

Academic Year/course: 2022/23

## 26701 - Biostatistics

### Syllabus Information

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**Academic Year:** 2022/23

**Subject:** 26701 - Biostatistics

**Faculty / School:** 104 - Facultad de Medicina

229 - Facultad de Ciencias de la Salud y del Deporte

**Degree:** 304 - Degree in Medicine  
305 - Degree in Medicine

**ECTS:** 6.0

**Year:** 1

**Semester:** Second semester

**Subject Type:** Basic Education

**Module:**

## 1. General information

### 1.1. Aims of the course

**The subject and its expected results respond to the following approaches and objectives:**

The subject is part of the second semester of 1st year, belongs to the Module of Social Medicine, Communication skills and Initiation to Research. The inclusion of Biostatistics as a basic subject in the Medical Degree, responds to the need for the students who have it to have sufficient knowledge and management of the statistics to be able to use it in the future both in their care work and research. This need is a consequence of the increasing expansion of statistical applications to all scientific work, both to develop the sampling plans or experimental designs necessary to obtain objective results, and to evaluate the validity of those results. It provides the basis for the understanding of studies related to different specific subjects, such as Preventive Medicine and Public Health, as well as for the rest of the subjects of the degree.

### 1.2. Context and importance of this course in the degree

The subject is part of the basic training of students who require a methodological knowledge that allows them to apply the scientific method to daily practice.

It teaches to apply statistics in the analysis of health problems, to optimize the information obtained from reading scientific articles of interest for the development of their professional activity, to evaluate the interventions made and to use the scientific evidence as a useful instrument in the Decision-making in professional practice.

### 1.3. Recommendations to take this course

It is recommended that you attend in person. It gives importance to the work and continuous participation. In this subject the practical load is of utmost importance.

## 2. Learning goals

### 2.1. Competences

**By passing the subject, the student will be more competent to ...**

CE23 - To know the basic concepts of biostatistics and their application to the medical sciences.  
CE22 - To know, critically evaluate and know how to use the technologies and sources of clinical and biomedical information, to obtain, organize, interpret and communicate clinical, scientific and health information.  
CE24 - Be able to design and perform simple statistical studies using computer programs and interpret the results.  
CE25 - Understand and interpret statistical data in the medical literature.  
CE28 - Manage a personal computer autonomously. Use the search and retrieval systems for biomedical information

### 2.2. Learning goals

**The student, to overcome this subject, must demonstrate the following results ...**

Know the different types of data and measurement scales. Handle the symbols and notations typical of the statistical language to correctly express situations typical of the field of Medicine.

Construct and interpret frequency distributions using tables, graphs and data synthesis.

Decide if there is any relationship between two given variables and build the model of dependence or association more appropriate to that possible relationship.

Identify the most appropriate probability law to construct a model of a real situation or to perform a specific statistical analysis, correctly interpret and handle with ease and efficiency the probability tables of the most usual distributions in the inference.

Make estimates of population parameters using confidence intervals and interpret them properly.

Make hypothesis contrasts on parametric and non-parametric theoretical models and correctly express the likelihood of the decision taken in a particular contrast.

Calculate the sample size needed to perform statistical inference.

Interpret the results of a statistical analysis and arrive at conclusions based on the proposed objectives.

### 2.3. Importance of learning goals

In your daily work, a physician must handle information in the form of data, probabilities, etc. and must be able to make decisions based on that information. This subject teaches the basic principles of decision making in the presence of uncertainty.

Students work with real data individually and in groups, so they develop team collaboration skills in solving real problems.

## 3. Assessment (1st and 2nd call)

### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

#### 3.1. Types of tests and their value on the final grade and evaluation criteria for each test

The student must demonstrate that he / she has attained the expected learning outcomes through the following assessment activities:

For the evaluation of the students, their capacity for assimilation, analysis and synthesis will be acquired, the ability to adequately relate different information, the degree of familiarity with the the ability to solve practical exercises raised during the grade.

In the numerical evaluation of this evaluation will take into account two sections:

1. The degree of knowledge and management of the theoretical contents of the subject, which will be evaluated by means of a written exam, in which you will have to answer questions like test or subject, or short questions about the theory that you should apply to the various situations raised in they.
2. The ability to apply the contents of the subject in specific problems. The completion of a written exam will be evaluated, in which you will have to solve various practical situations, both practical cases through a set of data on which you will have to apply the knowledge acquired, and the interpretation of results thrown by a statistical package.

### EVALUATION OF THE SUBJECT.

There are two calls. One in MAY-JUNE and another in JUNE-JULY.

#### EVALUATION OF MAY – JUNE.

It consists of a partial exam and a final.

- **Midterm exam.** It is eliminatory in nature and consists of two parts: a theoretical part consisting of test-type and/or topic-type questions and a practical part with type-problems and/or computer o

The material included in this test is the same as the first part of the subject.

