

Course Code MED-403	Course Title Epidemiology and Public Health	ECTS Credits 6
School Medical School	Semester Fall (Semester 7)	Prerequisites None
Type of Course Required	Field Medicine	Language of Instruction English
Level of Course	Year of Study 4th	Course Lead: Behrooz Behbod
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

The course aims to provide an overview of concepts and principles of epidemiology and public health. Specifically the main objectives of the course are to ensure students:

- Understand the value of epidemiology and public health in the design, delivery and evaluation of effective and evidence-based clinical practice.
- Learn about the principles behind the measurement and distribution of disease in the population.
- Describe epidemiological study designs used to investigate determinants of health and disease in the population.
- Critically appraise research publications to inform clinical practice.
- Understand the principles of health promotion, health protection and disease prevention.
- Describe the work and organization of health services.
- Learn how to evaluate the effect of diagnostic tests and treatment.

Learning Outcomes:

After completion of the course students should be able to:

Week 1

Lobs covered during lectures and tutorials:

1. Discuss the importance and value of epidemiology and public health in clinical medicine.
2. Define disease prevalence, incidence and rates for quantifying disease frequency in populations.
3. Define life expectancy and health-adjusted life expectancy.
4. Describe the dependency ratio.
5. Describe and interpret quality-adjusted life years (QALYs).
6. Describe disability-adjusted life years (DALYs).
7. Define, apply, and compare direct and indirect standardisation.
8. Describe and interpret standardised mortality ratios.
9. Define and describe the importance of measuring different types of mortality

rates (crude and adjusted rates; maternal / neonatal / infant / under-5 mortality; cause / age-specific and all-cause mortality).

10. Describe the global distribution, causes and interventions to address high maternal and child mortality.
11. Calculate, apply and interpret direct and indirect standardisation.

Week 2

Lobs covered during lectures and tutorials:

12. Describe the design and main features of descriptive (case report / case series) and observational analytic studies (cross-sectional, ecological, case control, and cohort).
13. Compare and contrast the use, advantages and disadvantages of the descriptive (case report / case series) and observational analytic studies (cross-sectional, ecological, case control, and cohort).
14. Define and describe the cause and implications of ecologic fallacy.
15. Discuss the considerations for obtaining and describing study participants, including matching, restriction, inclusion / exclusion criteria, selecting appropriate controls, lack of controls.
16. Calculate, apply, and interpret odds ratios and relative risks.
17. Define, describe the use of, and interpret hazard ratios.
18. Select the most appropriate regression technique (logistic / linear regression or survival analysis) based on the study question and design.
19. Interpret coefficients from logistic, linear and Cox regression (survival analysis), including coefficients of continuous and categorical (nominal) variables.
20. Interpret the Kaplan-Meier curve.
21. Calculate, apply and interpret number needed to treat/harm (NNT/NNH); absolute risk (AR), absolute risk percent (AR%); population attributable risk (PAR), population attributable risk percent (PAR%).
22. Select the most appropriate regression technique (logistic / linear regression or survival analysis) based on the study question and design.
23. Calculate, apply and interpret odds ratios and relative risks.
24. Interpret hazard ratios.
25. Calculate, apply and interpret number needed to treat/harm (NNT/NNH); absolute risk (AR), absolute risk percent (AR%); population attributable risk (PAR), population attributable risk percent (PAR%).

Week 3

Lobs covered during lectures and tutorials:

26. Discuss the potential reasons for study findings (chance, confounding, bias, truth).
27. Describe the impact, assessment and control of chance, confounding and bias (including selection and information bias and measurement error).
28. Describe and interpret effect modification or interactions.
29. Compare statistical significance to clinical significance.
30. Formulate the null and alternative hypothesis for given research scenarios.
31. Select and interpret basic tests of statistical significance (chi-square, t-test, ANOVA).

32. Calculate and interpret a 95% confidence interval and use it to infer statistical significance.
33. Interpret a p-value and use it to infer statistical significance.
34. Define the terms: Type I and II errors, alpha level, beta, power, precision and degrees of freedom.
35. Describe the relationship between sample size, power and precision.
36. Describe the impact of missing data and outline methods to address it (Last Observation Carried Forward and imputation).
37. Describe the difference between efficacy and effectiveness.
38. Compare clinical effectiveness to cost effectiveness.
39. Evaluate causality.
40. Evaluate internal and external study validity.
41. Calculate and interpret a 95% confidence interval, using it to infer statistical significance.
42. Interpret a p-value and use it to infer statistical significance.
43. Select and interpret basic tests of statistical significance (chi-square, t-test, ANOVA).
44. Interpret a correlation coefficient.

