



Universitat de Lleida

DEGREE CURRICULUM  
**ADVANCED AND  
MULTIVARIATE ANALYSIS**

Coordination: GOMEZ ARBONES, XAVIER

Academic year 2023-24

## Subject's general information

<b>Subject name</b>	ADVANCED AND MULTIVARIATE ANALYSIS			
<b>Code</b>	14094			
<b>Semester</b>	2nd Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	Degree	Course	Character	Modality
	Master's Degree in Research, Innovation and Health Transfer	1	OPTIONAL	Blended learning
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRAULA	TEORIA	
	<b>Number of credits</b>	3	3	
	<b>Number of groups</b>	1	1	
<b>Coordination</b>	GOMEZ ARBONES, XAVIER			
<b>Department</b>	MEDICINE AND SURGERY			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GOMEZ ARBONES, XAVIER	xavier.gomez@udl.cat	3	
VILAPRIÑO TERRE, ESTER	ester.vilapriño@udl.cat	3	

## Subject's extra information

### Description of the subject / Complementary information of the subject

This is an optional subject of 6 ECTS credits scheduled for the second semester. It is a subject aimed at people who want to delve into the field of biostatistics applied to the health sciences. Advanced statistical methodologies and procedures are being worked on in this subject, which are a continuation and extension of the compulsory subject Data analysis and interpretation of results. These analyzes are needed in many health research projects. Aspects such as procedures for evaluating diagnostic tests, analyzing survival, and multivariate methods and modeling health outcomes are discussed, as well as more advanced techniques for classification, discrimination, and decision-making. This course provides tools for improving clinical decisions, assessing the impact of health interventions, and basing performance on the best scientific evidence. The language of instruction is mostly Spanish, Catalan and English. The subject is based in an eminently practical and applied way, although to take advantage of it you must have passed and achieved with excellence the concepts of the compulsory subject Data analysis and interpretation of results.

This subject is a basically non-contact subject, structured so that each person can progress according to their availability and dedication, with the help of the CV and the teaching staff. The CV provides students with the material and resources needed to monitor the subject, as well as the activities and tests to be taken and passed. Tutorials are done through videoconferencing, as well as sessions for the follow-up of the subject and resolution of doubts.

There are scheduled face-to-face sessions of the subject within the face-to-face days of the master's degree. If finally the face-to-face sessions could not be carried out, the sessions are expected to be done by synchronous videoconference through the CV, or will be made available to students in video format / presentation recorded on the CV.

The course begins with an introduction to the need for advanced statistical procedures, beyond traditional bivariate statistical tools.

We will work on the procedures for evaluating diagnostic tests, with the concepts of sensitivity, specificity, predictive values, as well as ROC curves. We will then go into the need for multivariate statistical procedures in the health sciences, beginning with the analysis of survival and proportional risk models, to continue with modeling techniques and linear regression and logistic regression procedures.

Other advanced tools such as key component analysis, factor analysis, cluster analysis, discriminant analysis, decision trees, and more will be presented..

Finally, we will reflect on the integration of all procedures and results and their interpretation.

It is intended that by passing it the student will be able to design, propose and perform and interpret the procedures related to the evaluation of diagnostic tests, survival analysis and multivariate analysis. Also that the student knows and is able to understand advanced procedures such as main component analysis procedures, factor analysis, cluster analysis, discriminant analysis, decision trees.

Specific software is released for statistical procedures. Among them, it is planned to use the free and friendly software program Jamovi, the program SPSS (the UdL has a campus license for SPSS and is available in the computer rooms of the university and as a remote virtualized application) and the statistical program R. R is a very powerful free programming language (<https://www.r-project.org/>) that provides a wide variety of statistical and numerical techniques, and is highly extensible through the use of libraries. Other statistical programs may be submitted or released.

## Learning objectives

### Academical objectives (Learning objectives)

- Know and use advanced quantitative data analysis techniques.
- Demonstrate mastery in the use and management of software for data analysis of a study of its scientific field.
- Have acquired advanced knowledge, in a context of scientific research, a detailed and substantiated understanding of methodological aspects.

