UAB
Universitat Autònoma de Barcelona

Biostatistics and Data Analysis

Code: 101917
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biomedical Sciences	FB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this
document.

Prerequisites

There are no official prerequisites, however prior knowledge of elementary mathematics including the concepts
of differentiation and integration is recommended.

Objectives and Contextualisation

Biostatistics and Data Analysis aims to introduce the student to the fundamental knowledge and use of the
basic tools of knowledge in accordance with the scientific method.

The course will address issues relating to research in the fields of Biology and Medicine with the mathematical
method and, especially, from the theory of probabilities. This approach will allow the precise quantification of
significant relationships between the various phenomena related to health and human pathology from the
perspective of Biomedical research.

To achieve these objectives, students will need to work with various conceptual, methodological and
instrumental tools necessary to develop a vision of Biomedicine in accordance with scientific rigor.

Learning Outcomes

1. CM14 (Competence) Evaluate biomedical processes, taking into account an appropriate experimental
   design.
2. CM15 (Competence) Evaluate diagnostic tests using sensitivity, specificity and predictive values.

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3. CM16 (Competence) Estimate the existence of gender/sex-based inequalities using mathematical models and statistical analysis.
4. KM19 (Knowledge) Describe the basic statistical concepts and techniques for analysing biological data and apply the fundamentals of statistics and experimental design.
5. KM20 (Knowledge) Calculate the sample size needed to test a hypothesis.
6. SM17 (Skill) Manage digital tools, scientific literature and online resources for statistical analysis and experimental design in the field of biomedicine.
7. SM18 (Skill) Interpret the results of statistical tests.

Content

UNIT 1. INTRODUCTION

    1.1. Definition and objectives

    1.2. Population and sample

    1.3. Descriptive statistics, probability theory and inferencial statistics

UNIT 2. MONOVARIANT DESCRIPTIVE STATISTICS

    2.1. Quantitative and qualitative variables. Absolute, relative and cumulative frequencies. Graphic representations

    2.2. Continuous quantitative variables. Enumerative data: Frecuency tables. Graphic representations. Measures of central tendency: mean, median and mode. Measures of dispersion: range, variance, standard deviation and coefficient of variation. Morphological measures: bias and kurtosis

UNIT 3. BIVARIANT DESCRIPTIVE STATISTICS

    3.1. Qualitative relationship between two variables: Contingency tables. Relationship between continuous quantitative and qualitative variables. Relationship between two continuous quantitative variables (correlation coefficient)

    3.2. Matching data (repeated measurements)

UNIT 4. PROBABILITY THEORY

    4.1. Experiment random sample space and event

    4.2. Event operations: union, intersection, difference and contrary events. Incompatible events

    4.3. Absolute and relative frequencies. Probability

    4.4. Conditional probability. Independent events. Probability of union and intersection of events

    4.5. Bayes Theorem

    4.6. Measuring the frequency of a disease in the population. Incidence and prevalence

    4.7. Evaluation of risk factors. Relative risk and odds ratio

    4.8. Evaluation of diagnostic criteria. Sensitivity, specificity, positive and negative predictive values

UNIT 5. RANDOM VARIABLES

    5.1. Discrete and continuous random variables

5.2. Probability density function, probability distribution function, expectation and variance of discrete and continuous random variables

5.3. Probability distributions from discrete random variables: Binomial and Poisson

5.4. Probability distributions from continuous random variables: normal, χ2 and Student's t

5.5. Central Limit Theorem. De Moivre theorem. Sampling distribution. Interval Probability

UNIT 6. ESTIMATION

6.1. Estimation methods: interval confidence. Differences between probability and confidence intervals

6.2. Estimated mean, variance and proportion of population. Determination of the sample size

UNIT 7. HYPOTHESIS TESTING

7.1. Null and alternative hypothesis. Errors type I and type II or α and β risk. One-tailed and two-tailed contrasts. Significance level. Sample Size

7.2. Testing about population mean, population variance and population proportion

7.3. Testing about of differences in mean, variance and proportions. F Fisher Snedecor distribution. Kolmogorov-Smirnov test. Nonparametric comparison of two samples: Mann-Whitney U test

7.4. Hypothesis testing of paired data. Nonparametric Wilcoxon Signed-Rank test

UNIT 8. RELATIONSHIP BETWEEN QUANTITATIVE AND QUALITATIVE VARIABLES: ANALYSIS OF VARIANCE (ANOVA) AND REGRESSION

8.1. One-way ANOVA. Tests *a priori* and *a posteriori*

8.2. Regression: Least squares, significance of the regression and confidence intervals for population parameters. Linearity and utility tests

