Universitat de Lleida

DEGREE CURRICULUM
BIOSTATISTICS

Coordination: SORRIBAS TELLO, ALBERT

Academic year 2023-24

Subject's general information

Subject name	BIOSTATISTICS
Code	102783
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION

Typology	Degree	Course	Character	Modality
	Double bachelor's degree: Degree in Human Nutrition and Diethetics and Degree in Physiotherapy	3	COMMON/CORE	Attendance-based

Course number of credits (ECTS)	6

Type of activity, credits, and groups	Activity type	PRAULA	TEORIA
	Number of credits	3	3
	Number of groups	1	1

Coordination	SORRIBAS TELLO, ALBERT
Department	BASIC MEDICAL SCIENCES
Teaching load distribution between lectures and independent student work	48 theoretical-practical hours (in sessions of 2 hours) with presentation of concepts and examples and with practical work with the R program. 12 hours of seminars discussing examples of database analysis (last three weeks of the course).
Important information on data processing	Consult this link for more information.
Language	The language of the subject is Catalan, although bibliographic and simulation material will be used in English and Spanish
Distribution of credits	3 theoretical credits and 3 practical credits

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
HERNÁNDEZ GARCÍA, CRISTIAN DIDIER	didier.hernandez@udl.cat	0	
SORRIBAS TELLO, ALBERT	albert.sorribas@udl.cat	6	

Subject's extra information

It is a third-year subject of the double degree in Human Nutrition and Dietetics and Physiotherapy that is taught during one semester.

In this subject students must learn the statistical concepts and methods that allow addressing the analysis of results in study typical of this field. Without this methodology, it is very difficult to generalize the observed results and determine their significance. This is the case of observational and experimental studies in the field of health sciences, where individual variability and the large number of factors that influence each situation make intuitive analysis of the problem difficult.

The learning of the basic concepts of statistical tools and the practice of their use in situations of interest is a fundamental aspect in the training of future professionals. As a methodological tool, statistics plays a transversal role in establishing the best scientific evidence in each case.

In this subject the transversal competences of use of information technologies, group work, practice of English and oral presentation will also be worked on.

Learning objectives

To pass the subject, the student must know and know how to use the basic concepts of the statistical method in relation to problems of application typical of the professional activity in Human Nutrition and Dietetics and in Physiotherapy, with special attention to the critical evaluation of the results of observational and experimental studies.

In relation to knowledge, the student who passes the subject must be able to:

- Identify and know the main characteristics of the most commonly used designs in health studies.
- Demonstrate that you know how to analyze data in a descriptive way.
- Be able to interpret basic statistical test results and especially understand the use of confidence intervals.

In addition, the student who passes the subject must achieve the following competencies:

- Interpret and describe the results of a given study using the tools of descriptive statistics.
- Obtain information, relate it to their knowledge, synthesize it and present it publicly.
- Use the R program to analyze data.
- Work as a team.
- Understand basic English in the scientific literature.

Competences

Specific Competencies

- CE3 Know statistics applied to Health Sciences

General Competencies

- CG3. Recognize one's own limitations and the need to maintain and update professional competence, paying special attention to the learning, autonomously and continuously, of new knowledge, products and techniques in nutrition and food, as well as the motivation for quality.
- CG5. Know, critically assess, and know how to use and apply sources of information related to nutrition, food, lifestyles and health aspects.

Core competencies

- CB1 Students have demonstrated knowledge and understanding in an area of study that builds based on general secondary education, and is usually at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.
- CB3 Students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues.
- CB5 That students have developed the learning skills necessary to undertake further studies with a high degree of autonomy.

Transversal Competencies of the UdL

- CT2 Mastering a foreign language
- CT3 Mastering TIC
- CT5. Acquire essential notions of scientific thinking.

Subject contents

Statistics as a tool to support research. Research in health sciences: a fundamental role of statistics in the research process. Variability, representativeness of a sample. •

- Introduction: what do you know about statistics? What do we need it for?
- How to prepare a study: Study design: Objectives and hypotheses; Key elements of a study; Variables and factors; How do we measure a feature of interest?
- Installation of R and RStudio. Packages. Basic use.

Probability. Probability as a relative frequency. Probability calculation rules. Conditional probability. Bayes' theorem. Sensitivity, specificity and predictive values. Interpretation of its meaning.

