

Course Title	Epidemiology and Biostatistics				
Course Code	HSA-511				
Course Type	Required				
Level	2 <sup>nd</sup> Cycle				
Year / Semester	1 / 1				
Teacher's Name	Dr Christos Varounis				
ECTS	10	Lectures	22	Interactive learning activities	22
Course Purpose and Objectives	<p>The main objectives of the course are to:</p> <ul style="list-style-type: none"> <li>• Introduce and analyse the concepts of Epidemiology and Public Health and highlight their importance for ensuring disease prevention, wellbeing and prosperity in populations.</li> <li>• Introduce and analyse the concepts of evidence-based medicine and evidence-based decision making and highlight their importance in healthcare services management.</li> <li>• Analyse the knowledge and skills needed to conduct systematic literature search for existing evidence, using appropriate search engines and databases such as PubMed Health and Cochrane Library.</li> <li>• Cover and explain the different types of data involved in epidemiological research and highlight the importance of their differences.</li> <li>• Equip students with the analytical and critical thinking skills for performing and interpreting basic descriptive analysis of numeric variables.</li> <li>• Equip students with the analytical and critical thinking skills for performing and interpreting basic descriptive analysis of categorical variables.</li> <li>• Cover and analyse in detail measures of descriptive epidemiology used to assess the frequency and distribution of disease and mortality in human populations.</li> <li>• Cover and analyse in detail the common observational study designs used in Epidemiology and Public Health research and equip students with the skills to design their own epidemiological studies and critically appraise published epidemiological studies.</li> <li>• Cover and analyse in detail the common interventional study designs used in Epidemiology and Public Health research and equip students with the skills to design their own epidemiological studies.</li> <li>• Cover and analyse in detail, as well as enable critical thinking on concepts pertaining to sampling methodologies and random error.</li> <li>• Cover and analyse in detail, as well as enable critical thinking on concepts pertaining to statistical inference, hypothesis testing and statistical significance.</li> </ul>				

	<ul style="list-style-type: none"> <li>• Cover and analyse in detail, as well as enable critical thinking on concepts pertaining to selection, measurement, classification (including disease ascertainment) and information bias.</li> <li>• Equip students with the analytical and critical thinking skills to perform basic analysis for determining associations between categorical independent variables and numeric dependent variables as well as associations between numeric independent variables and numeric dependent variables.</li> <li>• Equip students with the analytical and critical thinking skills to perform basic analysis for determining associations between numeric or categorical independent variables and numeric dependent variables.</li> <li>• Familiarize students with and analyse the results of linear regression analysis for determining associations.</li> <li>• Familiarize students with non-parametric statistical tests that can be used for univariate analyses of numeric outcomes.</li> <li>• Equip students with the analytical and critical thinking skills to perform basic analysis for determining associations between two categorical variables using the chi-square test.</li> <li>• Equip students with the analytical and critical thinking skills to perform univariate logistic regression analysis for determining associations with binary outcome variables.</li> <li>• Equip students with critical thinking on the multi-factorial nature of disease and the theoretical difference between confounding, effect modification (interaction) and effect mediation, and how this translates into the need for multivariate analyses and statistical adjustment for confounding.</li> <li>• Analyse the knowledge and skills needed to critically evaluate the existing literature, identify gaps in knowledge and generate testable research questions on topics relevant to healthcare services management.</li> <li>• Cover and analyse in detail the characteristics and the transmission chain of infectious diseases, giving a special emphasis on Covid-19.</li> </ul>
<p>Learning Outcomes</p>	<p>After completion of the course students are expected to be able to:</p> <ol style="list-style-type: none"> <li>1. Define Epidemiology and Public Health and describe their importance for ensuring disease prevention, wellbeing and prosperity in populations.</li> <li>2. Define the terms evidence-based medicine and evidence-based decision making.</li> <li>3. Examine the ways in which scientific evidence is provided as well as how its validity can be assessed.</li> <li>4. Evaluate the main criteria used when making evidence-based decisions in healthcare services management.</li> <li>5. Describe in detail how to conduct a systematic literature search for existing evidence, using appropriate search engines and databases such as PubMed Health and Cochrane Library.</li> <li>6. Outline and examine the different types of variables in epidemiological research.</li> </ol>

