

### PHDPH101- Research Methods - Biostatistics

Course Title	Research Methods - Biostatistics				
Course Code	PHDPH101				
Course Type	Compulsory				
Level	PhD				
Year / Semester	1 <sup>st</sup> semester				
Teacher's Name	Dr Maria – Angeliki Stamouli				
ECTS	10	Lectures / week	2	Laboratories / week	1
Course Purpose and Objectives	<p>The main purpose of this course is the understanding of the basic concepts of Biostatistics and its application in research in the field of health sciences. More specifically, this course aims to make students capable of planning, designing, conducting, performing statistical analysis, presenting results and interpreting the findings of the research that is carried out in medicine and in the health sector generally. In addition, the detailed presentation of the basic concepts of Biostatistics such as the different types of variables (categorical, qualitative, quantitative), the measures of central tendency, of variation and shape, the various statistical tests and models that illustrate the relation between two variables aims to provide students with the appropriate skills in the use and application of appropriate biostatistical methods, while at the same time it enables them to properly document and evaluate their research results.</p>				
Learning Outcomes	<p>After the end of the course students will be able to:</p> <ul style="list-style-type: none"> <li>• Have proven basic knowledge of Biostatistics and its applications in the processing and analysis of data in the health and pharmaceutical sector.</li> <li>• Plan, design and conduct studies in the field of pharmaceutical sciences.</li> <li>• Carry out simple and complex statistical tests of both descriptive and inferential statistics.</li> <li>• Use and utilize the correct statistical analysis and methods.</li> <li>• Present the findings, interpret them correctly and document the results of the various statistical tests.</li> <li>• Acquire those skills in biostatistics that will enable them to evaluate the results of research in pharmacy and health, and also to formulate speculations for further research.</li> </ul>				
Prerequisites	-	Required	-		
Course Content	<p><b>1. Introduction to Biostatistics</b></p> <p>A) What is Biostatistics</p> <p>i) A historical overview of the first use of statistics</p> <p>ii) Role and function of Biostatistics</p> <p>B) Stages of biostatistics (briefly)</p> <p>i) Research question</p>				

- ii) Sampling
- iii) Coding and importing data in a statistical program
- iv) Descriptive Statistics
- v) Descriptive statistical measures
- vi) Frequency Tables and Charts
- vii) Inferential Statistics
- viii) Presentation and interpretation of results
- ix) Documentation of results – Conclusions

## 2. Descriptive statistics

- A) What is Descriptive Statistics
  - i) Population - Census
  - ii) Sample – Sampling - Probability and non-Probability  
Sampling techniques
- B) Variables
  - i) Categorical - Qualitative-quantitative
  - ii) Grouping
- C) Frequency tables
  - i) Absolute, Relative and Cumulative Frequencies
- D) Graphs
  - i) Bar charts - Pie charts - Histograms- Boxplots.
- E) Descriptive Measures
  - i) Measures of central tendency
  - ii) Measures of variation
  - iii) Measures of shape
- F) Contingency tables
- G) Pearson correlation coefficient

## 3. Inferential statistics

- A) What is inferential statistics
- B) Methodology of statistical inference
- C) Confidence intervals
- D) Hypothesis testing
  - i) The Null ( $H_0$ ) Hypothesis and Alternative ( $H_1$ )
  - ii)  $\chi^2$  test of independence and homogeneity
  - iii) t-test for the difference of the means
  - iv) One-way analysis of Variance
- E) Simple Linear Regression.

## 4. Sampling and Sampling size calculation

- A) Methods of selecting a representative sample
  - i. Simple random sampling
  - ii. Systematic sampling
  - iii. Stratified sampling
  - iv. Cluster sampling
  - v. Independent – Dependent samples
- B) Sample size in different research designs

- a. Clinical trials
- b. Cohort studies
- c. Case - Control studies
- d. Sample calculation programs

## 5. The SPSS tool

- A. Introduction to SPSS
- B. Open SPSS
- C. Review the layout of SPSS
- D. Open an SPSS file
- E. Create a new data set
- F. Save an SPSS file
- G. SPSS applications using a questionnaire
  - i. Coding a questionnaire
  - ii. Defining variables
  - iii. Data entry and editing
  - iv. Data transformation and calculation using the compute και recode commands
  - v. Frequency tables
  - vi. Descriptive statistics
  - vii. Charts
  - viii. Crosstabs
  - ix. Contingency tables in epidemiological studies
  - x. Chi-square test for independence and homogeneity
  - xi. One sample t-test, independent samples t-test, paired samples t-test
  - xii. One Way ANOVA
  - xiii. Pearson Correlation Coefficient
  - xiv. Normality tests and graphs
  - xv. Non-parametric tests
- H. Advanced SPSS applications
  - i. Simple linear regression
  - ii. Repeated measures ANOVA κ.α.
  - iii. Cronbach's alpha reliability analysis
  - iv. Factor analysis

## 6. Logistic Regression

- A. Introduction to logistic regression
  - i. The logistic function
  - ii. The logistic model
- B. Interpretation of the parameters
  - i. Regression
    - 1. With one independent categorical variable
    - 2. With one independent continuous variable
    - 3. With more than one independent variables
- C. Estimation techniques