UNIT 9. RELATIONSHIP BETWEEN TWO RANDOM QUANTITATIVE VARIABLES: CORRELATION

9.1. Correlation Coefficient. Significance of correlation coefficient. Comparison between regression and correlation

UNIT 10. RELATIONSHIP BETWEEN QUALITATIVE VARIABLES: CHI-SQUARE TESTS

10.1. Goodness-of-fit of theoretical distributions frequency distributions

10.2. Homogeneity and independence tests

10.3. McNemar test for paired data

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	16	0.64	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14
Seminars and problems classes	8	0.32	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14

Theory lectures	28	1.12	CM14, CM15, CM16, KM19, KM20, SM18, CM14
Type: Supervised			
Consolidation practices	3	0.12	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14
Type: Autonomous			
Personal study	42	1.68	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14
Questionnaires of practices	7	0.28	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14
Resolution of exercises	24	0.96	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14
Tests resolution	10	0.4	CM14, CM15, CM16, KM19, KM20, SM17, SM18, CM14

Theory lectures:

The lectures will be taught with face-to-face methodology, although the interaction and participation of the students will be made possible and estimulated to the maximum. The classes will be supported by audiovisual media. The material used in class by the teacher, will be available on the Virtual Campus; students are encouraged to print and bring it to class to use as a support when taking notes. The student will also be encouraged to deepen the knowledge acquired in class using the recommended bibliography and simulation software.

Problem classes / Practice seminars:

Given the character and orientation of the subject, the classes of problems, conveniently interspersed with those of theory, will play a key role in its development and in the learning of the subject.

Through the Virtual Campus collections of problems will be delivered, organized according to the topics of the subject, which the student must develop both in class and individually. Most of these problems will be practical cases that, in solving them, allow the student a greater understanding of the knowledge acquired in the theory classes and in personal study.

In the classes of problems, tools such as *Kahoot* will also be used for the consolidation of content and as a diagnosis of the knowledge acquired.

In the practical seminars, conveniently interspersed with the theory classes, the methodology and dynamics of the SPSS software (or other statistical package) will be introduced. The student must use them in practical classes in order to achieve the learning object of the subject.

Practical Classes:

The practical classes are a fundamental point for the correct fulfillment of the objectives of the subject. In them the students will have to solve practical cases, previously selected, by means of statistical software.Learning includes both the introduction and manipulation of data, as well as the use of the main facilities offered by this software for data analysis. The practices will be carried out individually or in pairs. The development of these classes will be linked to the theoretical and problems classes with good temporal correlation.

Note: *15 minutes of a class, within the timetable established by the centre/degree, will be set aside for students to fill in the surveys to evaluate the performance of the teaching staff and the evaluation of the subject/module.*

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Attendance and completion of practical exercises and questionnaires.	10%	2	0.08	CM14, CM15, CM16, SM17, SM18
Practical test with computer - 1st partial	10%	2	0.08	CM15, SM17, SM18
Practical test with computer - 2nd partial	15%	2	0.08	CM14, CM16, KM19, KM20, SM17, SM18
Theoretical and practical questions - 2nd partial	35%	3	0.12	CM14, CM16, KM19, KM20, SM17, SM18
Theoretical and practical questions - 1st partial	30%	3	0.12	CM15, SM17, SM18

Students with CONTINUOUS ASSESSMENT (CA)

The subject will be taught with TE, SEM and PLAB typologies. PLAB type classes are mandatory.

The competences of the subject will be evaluated according to the following criteria:

- 2 multiple-choice exams where errors will be subtracted (with one or more correct answers per question), corresponding to the content of TE and SEM classes, with conceptual questions and problem solving [tests T1 (30%) and T2 (35%)]
- 2 practical exams with computer [tests P1 (10%) and P2 (15%)] and attendance and completion of practices and resolution of practical questionnaires [Qs (10%)]

Theoretical contents:		
1st partial test	T1	30%
2nd partial test	T2	35%
Practical contents:		
1st partial test	P1	10%
2nd partial test	P2	15%
Assistance and completion of practices and resolution of Qs questionnaires	Qs	10%

Students with SINGLE ASSESSMENT (SA)

The subject will be taught with TE, SEM and PLAB typologies. PLAB type classes are mandatory.

To carry out the PLAB classes, you can choose between:

- Do them with the students of continuousevaluation, the same days and hours in which the scheduled practices are carried out.
- Carry them out independently, in computer rooms without regulated hours, or on their personal computer if they have the necessary software.