7. Outline and examine the different frequency distributions and describe the normal distribution and its statistical qualities.
8. Describe and apply different descriptive statistics for different research scenarios, and critically assess which descriptive statistics are more appropriate in different research scenarios.
9. Know how to interpret summary statistics, such as mean, median, standard deviation, interquartile range, proportions.
10. Know how to calculate and interpret basic summary statistics, such as proportions, risk, and rate.
11. Demonstrate deep understanding on the major measures of disease frequency (prevalence, incidence, rate, attack rate) and be able to calculate, interpret, and apply them in a relevant scenario.
12. Critically evaluate which measures of disease frequency are more appropriate in different public health and/or research scenarios.
13. Demonstrate deep understanding on the major measures of mortality (crude, cause-specific, age-specific, perinatal, case-fatality rate, standardized mortality ratio) and be able to calculate, interpret, and apply them in a relevant scenario.
14. Critically evaluate which measures of mortality are more appropriate in different public health and/or research scenarios.
15. Demonstrate deep understanding and apply the major concepts involved in analytic epidemiology, such as exposure/predictor, outcome/response, association, determinant, risk factor, protective factor.
16. Demonstrate deep understanding on the major measures of association used in Epidemiology and Public Health research (Odds Ratio, Relative Risk, regression coefficient, mean difference) and be able to calculate, interpret, and apply them in a relevant scenario.
17. Critically evaluate which measures of association are more appropriate in different public health and/or research scenarios.
18. Demonstrate deep understanding of the major Observational Epidemiological study designs (ecological, cross-sectional, case-control, cohort), critically evaluate observational studies in published literature, and be able to design a suitable study for answering specific research questions of Public Health importance.
19. Demonstrate deep understanding of the major Interventional Epidemiological study designs (Randomized Controlled Trials and other non-randomized trials), critically evaluate interventional studies in published literature, and be able to design a suitable study for answering specific research questions of Public Health importance.
20. Demonstrate deep understanding and critically evaluate concepts relating to sampling, estimation, such as parameters vs. estimates.
21. Demonstrate deep understanding and describe in detail the different sampling methods used in Epidemiology, as well as be able to critically appraise sampling approaches from published studies, as well as design their own sampling strategy for a given research scenario.
22. Demonstrate deep understanding and critically evaluate concepts relating to sampling, estimation, and statistical inference, such as parameters vs. estimates, and statistical significance.

23. Demonstrate deep understanding and describe in detail the different types of selection bias and critically appraise how they could affect the validity of each different study design, as well as describe ways on how to avoid these, and be able to detect and determine them in published research studies.
24. Demonstrate deep understanding and describe in detail the different types of information bias and critically appraise how they could affect the validity of each different study design, as well as describe ways on how to avoid these, and be able to detect and determine them in published research studies.
25. Demonstrate deep understanding and describe in detail the concepts of sensitivity, specificity, positive and negative predictive values and be able to calculate, interpret and critically appraise such results from the published literature.
26. Describe and apply different analytic statistics for different research scenarios, including critically appraising the suitability of each analytic statistic for different research scenarios.
27. Describe the concept of the dependent and the independent variable and how these are used for statistically determining the presence of associations.
28. Understand and interpret measures of association for categorical exposures and numeric outcomes (t-test and ANOVA).
29. Understand and interpret measures of association for numeric exposures and numeric outcomes (scatterplots and correlation analysis).
30. Describe and apply different analytic statistics for different research scenarios, including critically appraising the suitability of each analytic statistic for different research scenarios.
31. Describe the concept of the dependent and the independent variable and how these are used for statistically determining the presence associations.
32. Understand and interpret univariate linear regression analyses for analysing numeric outcomes.
33. Be familiar with and know how to interpret non-parametric statistical tests for numeric outcomes.
34. Understand and interpret measures of association for categorical or linear exposures and categorical outcomes (chi-squared test and univariate logistic regression).
35. Demonstrate deep understanding and describe in detail the multi-factorial nature of disease and the concept of confounding and critically appraise how it could affect the validity of research findings, as well as describe ways on how to avoid it, and be able to detect and determine it in published research studies (including the interpretation of crude and adjusted estimates).
36. Understand and interpret multiple linear and multivariate logistic regression analyses and critically evaluate their suitability for particular research scenarios.
37. Demonstrate deep understanding on how to critically evaluate and synthesize evidence provided in the existing literature, identify and

