Course guide
370020 - ESTADIS - Statistics and Epidemiology

Last modified: 11/06/2025

Unit in charge: Terrassa School of Optics and Optometry
Teaching unit: 731 - OO - Department of Optics and Optometry.

Degree: BACHELOR'S DEGREE IN OPTICS AND OPTOMETRY (Syllabus 2020). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Guisasola Valencia, Laura https://futur.upc.edu/LauraGuisasolaValencia

Others: Cardona Torradeflot, Genis https://futur.upc.edu/GenisCardonaTorradeflot

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.
CE15. (ENG) Adquirir habilitats de treball en equip com unitat en la que s'estructuren de forma uni o multidisciplinar els professionals i demés personal relacionats amb la salut visual.

Generical:
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CG8. Plan and carry out research projects that contribute to the production of knowledge in the field of optometry and disseminate this scientific knowledge via the typical communication channels.
CG5. Give opinions and produce reports and expert reports when necessary.
CG11. Locate new information and interpret it in context.

CG12. (ENG) The ability to understand the general structure of optometry and its connection to other specific disciplines and other complementary ones.

CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.

Transversal:
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management
CT7. Foreign language. Demonstrate knowledge of a foreign language, preferably English, at an oral and written level that is consistent with graduates' future needs.

TEACHING METHODOLOGY

MD1 - Participatory lecture class of theoretical and practical content
MD2 - Active methodologies in the classroom (project-based learning (PBL), case studies, role-playing games, cooperative learning, ...)
MD3 - Practical class of resolution, with the participation of the students, of practical cases and / or exercises related to the contents of the subject
MD5 - Reading of didactic material, texts and articles related to the contents of the subject
MD6 - Carrying out problems, exercises, assignments and resolution of doubts through the Atenea virtual campus

LEARNING OBJECTIVES OF THE SUBJECT

1. Recognize the statistical part in the method and the results of scientific work.
2. Assess the adequacy of the statistical techniques used in scientific works, taking into account the objectives of those works.
3. Use computer tools to carry out statistical analysis of sample data: estimation of statistical parameters and hypothesis testing.
4. Use computer tools for the graphical representation of statistical data in accordance with previously defined objectives.
5. Design simple statistical studies.
6. Know the distribution of diseases related to vision in populations and the factors that influence or determine it, and apply the results of these studies to the control of visual health problems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	45,0	30.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

1. The scientific evidence.

Description:
• What scientific evidence is?
• Where the scientific evidence is found?
• Books, websites, Google, Wikipedia, articles.
• What type of study / article gives us the most scientific evidence?
• How to cite a book / article correctly. What DOI is ?
• Bibliographic managers.

Related activities:
Delivery 1 EST: Brief bibliographical list. Group work of 2-3 people. 20% grade for the statistics section.

Related competencies :
CE15. (ENG) Adquirir habilitats de treball en equip com unitat en la que s'estructuren de forma uni o multidisciplinar els professionals i demés personal relacionats amb la salut visual.

CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management

Full-or-part-time: 4h
Practical classes: 4h

2. Basic descriptive statistics.

Description:
• Data types: nominal, ordinal, quantitative, continuous, discrete, etc.
• Normal and non-normal distributions.
• How to find out if a data set has a normal distribution.
• Descriptive statistics in normal distribution: mean, standard deviation, confidence interval
• Descriptive statistics in non-normal distribution: median, minimum, maximum, range, IQR.
• How to graphically represent results based on normality and data types.
• Outliers.
• Special considerations of descriptive statistics in visual data (refractive errors, logMAR visual acuity, one eye or two eyes, etc.).

Related activities:
EST Practice 2 (4 practical sessions = 4 hours): Design of an Excel spreadsheet to facilitate data entry and subsequent analysis with a statistical program.
Sort and clean data in Excel. First steps in descriptive statistics in Excel. Import data into the JASP statistical program.
First steps in descriptive statistics in JASP. Presentation of results in Excel and JASP using a table and graph.
EST Handout 2: Descriptive and inferential statistical report with Excel. Group work of 2-3 people. 30% grade for the statistics part.
EST Handout 3: Descriptive and inferential statistical report with JASP. Group work of 2-3 people. 30% grade for the statistics part.