In both parts, both theoretical and practical, a minimum of 4 points out of 10 is required to be at average and to eliminate the partial an average of 5.

The Partial Exam is only qualifying for the Final Exam of the May - June evaluation.

· **Final exam.** For students who have eliminated the subject of the first part and do not wish to raise their grade, it will consist of a theoretical part consisting of test-type questions and/or theoretical questions. To average, a minimum of 4 points out of 10 must be obtained in both parts, both theoretical and practical, and an average of 5 to pass.

The final mark of the subject will be the result of the sum of the mark obtained in the first test multiplied by 0.45 and the mark obtained in the second test multiplied by 0.55.

· **For students who have NOT passed** or have not taken the first part, it will consist of test-type questions and/or theme-type questions and a practical part with type problems and/or with computer outputs. The subject that is evaluated in this test is the total of the subject.

To average, you must obtain a minimum of 4 points out of 10 in both parts, both theoretical and practical, and to pass it, an average of 5.

## **EVALUATION JUNE - JULY**

It consists of test-type and/or topic-type questions and a practical part with type-problems and/or computer outputs. The subject of which it evaluates in this test is the total of the subject.

To average, you must obtain a minimum of 4 points out of 10 in both parts, both theoretical and practical, and to pass it, an average of 5.

The qualifications of the continuous evaluation for calls of the same and subsequent to the current one are NOT saved.

<http://medicina.unizar.es/primer-curso>

Dates of the Global Assessment in Huesca:

<https://fccsyd.unizar.es/horarios-y-calendarios-medicina>

## **4. Methodology, learning tasks, syllabus and resources**

### **4.1. Methodological overview**

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

1. Lectures, whose purpose is the transmission of knowledge and logical fundamentals of the subject.  
Practice classes, in which the theoretical concepts are applied, consist in this case in problem solving.

2. Computer practices.
3. Directed work and activities.
4. Seminars as learning and evaluation.
5. Tutorials.
6. ADD.

Students are expected to participate actively in class throughout the semester.

Further information regarding the course will be provided on the first day of class.

## 4.2. Learning tasks

### The program offered to the student to help him achieve the expected results includes the following activities ...

The student receives a total of 60 classroom hours during the semester, 30 of them are type 1, 24 type 2 and 6 type 3. Activities in the Faculty of Medicine and in the Faculty of Health Sciences And Sports are similar. Given the eminently applied nature of Statistics, and taking into account that the subject's practices consist in solving problems, the distribution of teaching hours between practices and theory must be based on dynamic criteria, so that practices are not only Application of theoretical concepts, but also a motivation to introduce new concepts, reflecting the way in which the new models arise in response to problems raised by previous models.

This effect of continuous feedback between the two requires that they be inextricably linked in the exhibition, so that the time allocated to each other cannot be separated at different times, but must be distributed every hour of class between the two, in a way that respects The proportion of time between one and the other along the course.

The final objective of this methodology is to provide the student with a clear vision of the fundamentals and applications of the subjects of this course, intuitively introducing, whenever possible, each of the statements and giving examples of their applications to research in Medicine.

The course includes the following learning tasks:

- **Lectures.** The theoretical classes will be given according to the schedule approved by the corresponding Center Board in the classrooms and schedules established in the Teaching Organization Plan. They are dedicated to the presentation of the theoretical contents of the subject. Explanations are made in a way that motivates the student the need to introduce new concepts. At the same time, it is necessary to give meaning to the applicability of the same, avoiding the occurrence of the sensation that they are introduced capriciously. Brief exercises, as examples, will be interspersed as far as possible. Accurate audiovisual media will be used as support
- **Practice sessions.** They will be taught according to the schedule approved by the Board of the Center in the classrooms and timetables established. In general, it will be dedicated around 2 hours a week to the realization of practical exercises related to the contents taught in the theoretical classes. Practical classes should not be seen as a secondary complement to the development of theory because, by the nature of the subject to be taught, it is as important an activity as the explanation of the theory itself. These classes allow the active participation of the student, help him to establish theoretical knowledge, and bring him closer to solving real problems. In the same way, they serve both the teacher and the student, to control the level of learning.
- **Computer Practices.** After learning to identify the models presented in the theoretical classes and to verify that they understand the operation of the statistical techniques studied, the student must face problems with greater volume of data that allow us to focus on the interpretation of the results. It is the moment to approach the problems with the aid of some statistical package, which must be done in the computer room, dividing each group of students in the sufficient number of subgroups for each student to have a computer. Their evaluation will be done through the final work on the knowledge imparted.
- **Tutorials.** They will be voluntary and will take place preferably in the office of the teacher in the schedule destined for this type of educational activity.
- **Digital Teaching Ring (ADD / WebCT).** It will be the normal way to provide the didactic material, calendar of activities, give warnings and propose complementary exercises of the classroom sessions. The name that specifies the subject in the ADD is "Biostatistics".