	<p>examine gaps in knowledge and generate testable research questions on topics relevant to healthcare services management.</p> <p>38. Understand and describe in detail the transmission chain of infectious diseases and describe ways on how to control it, as well get familiarised with transmission patterns of Covid-19.</p>													
Prerequisites	None	Required	None											
Course Content	<p>1a. Introduction to Epidemiology and Public Health</p> <p>1b. Evidence based methods and practices: systematically searching for and critically evaluating evidence in the literature</p> <p>2. Introduction to measurement: types of variables and types of distributions</p> <p>3. Descriptive analysis of numeric and categorical data</p> <p>4. Measures of disease frequency and mortality in chronic and infectious disease epidemiology</p> <p>5. Measures of Association and Measures of Impact</p> <p>6. Observational study designs: Cross-sectional, Prospective, Retrospective</p> <p>7. Interventional study designs: Randomized Controlled Trials and other non-randomized trials</p> <p>8. Sampling and random error</p> <p>9. Introduction to Statistical Inference</p> <p>10. Systematic error in research: Selection bias and Information bias</p> <p>11. Univariate Analyses: Associations with numeric outcomes I</p> <ul style="list-style-type: none"> <li>o T-test and ANOVA</li> <li>o Scatterplots and correlation analysis.</li> </ul> <p>12. Univariate Analyses: Associations with numeric outcomes II</p> <ul style="list-style-type: none"> <li>o Linear Regression Analysis</li> <li>o Non-parametric equivalents of numeric outcome tests</li> </ul> <p>13. Univariate Analyses: Associations with categorical outcomes</p> <ul style="list-style-type: none"> <li>o Chi-squared</li> <li>o Logistic Regression</li> </ul> <p>14. Multi-factorial nature of disease and Multivariate Analyses: confounding, effect modification, and effect mediation</p> <ul style="list-style-type: none"> <li>o Multivariate Linear and Logistic Regression Analyses</li> </ul> <p>15a. Synthesis and critical evaluation of evidence</p> <p>15b. Infectious diseases and Covid-19</p>													
Teaching Methodology	<p>This programme is delivered via distance learning (online) and includes recorded lectures, interactive online tutorials (Webinars) and discussion forums, as well as online exercises and other activities.</p>													
Bibliography	<p><b>Required Textbooks / Reading:</b></p> <table border="1"> <thead> <tr> <th>Title</th> <th>Author(s)</th> <th>Publisher</th> <th>Year</th> <th>ISBN</th> </tr> </thead> <tbody> <tr> <td>Epidemiology in Medicine</td> <td>Hennekens CH, Buring JE.</td> <td>Little, Brown &amp; Co</td> <td>1987</td> <td>031635 6360</td> </tr> </tbody> </table>				Title	Author(s)	Publisher	Year	ISBN	Epidemiology in Medicine	Hennekens CH, Buring JE.	Little, Brown & Co	1987	031635 6360
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Epidemiology in Medicine	Hennekens CH, Buring JE.	Little, Brown & Co	1987	031635 6360										

Oxford Handbook of Public Health Practice (3 <sup>rd</sup> ed.)	Guest C, Ricciardi W, Kawachi I, Lang I.	Oxford University Press	2013	978-0199586301
Modern Epidemiology (3rd edn.)	Rothman KJ, Greenland S, Lash TL	Lippincott, Williams & Wilkins	2008	031675780-2
Essential Medical Statistics (2nd ed.)	Kirkwood B. Sterne J.	Blackwell Scientific	2003	0865428719
Infectious Diseases Epidemiology (1st ed.)	Abubakar I. Stagg H. Cohen T. Rodrigues L.	Oxford University Press	2016	978-0198719830

**Recommended Textbooks / Reading:**

<b>Title</b>	<b>Author(s)</b>	<b>Publisher</b>	<b>Year</b>	<b>ISBN</b>
Mastering Public Health: A Postgraduate Guide to Examinations and Revalidation, (2nd ed.)	Lewis G, Sheringham J, Bernal JL), Crayford T	CRC Press	2014	978-1444152692
A Dictionary of Epidemiology. (5 <sup>th</sup> ed.)	Porta M, Last JM.	Oxford University Press	2008	0195141506
Epidemiology, principles and methods. (2nd ed.)	MacMahon B, Trichopolous D.	Little Brown and Co.	1996	031654222-9
Issues in Public Health 2 <sup>nd</sup> ed.)	Sim F, McKee M.	Open University Press	2011	978-0335244225

	Public Health at the Crossroads	Beaglehole R, Bonita R.	Cambridge University Press	1997	978-0521540476
	Epidemiology for Public Health Practice	Friis RH Sellers TA	Jones and Bartlett Learning	2014	978-1449665494
	Essentials of Epidemiology in Public Health (3rd edn.)	Aschengrau A, Seage GR.	Jones & Bartlett Learning	2014	9781284028911
	An Introduction to Medical Statistics (3 <sup>rd</sup> ed.)	Bland M.	Oxford Medical Publications	2006	978-0192632692
	Practical Statistics for Medical Research (2 <sup>nd</sup> ed.)	Douglas G. Altman	Chapman and Hall/CRC	2006	978-1584880394
Assessment	<ul style="list-style-type: none"> <li>• Participation (10%)</li> <li>• Course work: Assignments x 1 (30%)</li> <li>• Final Exam (60%)</li> <li>• Online quiz (formative)</li> </ul>				
Language	English				