Related competencies :
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.
CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management

Full-or-part-time: 14h
Practical classes: 10h
Laboratory classes: 4h

3. Basic inferential statistics.

Description:
• Comparisons of two normal and non-normal groups, matched and unmatched.
• Comparisons of more than two normal and non-normal groups, matched and unmatched.
• Contingency tables, comparisons of nominal data.
• Study of correlations between normal and non-normal variables. Regression line.
• Correlation and concordance. Bland-Altman graph.h

Related activities:
Practice 2 EST (approx. 3.5 h): Inferential statistics using Excel and JASP.
Presentation of correlation graphs and regression lines using Excel and JASP. Construction of a Bland-Altman graph using Excel.
Assignment 2 EST: Descriptive and inferential statistical report using Excel. Work in groups of 2-3 people. 30% grade for the statistics part.
Assignment 3 EST: Descriptive and inferential statistical report using JASP. Work in groups of 2-3 people. 30% grade for the statistics part.

Related competencies :
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.
CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management

Full-or-part-time: 10h
Practical classes: 6h 30m
Laboratory classes: 3h 30m

4. Validity and Reliability.

Description:
• Validity: reproducibility and repeatability.
• Reliability: sensitivity and specificity.
• ROC curve.
• Critical analysis of the diagnostic capacity of various visual and ocular health tests.

Related competencies :
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.
CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management

Full-or-part-time: 2h
Practical classes: 2h

5. Introduction to Epidemiology.

Description:
• Theoretical and practical concepts of epidemiology.
• Connection with Public Health
• What can be measured
• What tools are used
• How the results obtained are interpreted.

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Full-or-part-time: 4h
Practical classes: 4h

6. Cross-sectional epidemiological designs.

Description:
• Characteristics and objectives of the studies
• Advantages and limitations
• Types of epidemiological frequency measures: Prevalence measures
• Types of cross-sectional studies
• Treatment of vision in official surveys: ESCA; international surveys
• RAABS, RACS, RESCO studies

Related activities:
Practice 2 EPI (2 practical sessions = 4 hours)
Session 1: Search for vision questions contained in official health surveys from different countries. Work in groups of three people.
Session 2: Presentation of the results obtained in each group. Analysis and comparison of vision treatment with the results obtained by country.

Related competencies :
CG12. (ENG) The ability to understand the general structure of optometry and its connection to other specific disciplines and other complementary ones.

CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Full-or-part-time: 12h
Practical classes: 8h
Laboratory classes: 4h

7. Longitudinal or Cohort Epidemiological Designs.

Description:
• Characteristics and objectives of the studies
• Advantages and limitations
• Types of measures:
- Frequency: Incidence
- Association: Relative risk
- Impact: Attributable risk, etiological fraction, population attributable risk
• Childhood vision cohorts (Terrassa school cohorts)
• Geriatric vision cohorts (Beever Damm cohort)

Related activities:
Practice 2 EPI (1 practice session = 2 hours)
Search for a scientific article from a longitudinal epidemiological study of vision.
In-depth analysis of the chosen article based on the script and the questions that will be provided.

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CG12. (ENG) The ability to understand the general structure of optometry and its connection to other specific disciplines and other complementary ones.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Full-or-part-time: 8h
Practical classes: 6h
Laboratory classes: 2h

8. Epidemiological designs of Cases and Controls.

Description:
• Characteristics and objectives of the studies.
• Advantages and limitations.
• Types of measures.
• Analysis of a case.

Related activities:
Practice 3 EPI (2 practical sessions = 2 hours)
Groups of three people search for a vision study with a case-control design and choose the best one.
Group analysis of the chosen study.

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CG12. (ENG) The ability to understand the general structure of optometry and its connection to other specific disciplines and other complementary ones.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Full-or-part-time: 4h
Practical classes: 2h
Laboratory classes: 2h

9. Updated epidemiological data on vision problems and ocular pathologies.

Description:
• Epidemiological data on Refractive Errors at a global and local level.
• Epidemiological data on the main Binocular Vision and accommodative dysfunctions.
• Epidemiological data on the main ocular pathologies (cataracts, glaucoma, retinal pathologies, etc.)