## 4.3. Syllabus

Lectures

Module I: Statistical methods for one and two variables. The theoretical basis for biostatistics.

- Descriptive statistics.
  - TOPIC 1. UNIDIMENSIONAL STATISTICAL VARIABLES. Frequency distributions. Tables and graphs. Descriptive statistics: Moments, central tendency, spread, position and shape. Data exploratory analysis.
  - TOPIC 2. BIDIMENSIONAL STATISTICAL VARIABLES. Two-way tables and graphical representations.
- Probability and random variables
  - TOPIC 3. PROBABILITY: CONCEPTS AND THEOREMS. Generalities. Relative frequencies and probability. Conditional probability and total probability. Bayes theorem. usefulness in medical diagnosis.

- TOPIC 4. RANDOM VARIABLE. Probability distributions: properties and parameters.
- TOPIC 5. DISCRETE DISTRIBUTIONS: Binomial, Poisson, etc. CONTINUOUS DISTRIBUTIONS: Normal, chi-squared, Student's t and Snedecor's F. Central limit theorem. Convergence to the normal distribution

#### Module II. Inferential statistics.

- Parametric Inferential Statistics
  - TOPIC 6. ESTIMATION: Point estimation of population distribution parameters. Qualities of a good estimator. Estimation by confidence interval: confidence coefficients. Confidence intervals for normal populations. Confidence intervals for proportions. Sample size determination.
  - TOPIC 7. HYPOTHESIS TESTING: Methodology, foundations, error types, significance level, power of the test and p values. Relationship between confidence intervals and hypothesis testing.
  - TOPIC 8. PARAMETRIC HYPOTHESIS TESTING. Hypothesis testing based on one, two or more sample means from normal populations, Hypothesis testing based on one or two sample variances from normal populations. Hypothesis testing for one or two proportions. Sample size determination.
- Non-Parametric Inferential Statistics
  - TOPIC 9. NON PARAMETRIC TESTS. Goodness of fit tests. Tests for comparing 2 or more samples from non-normal population distributions.
- Analysis the statistical association of quantitative and categorical variables
  - TOPIC 10. Correlation and Regression: Covariance. Coefficients of Correlation. Estimation and hypothesis testing in Correlation Coefficient. Other correlation coefficients. Simple Linear Regression Model. Estimation and hypothesis testing in linear regression.
  - TOPIC 11. Contingency Tables: Chi-square test for independence and homogeneity. Conformance tests (goodness of fit tests).

#### Practice sessions

- Session-1.- VARIABLES UNIDIMENSIONAL STATISTICS. Tables and Graphics. Characteristic measures of the statistical variables: Measures of central tendency, position, dispersion and form. Exploratory Data Analysis.
- Session-2.- VARIABLES UNIDIMENSIONAL STATISTICS. Tables and Graphics. Characteristic measures of the statistical variables: Measures of central tendency, position, dispersion and form. Exploratory Data Analysis. BIDIMENSIONAL STATISTICAL VARIABLES. Double-entry tables and graphic representations.
- Session-3.- PROBABILITY: CONCEPTS AND THEOREMS. Conditioned probability and total probability. Bayes Theorem: Its application in medical diagnosis.
- Session-4.- PROBABILITY: CONCEPTS AND THEOREMS. Conditioned probability and total probability. Bayes Theorem: Its application in medical diagnosis.
- Session-5.- ESTIMATION. Estimation by intervals and determination of the sample size.
- Session-6 and 7.- PARAMETRIC CONTRASTS. Contrasts on the means of one and two samples of normal populations. Contrasts on the variances of one or two samples of normal populations. Contrasts on proportions. Determination of sample size.
- Session 8 and 9.- NON PARAMETRIC CONTRASTS. Tests of goodness of fit. Contrasts for two samples of no normal populations.
- Session-10 and 11.- CORRELATION AND REGRESSION. Correlation coefficients. Simple linear regression model.
- Session-12.- CONTINGENCY TABLES. Chi-square contrast for independence and homogeneity.

#### Practical computer sessions

- Session-1.- Descriptive statistics and confidence interval with IBM SPSS. Probability, Distributions and Size of the sample with Epidat ..
- Session-2.- Parametric and non-parametric inference with IBM SPSS ..
- Session-3.- Statistical association of quantitative and categorical variables with IBM SPSS

### 4.4. Course planning and calendar

Control (**Partial**) of the Descriptive matter: Unidimensional and Bidimensional, Probability and Estimate.

Control (**Final**) of the subject Parametric and non-parametric Statistical Inference. Association Correlation and Regression and Contingency tables. (Those students who have passed the partial

Control (**Final**) of all the matter for those who have not passed or have not examined the part:

#### **4.5. Bibliography and recommended resources**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=26701>