COURSE DATA

Data Subject	
Code	34454
Name	Statistics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1204 - Degree in Medicine	Faculty of Medicine and Odontology	1	First term

Subject-matter

Degree	Subject-matter	Character
1204 - Degree in Medicine	8 - Statistics	Basic Training

Coordination

Name	Department
MARTINEZ BLAZQUEZ, MARIA DEL CARMEN	130 - Statistics and Operational Research

SUMMARY

The Statistics subject is conceived as an indispensable subject for the formation of any experimental scientist. Its goal is to provide the student with the tools and necessary concepts to formulate statistical hypothesis, to recognize simple probabilistic models, to analyze data statistically, which have been directly obtained in the clinical practice or a result of laboratory experimentation, and to take decisions based on the conclusions obtained form this analysis.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Los conceptos de Estadística y Probabilidad correspondientes a la asignatura Matemáticas I, de Primer Curso de Bachillerato:

Distribuciones bidimensionales. Relaciones entre dos variables estadísticas. Regresión lineal.
Estudio de la probabilidad compuesta, condicionada, total y a posteriori.
Distribuciones Binomial y Normal como herramienta para asignar probabilidades a sucesos.

OUTCOMES

1204 - Degree in Medicine

- Know how to use the sources of clinical and biomedical information available, and value them critically in order to obtain, organise, interpret and communicate scientific and sanitary information.
- Be able to formulate hypothesis, gather information and evaluate it critically in order to solve problems by following the scientific method.
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- Proper organisation and planning of the workload and timing in professional activities.
- Team-working skills and engaging with other people in the same line of work or different.
- Criticism and self-criticism skills.
- Capacity for communicating with professional circles from other domains.
- Acknowledge diversity and multiculturality.
- Consideration of ethics as a fundamental value in the professional practise.
- Working capacity to function in an international context.
- Knows, evaluates and uses technology and sources of clinical and biomedical information to obtain, organise, interpret and communicate clinical, sanitary and scientific information.
- Knows key concepts of biostatistics and their application to medical sciences.
- Is able to design and elaborate simple statistic studies by using computer programming and interprets the results.
- Understands and interprets statistical data in medical literature.
- Is able to handle a personal computer with autonomy, uses searching and retrieval information systems, knows and handles clinical documentation procedures.
- Understands and interprets scientific texts critically.

- Knows the principles of the scientific method, biomedical research and clinical trial.

LEARNING OUTCOMES

Once the Statistics subject is coursed, the students:

- Are familiar with the inherent variability to the biological measures and the problems that this arouses in the elaboration of conclusions in the experimental research.
- Acquire the basic ideas of the modeling of simple random experiments, identifying the proper model of probability and selecting the optimal sample size for the study objectives.
- Initiate in the procedures of Statistical Inference, with the techniques of hypothesis estimation and contrast, that will be used in the statistical analysis of the experiments.
- Get used to analyze the conditions of applicability and limitations of the most common statistical methods.

Are prepared to know how to use statistical software, which allows them to work with databases.

DESCRIPTION OF CONTENTS

1. Data exploratory analysis.

THEORETICAL SESSIONS

1.- Experimental research in medicine and data analysis. Need of statistical techniques. Some examples.
2.- Population and sample. Measurement ranges. Qualitative and quantitative, discrete and continuous data. Examples.
3.- Qualitative data description. Absolute and relative frequencies. Relation with the probabilities in population.
4.- Quantitative data description. Statistics of localization and dispersion. Percentiles.
5.- Data graphic description. Bars and pie charts. Histograms and box diagrams. Other graphic representations.
6.- Use of incomplete data. Survival data and Kaplan-Meier curves.

COMPUTER PRACTICAL SESSIONS
1. Proposal and realization of a scientific experience: objectives, experience design and data observation.
2. Databases. Insertion of date in a database. Basic functioning of this computer tool.
3. Data numeric description. Frequency chart. Statistics of localization, dispersion and form. Percentiles.
4. Data graphic description. Bars and pie charts. Histograms and box diagrams. Kaplan-Meier survival curves.

2. Statistical analysis of a population.

THEORTICAL SESSIONS

7.- Sample variability. Performance of the sample average in big samples. The normal distribution. Some examples.
8.- Punctual and by intervals estimation of the population average with big samples. Estimation error and its interpretation. Interpretation of the confidence interval.
9.- Contrasts of hypothesis about the average of a population with big samples. Unilateral and bilateral contrasts. Contrasts of significance and p-value.
10.- Error of Type I and of Type II. Error delimitation to calculate the sample size. Calculation of the sample size through confidence intervals.
11.- Statistical study of a population proportion. Bernoulli and Binomial distributions. Estimation of a proportion.
12.- Contrast of hypothesis about a proportion. Calculation of the sample size.
13.- Estimation of the population average in small samples. Student's T distribution. Confidence intervals.
14.- Student's T test for a sample. Solution to a bilateral contrast. Solution to unilateral contrasts.
15.- Applicability conditions of the Student's T test for a sample. Normality contrasts. Non-parametric alternatives: signs test and Wilcoxon test.

COMPUTER PRATICAL SESSIONS
5. Data simulation: asymptotic performance of the sample average; the normal distribution; normal approach to the Binomial one.
6. Interpretation of confidence intervals. Simulation of intervals and their performance in the sampling.
7. Study about a proportion. Binomial test. Sample size.
8. Study about a population average. Student's T test. Normality contrasts. Non-parametric test. Sample size.