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CG12. (ENG) The ability to understand the general structure of optometry and its connection to other specific disciplines and other complementary ones.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Full-or-part-time: 2h
Practical classes: 2h

ACTIVITIES

Practice 1 EST : Basic Descriptive Statistics.

Description:
Design of an Excel spreadsheet to facilitate the entry of data and subsequent analysis with a statistical program.
Sorting and cleaning data in Excel. First steps in descriptive statistics in Excel.
Importing data to a JASP statistical program. First steps in descriptive statistics in JASP.
Presentation of results in Excel and JASP by table and graph.

Material:
Excel program.
JASP program.

Delivery:
Delivery 1 EST: Descriptive and inferential statistical report with Excel. Group task of 2-3 people.
Delivery 2 EST: Descriptive and inferential statistical report with JASP. Group task of 2-3 people.

Related competencies :
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.

Full-or-part-time: 4h
Laboratory classes: 4h

Practice 2 EST: Basic Inferential Statistics .

Description:
Inferential statistics through Excel and JASP. Presentation of correlation graphs and regression line with Excel and JASP.
Construction of a Bland-Altman graph with Excel.

Material:
Software Excel.
Software JASP.

Delivery:
Delivery 2 EST: Descriptive and inferential statistical report with Excel. Group task of 2-3 people.
Delivery 3 EST: Descriptive and inferential statistical report with JASP. Group task of 2-3 people.

Related competencies :
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.

Full-or-part-time: 3h 30m
Laboratory classes: 3h 30m

Practice 1 EPI: Questions about vision in official health surveys.

Description:
Session 1: Search for the vision questions contained in the official health surveys of different countries. Work in groups of three people.
Session 2: Presentation of the results obtained in each group. Analysis and comparison of the treatment of vision with the results obtained by countries.

Material:
Computers with network connection.

Delivery:
There are no associated deliverable materials, but during the second session the results obtained in each group are presented.

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CE15. (ENG) Adquirir habilitats de treball en equip com unitat en la que s'estructuren de forma uni o multidisciplinar els professionals i demés personal relacionats amb la salut visual.

CT7. Foreign language. Demonstrate knowledge of a foreign language, preferably English, at an oral and written level that is consistent with graduates' future needs.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Full-or-part-time: 2h
Laboratory classes: 2h

Practice 2 EPI: Search for a scientific article of across sectional or longitudinal epidemiological study of vision.

Description:
Search for a scientific article of a cross-sectional or longitudinal epidemiological study of vision
In-depth analysis of the chosen article, based on the script and the questions that will be provided.

Material:
Computers with network connection.

Delivery:
Delivery of a report based on a pre-established script of the in-depth analysis of one of the articles chosen (transversal design or transversal design)
longitudinal) with emphasis on the interpretation of statistical results.

Related competencies :
CE15. (ENG) Adquirir habilitats de treball en equip com unitat en la que s'estructuren de forma uni o multidisciplinar els professionals i demés personal relacionats amb la salut visual.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

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CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management

Full-or-part-time: 2h
Laboratory classes: 2h

Practice 3 EPI: Search for an epidemiological study of vision with cohort design.

Description:
Search for a scientific article of an epidemiological cohort study
In-depth analysis of the chosen article, based on the script and the questions that will be provided.

Material:
Computers with network connection.

Delivery:
Delivery of a report based on a pre-established script of the in-depth analysis of one of the articles chosen with an emphasis on the interpretation of statistical results.

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CG11. Locate new information and interpret it in context.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT7. Foreign language. Demonstrate knowledge of a foreign language, preferably English, at an oral and written level that is consistent with graduates' future needs.

Full-or-part-time: 2h
Laboratory classes: 2h

EUROPEAN DIPLOMA IN OPTOMETRY COMPETENCES

Description:
This module contributes to the European Diploma in Optometry competencies indicated in the following link:
https://drive.google.com/drive/folders/1bwmHBsvkrGnY63DfXAnWZB_i0I2pXa-I?usp=drive_link

Statistical part evaluation.