The Questionnaires of the PLAB will have to be presented before the two tests corresponding to the practical contents (tests P1 and P2, of the 1st and 2nd part of the subject, respectively).

The competences of the subject will be evaluated according to the following criteria:

- 1 multiple-choice exam where errors will be subtracted (with one or more correct answers per question) corresponding to the content of TE and SEM classes, with conceptual questions and problem solving [test T (65%)]
- 2 practical exams with computer [tests P1 (10%) and P2 (15%)] and attendance and completion of practices and resolution of practical questionnaires [Qs (10%)]

Theoretical contents:		
Una única prueba con contenido teórico/práctico	T	65%
Practical contents:		
1st partial test	P1	10%
2nd partial test	P2	15%
Completion of practices and resolution of Qs questionnaires	Qs	10%

In the T test, the contents of the entire theory program of the subject corresponding to the material taught in the TE and SEM type classes will be evaluated. It will be done coinciding with the same date set in the calendar for the last continuous assessment theory test (T2), and it will mean 65% of the final grade for the subject.

The P1 and P2 tests will be carried out jointly with the rest of the continuous assessment students.

Ratings:

The minimum global qualification necessary to pass the subject will be 5 points.

- CA students: the minimum score in the theoretical exams to be able to average and pass by continuous assessment will be 3.0 points.
- SA students: the minimum score in the P1 and P2 exams, as well as the average score of the Qs questionnaires, must be 4.0 points.
- In both previous cases, the grade for the course will be a maximum of 4.0 points.

It will be considered that a student will obtain the qualification of "Not evaluable" if the evaluation of all the evaluation activities carried out does not allow him to reach the overall qualification of 5 points in the event that he had obtained the highest grade in all of them.

Recovery/Final Exam:

- There will be a recovery exam, either for those students who have not passed the subject by course, or for those who want to raise their grade (which implies giving up the grade obtained in the previous theoretical exams).
- The recovery/final exam will include all the material, although its result will represent 65% of the final grade since the remaining 35% will continue to depend on the results of the practical part.
- Only students who have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade for the subject may take the recovery exam.

Repeating students:

From the second registration, students who have passed the practical contentsin one of the last three courses, may decide between two options:

- Repeat the practical classes and take advantage of the same evaluation scheme as the newly arrived students.
- Be evaluated only for theoretical content. In this case:
  CA students: the percentages of the T1 and T2 tests will be 40% and 60% in the case of partial exams and 100% in the final exam.
  SA students: T test will represent 100% of the grade in any case.

Exam revision:

Following the regulations of the University, the procedure, place, date and time of the review of exams will be announced.

Bibliography

Basic bibliography:

Milton JS. Estadística para biología y ciencias de la salud. 3a. Edición. Madrid: Interamericana. McGraw-Hill, 2007.

Taylor RA, Blair RC. Bioestadística. México: Pearson Education, 2008.

Daniel WW. Bioestadística. Base para el análisis de las ciencias de la salud. 4a Edición. México: Limusa Wiley, 2002.

Sentís J, Pardell H, Cobo E, Canela J. Manual de Bioestadística. 3a. Edición. Barcelona: Masson, 2003.

Sorribas A, Abella F, Gómez X, March J. Metodologia estadística en ciències de la salut: Del disseny de l'estudi a l'anàlisi de resultats. Edicions de la Universitat de Lleida i F.V. Libros. 1997.

Ferrán M, SPSS para Windows. Análisis Estadístico. McGraw-Hill, 2001.

Visauta B. Analisis estadístico con SPSS 14. Estadística básica. 3a Edición. McGraw-Hill, 2007.

Martínez-González MA, Sánchez-Villegas A, Toledo E, Faulin FJ. Bioestadística amigable. 4a. Edición. Elsevier. 2020

Web links:

https://www.ibm.com/docs/SSLVMB_27.0.0/pdf/es/IBM_SPSS_Statistics_Brief_Guide.pdf

http://www.hrc.es/bioest/M_docente.html

https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010091339706709

http://davidmlane.com/hyperstat/index.html

https://seeing-theory.brown.edu

http://vassarstats.net

Simulators:

http://Statdistributions.com/

http://demonstrations.wolfram.com/ - http://demonstrations.wolfram.com/topic.html?topic=Statistics&limit=20

http://socr.ucla.edu/SOCR.html

Software

In the practical classes, the statistical program IBM SPSS or an equivalent one will be used.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	511	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	512	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	511	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	512	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	513	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	514	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	51	Catalan/Spanish	second semester	afternoon