3. Comparison with several populations (Continuous data)

THEORETICAL SESSIONS

16.- Experiments design: paired samples and independent samples. Analysis of paired data.
17.- Comparison of two independent samples. Comparison of the population variances, Levene test. Student's T test for two independent samples.
18.- Applicability conditions of the Student's T test for samples. Non-parametric alternatives. Wilcoxon test and Mann-Whitney test.
19.- Comparison of more than two independent samples. ANOVA chart and F test.
20.- Multiple comparisons test. Applicability conditions of the F test. Non-parametric alternatives, Kruskal-Wallis test.

COMPUER PRACTICAL SESSIONS
9. Comparison of two samples. Paired samples and independent samples. Student's T test. Non-parametric alternatives.

10. Comparison of more then two samples. Variances comparison tests. ANOVA chart. Multiple comparisons test. Non-parametric alternatives.

4. Comparison of several populations (categorical data)

THEORETICAL SESSIONS
21.- Comparison of population proportions. 2x2 contingency charts. Chi-squared test.
22.- RxC contingency charts. Contrasts of homogeneity and independence. Chi-squared test.
23.- Risk factor and relative risk. Ethiologic fraction. Odds ratio.

COMPUTER PRACTICAL SESSIONS
11.Contingency charts. Chi-squared test. Risk and relative risk. Ethiologic fraction. Odds ratio.

5. Regression.

THEORETICAL SESSIONS

24.- Relation between two quantitative variables. Correlation coefficients. Least squares line.
25.- Model of lineal simple normal homocedastic regression. Estimation and contrasts of hypothesis about the parameters model. Punctual and by intervals prediction.
26.- Residues analysis and model adjustment. Changes of variables. Polynomial regression.
27.- Regression lines comparison. Covariance analysis.
28.- Multiple regression. Residues analysis and model adjustment.
29.- Multiple regression. Selection of variables. Prediction.
30.- Logistical regression. Residues analysis and model adjustment. Selection of variables. Odds ratio.

COMPUTER PRACTICAL SESSIONS

12. Correlation coefficients. Least squares line. Graphic representation.
13. Residues analysis in the lineal model. Hypothesis estimation and contrast. Prediction.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Computer classroom practice	27,00	100
Development of group work	5,00	0
Development of individual work	10,00	0
Study and independent work	20,00	0
Readings supplementary material	5,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

In the **theoretical lessons** real problems will be set whose resolution requires the methodology corresponding to each topic. Then, the appropriate statistical technique will be presented and the problem resolution will be applied using statistical software. For the preparation of the subject, the student will have a collection of problems, divided into topics, that he/she has to solve by himself/herself.

The **practical sessions**, in the computer room and synchronized with the theory, will allow the student to put into practice these procedures for the problem solving, some of them being delivered to the professor for their assessment. Each student will have a dossier in which the content of each practice will be described, and will include the problems that will be solved in the dossier.

All the documents will be available in the Aula Virtual in pdf format (portable document format).

EVALUATION

Theoretical assessment: 60% of the final mark, that is, 6 points, **2 points** corresponding to the **continuous assessment** (Proposed tasks in theoretical sessions) and **4 points** corresponding to the **final assessment in the written test** aiming to assess the following aspects: Objectives recognition of the proposed medical studies, formal approach of the statistical problem, results interpretation and elaboration of conclusions.

Practical assessment: 40% of the final mark, that is, 4 points. It will be made by the **continuous assessment** of the participation of the different proposed tasks and/or performed in the practical sessions (**2 points**) and with the **final assessment in the written test (2 points)** that assesses the acquisition of skills related with the general and specific competencies (Creation and use of databases and recognition of charts and graphics of the software used).

The written tests referred in the previous paragraphs (Theoretical assessment and Practical assessment) consist on a theoretical-practical test, which will evaluate the knowledge as described in those paragraphs and the content being the same for all the groups of the subject.

In conclusion, the global assessment of the Statistics subject is composed of continuous assessment (up to 4 points) and final assessment in written test (up to 6 points). The points obtained in the continuous assessment will be kept in both calls in the same academic year in which the proposed tasks are presented.

If the subject is not passed, the student will choose to repeat the tasks or request that the grade obtained in their first enrollment be maintained, as long as no more than two years have elapsed since it. To pass the subject, the mark obtained in the final written test must be greater or equal to 4 out of 10, and the global mark must be equal or superior to 5 points.

Attendance to practical sessions is mandatory. Unjustified non-attendance to more than 20% of the sessions will make it impossible to pass the course.

Students are reminded of the importance of carrying out evaluation surveys on all the teaching staff of the degree subjects.

REFERENCES

Basic

- Bowers, D. (2014). Medical Statistics from Scratch. An Introduction for Health Professional (3 Edition). Wiley.
- Milton, J.S. (2007) Estadística para Biología y Ciencias de la Salud. Ed. McGraw-Hill
- Rosner, B. (2016). Fundamentals of Biostatistics (8 Edition). Cengage Learning.
- Samuels, M. L.; Witmer, J. A. y Schaffner, A. (2012) Fundamentos de Estadística para las Ciencias de la Vida (4 Edicion). Pearson.

- Samuels, M. L., Witmer, J. A. & Schaffner, A. (2016). Statistics for the Life Sciences (5 Edition). Pearson.
- Recursos e-Salut: ClinicalKey Student. Elsevier (Scopus, ScienceDirect). uv-es.libguides.com/RecursosSalut/BibliotecaSalut