified reasons) may complete the pending tests in this session. Each will last 30 minutes per block.

Important:

Grades obtained from tests and practices **will not be retained** for future academic years.

REFERENCES

- Vinuesa, J. i altres (1993). Demografía. Análisis y proyecciones. Madrid: Síntesis S.A. -
- Apuntes de Bioestadística (Unidad de Bioestadística Clínica del Hospital Ramón y Cajal) (http://www.hrc.es/bioest/M_docente.html) STATISTICS, Methods and Applications (llibre electrònic) (http://www.statsoft.com/textbook/stathome.html)

- 1. Bioestadística. Métodos y Aplicaciones (Universidad de Málaga). http://www.bioestadistica.uma.es/libro/ 2. Pastor-Barriuso, R. Bioestadística. Madrid: Escuela Nacional de Sanidad y Centro Nacional de Epidemiología, ISCIII, 2012. http://gesdoc.isciii.es/gesdoccontroller?action=download&id=03/062013-7dd67975c5 3. Estadística básica en Ciencias de la Salud. Andreu Nolasco y Joaquín Moncho. Universidad de Alicante. https://rua.ua.es/dspace/bitstream/10045/60526/1/Estadística%20básica%20en%20Ciencias%20de%20la%20Salud.pdf 4. Instituto Nacional de Estadística. http://www.ine.es