Universidad Zaragoza

Year : 2020/21

26701 - Biostatistics

Syllabus Information

Academic Year: 2020/21
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

CROSS-COMPREHENSIVE COMPETENCES

INSTRUMENTS

1. Ability to analyze and synthesize

2. Capacity for organization and planning

3. Oral and written communication in the native language

4. Troubleshooting

5. Decision making

B. PERSONAL

6. Teamwork

7. Interpersonal skills

8. Critical reasoning

C. SYSTEMS

9. Autonomous learning

10. Adapting to new situations

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:

Each student will be assessed for his or her ability to assimilate, analyze and synthesize, assessing the information acquired, the ability to adequately relate different information, the degree of familiarity with the specific terminology of the subject, the ability to solve practical exercises raised during The course, their active participation in specific points of the exposition of the agenda and the work done by the student, only and in a group.

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 use the contents of the subject in specific problems will be evaluated through the personal contributions of the student (jobs resolved) during the development of the subject and the accomplishment of a written examination, in which it will have to solve several practical situations.

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

CONTINUOUS ASSESSMENT.

It is mandatory the delivery of the two notebooks and computer practices to perform the continuous evaluation.The student must perform a series of tests.

The material evaluated in each notebook is:

-Cuaderno-1: Descriptive: Unidimensional and Bidimensional, Probability and Random Variable. Estimate.

-Cuaderno-2: Parametric and non-parametric statistics inference. Association of variables: Correlation and Regression and Contingency Tables.

They consist in the resolution of problems of each of the parties addressed throughout the course.

The student will have to deliver each of the notebooks on the date established in the syllabus of the subject.

1º EXAMINATIONS (80%)

Two exams done individually. They consist of a theoretical part and the development of problems or practical situations of statistics, problems-type.

These controls have a weight of 80% on the final grade of the subject (35% corresponds to the first control and 45% to the second).

2º ACTIVE PARTICIPATION (5%)

It includes a set of activities whose function is to demonstrate the learning that the student is acquiring throughout the course. The student can achieve a 5% on the final grade of the subject with active participation in theory classes, practices, seminars, workshops.

3º FINAL WORK (15%)

It is a job, essential to carry out continuous evaluation, which consists of the application, through computer programs (SPSS and Epidat), of all the statistical techniques that are known throughout the course, with the interpretation of the results obtained.

This work is done under the tutoring of the teacher.

Very important note The student, to be able to incorporate to his final grade the 20% that corresponds to evaluation of practices, seminars and workshops and final work, must meet two requirements:

1.- Have obtained a minimum score of 3 out of 10, in each of the parts (theory and practice) of the two exams that are made throughout the course.

2.- Reach 50% of the final grade obtained by the exams, which is a 4 (remember that the maximum score, between the two exams, is 8).

FINAL EVALUATIONS

The student can take the final exams when: he has decided to opt for this form of evaluation, he has not passed the continuous evaluation, or when he has passed, he wants to improve the qualification.

FINAL EVALUATION OF JUNE

The final grade will be obtained through two exams, one practical and another theoretical (short questions) . Both will be scored on 10. The pass is obtained with the average grade of 5. It will only be possible to average when the minimum grade of 4 has been reached in any of the two exams.

FINAL EVALUATION OF SEPTEMBER

The final grade will be obtained through two exams, one practical and another theoretical (short questions) . Both will be scored on 10. The pass is obtained with the average grade of 5. It will only be possible to average when the minimum grade of 4 has been reached in any of the two exams.

The continuous evaluation grades are not saved for calls after the current year.

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 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.
- **The works and activities directed.** The student will elaborate works related to the topics explained in the subject. The application of theory to real data, done individually or in groups, is a great help for learning, since the study of real cases while serving to complement previous activities, can provide a wealth of methodological knowledge Useful for your future professional activity.
  With the practical works (Notebooks 1 and 2), the students deepen in the resolution of problems, applying the techniques raised in class and to give an interpretation of the realized analyzes. Binder 1 must be delivered to the teacher prior to the examination of the first control and Binder 2 before the second examination. Both notebooks will be evaluated by the teacher.
  With the final work, which must be delivered to the teacher before the end of the second semester for evaluation, the student is expected to participate actively in the educational process, being responsible for his own learning, under guidance, tutoring and encouragement from the teacher.
- **Seminars such as an apprenticeship.** Throughout the course, there will be shown scientific articles in which the statistical treatment given will be developed and the results obtained will be discussed.
- **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".
- In FCCSD,

  Given the exceptional situation of the Academic Year 2020-2021, the large group teaching system will be online, that is to say, in a synchronic telematic system, by which teachers and students will be connected through technologies that allow interaction, such as Google Meet.

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. Data exploratory analysis. Frequency distributions. Tables and graphs. Descriptive statistics: Moments, central tendency, spread, position and shape.
        - TOPIC 2. BIDIMENSIONAL STATISTICAL VARIABLES. Two-way tables and graphical representations.
    - Probability and random variables
        - TOPIC 3. PROBABILITY: CONCEPTS AND THEOREMS. Random experiments: outcomes and events. Operations with events. 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' 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. Relationship between confidence intervals and hypothesis testing. 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.
    - 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.- DISCRETE DISTRIBUTIONS: Binomial, Poisson and others. CONTINUOUS DISTRIBUTIONS: Normal and associated: chi-square, Student's t and F of Snedecord.
  Session-6.- ESTIMATION. Estimation by intervals and determination of the sample size.
- Session-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.- 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-9.- NON PARAMETRIC CONTRASTS. Tests of goodness of fit. Contrasts for two samples of no normal populations.
- Session-10.- CORRELATION AND REGRESSION. Correlation coefficients. Simple linear regression model.
- Session-11.- CORRELATION AND REGRESSION. Correlation coefficients. Simple linear regression model.
- Session-12.- CONTINGENCY TABLES. Chi-square contrast for independence and homogeneity.
- Session-13.- 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

The information regarding planning and calendar will be presented on the first day of class and will be published in the ADD corresponding to each center (Faculty of Medicine of Zaragoza, Faculty of Health Sciences and Sports of Huesca).

The calendar of delivery of notebooks, final work and evaluations will be presented on the first day of class and will be published in the ADD corresponding to each center (Faculty of Medicine of Zaragoza, Faculty of Health Sciences and Sports of Huesca).

The key dates correspond to:

- Delivery of the first notebook "Descriptive: Unidimensional and Bidimensional, Probability and Random Variable. Estimate?
- Control of the continuous evaluation of Descriptive: Unidimensional and Bidimensional, Probability and Random Variable. Estimate.
- Delivery of the second notebook "Parametric and non-parametric statistics Inference: Association of variables: Correlation and Regression and Contingency tables".
- Control of continuous evaluation of Inference Parametric and non-parametric statistics. Association of variables: Correlation and Regression and Contingency tables.
- Final Work Delivery

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=26701&year=2020