	<ul style="list-style-type: none"> <li>i. Maximum likelihood estimation</li> <li>D. Hypothesis testing <ul style="list-style-type: none"> <li>i. Likelihood ratio test</li> <li>ii. Wald statistic</li> <li>iii. Confidence intervals</li> </ul> </li> <li>E. Evaluating goodness of fit</li> <li>F. Interactions and confounding factors</li> <li>G. Modeling strategies</li> <li>H. Multi-class logistic regression</li> </ul> <p><b>7. Survival Analysis</b></p> <ul style="list-style-type: none"> <li>A. Introduction to survival analysis</li> <li>B. Basic functions <ul style="list-style-type: none"> <li>i. Survival function</li> <li>ii. Hazard function</li> <li>iii. Mean residual lifetime</li> </ul> </li> <li>C. Censoring</li> <li>D. Non-parametric estimation <ul style="list-style-type: none"> <li>i. Kaplan-Meier estimator for survival function</li> </ul> </li> <li>E. Data analysis with SPSS <ul style="list-style-type: none"> <li>i. Hazard function</li> </ul> </li> <li>F. Hypothesis testing</li> <li>G. Proportional Hazard Models</li> </ul> <p><b>8. Specialized topics in Biostatistics</b></p> <p>In this section the following advanced and specialised topics (examples) could be developed:</p> <ul style="list-style-type: none"> <li>A. Generalized linear models</li> <li>B. Bioinformatics</li> </ul>
Teaching Methodology	<p>The course is delivered to the students by means of lectures, conducted with the help of computer presentations. Discussion with students includes questions / answers, pros / cons, role play and case studies. In addition, recent research findings and reviews are included. Lecture notes and presentations are available through the e-learning facility. There are also laboratories performed in the computer labs of the university.</p>
Bibliography	<ul style="list-style-type: none"> <li>• Μπερσίρης Σ., Σάχλας Α. (2016), Εφαρμοσμένη Στατιστική με Χρήση του IBM SPSS Statistics 23: Με έμφαση στις Επιστήμες Υγείας, Εκδόσεις Τζιόλα, Αθήνα.</li> <li>• Μπερσίρης Σ., Σάχλας Α. (2016), Εφαρμοσμένη Στατιστική με Έμφαση στις Επιστήμες Υγείας, Εκδόσεις Τζιόλα, Αθήνα. <i>Altman DG (1991), Practical statistics for medical research, Chapman and Hall, London.</i></li> <li>• <i>Armitage P, Berry G (1987), Statistical methods in medical research, Blackwell, Oxford.</i></li> </ul>

	<ul style="list-style-type: none"> <li>• Cochran G.W. (1977), Sampling Techniques, John Wiley and Sons, New York</li> <li>• D.R Cox and D Oakes (1984), Analysis of survival data, Chapman and Hall.</li> <li>• David Hosmer, Jr. and Stanley Lemeshow (1999), Applied Survival Analysis, Wiley.</li> <li>• Selvin S. (1996), Statistical analysis of epidemiologic data, 2<sup>nd</sup> edition, Oxford University Press.</li> <li>• Αποστολάκης Ι., Δάρας Τ., Μ.Α. Σταμούλη (2007), Ασκήσεις Υπολογιστικής Στατιστικής στην Υγεία, Τεύχος Α', Εκδόσεις Παπαζήση, Αθήνα.</li> <li>• Αποστολάκης Ι., Μ.Α. Σταμούλη (2007), Ασκήσεις Υπολογιστικής Στατιστικής στην Υγεία, Τεύχος Α', Εκδόσεις Παπαζήση, Αθήνα.</li> <li>• Γναρδέλλης Χ., (2013), Ανάλυση Δεδομένων με το IBM SPSS Statistics 21 Εκδόσεις Παπαζήση, Αθήνα.</li> <li>• Ιωαννίδης Ι. (2000), Αρχές αποδεικτικής Ιατρικής, Ιατρικές Εκδόσεις Λίτσας, Αθήνα.</li> <li>• Κτενάς Ε (1992), Βιοστατιστική – Αρχές επιδημιολογίας , Εκδόσεις ZYMEL, Αθήνα</li> <li>• Κτενάς Ε. (1993), Μέρος Β', Είδη επιδημιολογικών ερευνών (σημειώσεις).</li> <li>• Κτενάς Ε. (2003), Στατιστική στο χώρο της Υγείας, Εκδόσεις ZYMEL, Αθήνα.</li> </ul>
Assessment	<p>1. Final examination (60%) The final exam is a written exam and is scheduled during the exam period at the end of the semester. The subject matter is determined by the teacher and communicated in a timely manner to the students.</p> <p>2. Mid-term examination (25%) The midterm exam is a written exam and is scheduled within the semester (6th - 8th week of courses). The subject matter is determined by the teacher and communicated in a timely manner to the students.</p> <p>3. Small project (15%) This work is individual and concerns the elaboration of a small-scale research exercise for practicing statistical methods.</p>
Language	Greek/English