- What is probability? Probability and relative frequency. Central limit theorem. Calculations with probability.
- Elements of a diagnostic criterion. Sensitivity and specificity. Prognostic values. Description and presentation of the data.

Descriptive statistics. Types of variables. Measures of central tendency (mean, median) and measures of dispersion (variance, standard deviation, interquartile intervals). Graphical representation of the variables.

- Basic data and descriptive management: the tidyverse library.
- Data management: filter values, select variables, calculate statistical indexes, group description, etc.
- Basic graphs with ggplot: boxplot, histograms, bars, etc.

Probability distributions. The concept of distribution. Reference intervals. Normal distribution. z-scores. Construction of a diagnostic test.

- The concept of distribution. Reference intervals.
- Calculations with normal distribution.
- Construction of diagnostic criteria in biomarkers with normal distribution.

Estimation of population parameters. Population and sample. Confidence intervals of means and proportions. Confidence intervals of mean difference and proportion difference. Confidence intervals of probability ratios (relative risk). Statistical significance: the p-value.

- Introduction to the concept of parameter estimation and confidence intervals (CIs)
- CI for probabilities and for the difference in probabilities. Relative risk CI.
- CI for population mean and mean difference.
- Sample measurements necessary for a good estimate.

Observational studies. Cohort and case-control studies. Measures of frequency and association between risk factors and diseases. Relative risk and odds ratio. Advantages and limitations of observational studies. The logistic regression model.

- Review of the different types of observational studies.
- Relative risk and odds ratio. Interpretation and usefulness.
- Analysis of multivariate situations by fitting a logistic regression model. Estimation and interpretation of odds ratios.

Design of experiments. The clinical trial in health sciences research. Design of experiments. Factors that can influence the results. Effect Assessment: Variable Response Factors.

- Design of experiments. Placebo effect. Factorial designs.
- Discussion of designs and simulation of results. Interpretation of results.
- Introduction to the analysis of variance in factorial designs.
- Interpretation of the results of the analysis of variance and concept of interaction between factors.

Correlation and regression. Relationship between two quantitative variables. Concept of correlation. The regression model. Interpretation of the parameters of the regression model.

- Linear regression. Parameter interpretation.
- The Concept of Correlation: Interpretation and Limitations
- Linear regression with more than one predictor.
- Comparison of regression lines.

Multivariate methods. Evaluation of models with different predictors:

- Predicting the Probability of an Event with Logistic Regression
- Survival Time Assessment: Survival Analysis

Methodology

To achieve the objectives and competences attributed, the following activities will be scheduled:

Group classes

They aim to expose the contents and highlight those most important aspects of the use of statistics in NHD and Physiotherapy. They will be done by videoconference and will be complemented with videos where the concepts and techniques are specifically discussed and with the recording of the videoconference sessions of each topic, including the explanation of the teacher, the doubts that arise in class and the response of the teacher.

Practical activities

Students will carry out exercises of analysis and presentation of data with the R program, both during the classes, and in the practical work proposed. The teaching team prepared a set of commented cases where the different techniques will be applied in order to see their usefulness. In the resources space will be available videos where each example will be discussed so that the student can follow the activity and complement practical learning. The different cases will be discussed in the seminar sessions.

Tutories

They will be done voluntarily by videoconference and at the request of the student. They will serve to resolve doubts, comment on specific difficulties, clarify application mechanisms, clarify the use of R, etc.

Development plan

Considering the time distribution of the course (sessions of 6 hours, divided of 2 by two with breaks, every Friday for 10 Fridays), the development plan is conditioned by this distribution.

In the first two hours of each session, concepts will be presented, and their application will be discussed. In the next two-hour block, practical interpretation will be deepened, discussing examples. Finally, the last two hours will be devoted to problem solving and the introduction of calculation tools (fundamentally R).

Evaluation

Two tests

- Test (without recovery) on the contents of the first 4 topics. (25% of the grade) (in principle before the Easter break)
- Test of topics 5-8 and Recovery (50% of the grade)

Practical work or an analysis of a database where the concepts of the subject are used (25% of the grade).

Critical commentary of articles with attention to the following points

- Study Design Rationale for Sample Selection and Inclusion Criteria
- Data collection
- Interpretation of results and commentary of statistical procedures
- Critical discussion of the conclusions based on the previous points.
- The deadline will be determined according to the date established by the coordination to close events. In any case, however, there will be time, at least, until the end of June.