Specific objectives:

- To recognize and reflect on the need to use advanced statistical techniques for the analysis and interpretation of results in certain health science research studies.
- To know and apply the procedures for the evaluation of diagnostic tests. Be able to calculate the appropriate statistics and know how to interpret them in different clinical contexts.
- To know the basics of statistical methods based on the analysis of survival. Know how to apply and interpret them.
- To be able to assess the suitability, choice, application and interpretation of multivariate statistical methods (linear and logistic regression).
- To know and understand the fundamentals of advanced statistical techniques such as the procedures of analysis of main components, factor analysis, analysis of clusters, decision trees and others (discriminant analysis ...).
- Learn the basics of using statistical software to apply the appropriate statistical procedures in the field of the subject.
- To be able to interpret the results and draw conclusions from a statistical point of view from a scientific and clinical point of view in health sciences.

## Competences

Basic

CB8 That students are able to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.

General

CG2 Consider the gender and equality perspective in the scientific field in Health

CG4 Apply information and computing technologies in the scientific-technical field

Specific

CE4 Use the appropriate techniques to analyze the data and the relationships between variables or categories in quantitative research in health sciences

CE5 Use scientific language in the communication and transfer of health research results

CE7 Apply the bases of scientific evidence in health sciences and recognize the need for innovation and knowledge transfer

## Subject contents

Contents

- Introduction
- Evaluation of diagnostic tests
- Survival analysis. Proportional risk models
- Linear regression
- Logistic regression
- Analysis of main components
- Factor analysis
- Cluster analysis
- Decision trees
- Other techniques

## Methodology

### Methodology

The teaching methodology is aimed at the development of student learning through theoretical classes-seminars, cases and activities aimed at student participation, in addition to the work that the student must develop following problems and assumptions. raised. Enrolled people work autonomously under the direction of teachers. There are face-to-face sessions to summarize, clarify concept and present doubts.

Non-face-to-face dynamics are managed through the CV with the tools of announcements, messaging, video conferencing and others. Work sessions and follow-up by videoconference are proposed, as well as tutorials on demand.

The form of development of the subject is explained, already in part, in the section of Description of the subject / Complementary information of the subject. The subject is structured in lessons, so that each topic is a lesson, in which the resources (videos, texts and others), activities and related tests are presented. Students must work on the resources and answer and pass the proposed activities and tests, so that in order to progress in some lessons it is necessary to have passed some previous ones. Each person can progress according to their availability, although continuous work is recommended and not leave too much material for the end. Tutorials are on demand, although there will be a forum for questions and, where appropriate, thematic forums, and online sessions will be scheduled to be agreed with students.

If finally the face-to-face sessions could not be carried out due to COVID-19 or other circumstances, the sessions will be done via synchronous videoconference through the CV, or will be made available to students in video format presentation recorded on the CV.

## Development plan

Information in Methodology section.

## Evaluation

### Evaluation

For the subject' evaluation, regulations of the UdL are followed.

The tests that make up the evaluation system are: attendance and participation in online video conferencing; assistance and participation in face-to-face activities; individual activity and written test.

The statement of the evaluation activities are in Catalan, Spanish and English. The student can write the answer, if applicable, in any of the official languages of the University. The assessment is continuous and takes place within the teaching period delimited for the subject or subject, in accordance with the academic calendar of the course approved by the Governing Council. No alternative evaluation is foreseen.

The activities and tests will be carried out through the tools of the UdL CV, therefore it is essential to have a computer and access to the CV during the academic year. In order to carry out the activities, statistical software must be run either with the computer itself or by running the computers available at the UdL.

The written exams are scheduled online and the conditions and format of the test are published a few days before the test (number of questions, penalty for incorrect answers, ...).

Students who require or plan to require adaptations in the assessment tests must contact the teacher responsible for the subject during the first 15 days from the beginning of the course to assess their situation.

The final weight of the grade for the assessment activities is:

- Attendance and participation in online activities: 15%. Exceptional situations of non-attendance must be discussed with the teacher at the beginning of the course.
- Attendance and participation in face-to-face activities: 15%. Exceptional situations of non-attendance must be discussed with the teacher at the beginning of the course.
- Individual activity: 40%: tests, activities, forum, individual or group work on the content of the sessions, etc  
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- Written test: 30%. To pass the subject you must get a grade higher than 50% of the possible grade. This activity is entitled to recovery

Assessment activities or assessment results may be taken into account, which may serve to modulate grade in specific situations.

The subject is passed if the final grade taking into account all the evaluative evidence passed is higher than 5/10.

Rating scale: 0.00-4.99: suspended; 5.00-6.99: approved; 7.00-8.99: notable; 9.00-10.00: excellent.

## Bibliography

### **Bibliography**

Teachers will indicate the most appropriate bibliography and resources during the course. These resources will be available in the UdL library or will be provided by the teaching staff.