Description:
Delivery 1 EST: Brief bibliographic list. Group task of 2-3 people.
Delivery 2 EST: Proposal for design and study protocol. Group task of 2-3 people. 10% of the overall mark
Delivery 3 EST: Descriptive and inferential statistical report. Group task of 2-3 people. 10% of the overall mark
Theoretical Statistical Exam 30%

The evaluation of the Statistical part represents 50% of the subject.

Related competencies :
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.
CE03. (ENG) The ability to show basic knowledge of geometry and mathematical analysis. The ability to apply general statistical methods to optometry and vision sciences.
CT5. Efficient use of informacion resources. To manage data and technical and scientific information adquisition, organization, analysis and visualization and to provide a critical appraisal of the results of this management

Epidemiological part evaluation .

Description:
Deliverable 1 epidemiology : Report based on a pre-established script of the in-depth analysis of one of the articles chosen (Transversal design) with emphasis on the interpretation of statistical results (10% of the subject)
- Delivery 2 epidemiology : Report based on a pre-established script of the in-depth analysis of one of the articles chosen (design Cohorts) with emphasis on the interpretation of statistical results (10% of the subject)
- Exam of the contents of Epidemiology of vision (30% of the subject)

The evaluation of the Epidemiology part is 50% of the subject.

Related competencies :
CG4. Critically reflect on the clinical, scientific, ethical and social issues involved in the professional practice of optometry, understand the scientific foundations of optics and optometry and critically evaluate terminology, clinical trials and research methods related to optics and optometry.
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.
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GRADING SYSTEM

The evaluation of the subject is divided into 50% statistics and 50% epidemiology according to the following detail:

- Deliverable 1 statistics 10%
- Deliverable 2 statistics 10%
- Estatistics exam 30%

- Deliverable 1 epidemiology 10%
- Deliverable 2 epidemiology 10%
- Epidemiology exam 30%

RE-EVALUATION: The re-evaluation consists of a single exam that is worth 100% of the grade and will contain 50%-50% questions on statistics and epidemiology. In no case can a student who has less than a 3,5 or a non-presented NP be accepted.

EXAMINATION RULES.

In the event of a partial or total copy of any of the evaluations of the subject, the provisions of the Academic Regulations for undergraduate and master's degree studies at the UPC will be applied:
"Irregular actions that may lead to a significant variation in the grade of one or more students constitute a fraudulent conduct of an assessment act. This action involves the descriptive and numerical grade of 0 of the assessment act and the subject, without prejudice to the disciplinary process that may arise as a result of the acts performed.
If the student considers the decision to be incorrect, he or she may file a complaint with the principal or the dean of the school and, if the answer is not satisfactory, he or she may lodge an appeal with the principal.
The total or partial reproduction of the academic or research works, or their use for any other purpose, must have the explicit authorization of the authors.
It is the responsibility of the principal or the dean of the school to resolve the allegations on the aspects not included in the regulations. ”
Attendance at the practical sessions is mandatory to pass the subject.

BIBLIOGRAPHY

Basic:
- Friedman Lawrence M.; Furberg, Curt; DeMets David L. Fundamentals of clinical trials. 5th ed. Cham: Springer, 2015. ISBN 9783319185385.
- Armstrong, Richard A. "Statistical guidelines for the analysis of data obtained from one or both eyes". Ophthalmic and physiological optics [on line]. [Consultation: 20/02/2023]. Available on: https://doi.org/10.1111/opo.12009.- Prajapati, Bhavna; Dunne, Mark C.M.; Armstrong, Richard A. "Sample size estimation and statistical power analyses". Optometry today. 2010, july.
- Celentano, David D; Szklo, M; Gordis, L. Gordis epidemiología. 6ª ed. Barcelona: Elsevier, 2019. ISBN 9788491135364.

RESOURCES

Hyperlink:
- Equator. Resource
- GAPMINDER. Resource