Week 4

Lobs covered during lectures and tutorials:

45. Describe the design and main features of interventional epidemiological studies (phases of clinical trials; randomised controlled trials; non-inferiority / equivalence trials; community interventions).
46. Describe the reasons for and the methods of randomisation, stratification, blinding, allocation concealment and placebo controls.
47. Describe the Hawthorne effect and outline methods to address it.
48. Describe methods to handle noncompliance, loss to follow-up and contamination.
49. Compare intention-to-treat and per protocol analyses.
50. Discuss the importance of evidence-based medicine.
51. List the hierarchy of evidence.
52. Name the sources and databases to search for evidence.
53. Apply the PICO approach to search for evidence.
54. Describe the difference between patient-orientated evidence that matter (POEM) using clinical outcomes, and disease-orientated evidence (DOE) that use surrogate outcomes.
55. Outline the five steps of GRADE to assess the quality of the evidence for each specified outcome and decide whether to recommend an intervention.
56. Outline the main concepts of systematic reviews and meta-analyses.
57. Describe the importance and usefulness of systematic reviews and meta-analyses in clinical medicine, including their strengths over individual studies.
58. Describe the features of systematic reviews and meta-analyses, including the assessment of publication bias, the interpretation of funnel and forest plots and the estimation of effect sizes.
59. Apply the results of systematic reviews and meta-analyses in clinical practice.
60. Critically appraise epidemiological research studies.

61. Apply appropriate study designs to answer specific epidemiological research questions.

Week 5

Lobs covered during lectures and tutorials:

62. Discuss the theory, evidence and limitations of epidemiological paradigms (adult life risk factors, early life programming and life-course epidemiology).
63. Describe the role of genetic epidemiology in precision medicine and population health.
64. Describe differences in the implications of genetics and genomics for the health of individuals and of populations.
65. Describe the role of preconception health and care in the prevention of chronic non-communicable disease.
66. Apply preconception health evidence to clinical practice.
67. Discuss the design of a systems approach to improving preconception health and care.

Week 6

Lobs covered during lectures and tutorials:

68. Describe the global evidence (mortality, prevalence, incidence, risk factors, prevention and costs) of atherosclerosis, hypertension, and diabetes, ischaemic heart disease, and ischaemic and haemorrhagic stroke.
69. Describe the global evidence (mortality, prevalence, incidence, risk factors, prevention and costs) of lung, stomach, colorectal, liver, oesophageal, prostate, breast and cervical cancer.
70. Describe the global evidence (mortality, prevalence, incidence, risk factors, prevention and costs) of dementia (Alzheimer's and vascular) and Parkinson's disease.
71. Describe the global evidence (mortality, prevalence, incidence, risk factors, prevention and costs) of respiratory (asthma, COPD) and musculoskeletal (low back pain, osteoarthritis, rheumatoid arthritis) disease.

Week 7

Midterm Exam

Lobs covered during lectures and tutorials:

72. Interpret population pyramids.
73. Discuss the impact of demographic change and population ageing on public health.
74. Design a field epidemiology study to assess the health impact associated with an environmental incident.
75. Interpret results and formulate recommendations to the health authority.
76. Define case-control and cohort studies and describe the advantages and

disadvantages of each.

77. List some of the biases that may affect case control and cohort studies.
78. Calculate an odds ratio, rate ratio, rate difference, attributable risk percent and population attributable risk percent.
79. Interpret each measure (odds ratio, rate ratio, rate difference, attributable risk percent and population attributable risk percent) and describe each measure's main use.

Week 8

Lobs covered during lectures and tutorials:

80. Describe the global evidence (mortality, prevalence, incidence, risk factors, prevention and costs) of lower respiratory infections, HIV/AIDS, tuberculosis and upper respiratory infections in the developed world.
81. Describe the global evidence (mortality, prevalence, incidence, risk factors, prevention and costs) of malaria, lower respiratory infections, diarrheal diseases, HIV/AIDS in the developing world.
82. List the elements in the chain of infection.
83. Describe modes of transmission of infectious disease agents.
84. Define the terms 'attack rate', 'herd immunity' and 'cocooning'.
85. Describe the use and types of surveillance systems.
86. Outline the steps involved in outbreak investigations.
87. Define the terms outbreak, endemic, epidemic and pandemic.
88. List the types of stakeholders that contribute to outbreak investigations and response.
89. Describe the organization of infection control systems, including disease reporting and notifiable diseases.

Week 9

Lobs covered during lectures and tutorials:

90. List categories and examples of questions that should be asked of key informants who report a suspected outbreak of foodborne disease.
91. List criteria for prioritising the investigation of suspected foodborne disease outbreaks.
92. List common pitfalls in the collection of clinical specimens for the investigation of suspected foodborne diseases.
93. Determine the most efficient epidemiologic study design to generate and test a hypothesis (including the case definition and the appropriate comparison group).
94. Describe the advantages and disadvantages of different forms of questionnaire administration e.g., self-administered, telephone, in-person.
95. Name and describe the criteria required to provide evidence of causation.
96. List key areas of focus in interviewing foodhandlers and observing kitchen practices in a foodborne disease outbreak investigation.
97. Describe the use and process of health needs assessments.
98. Identify sources of knowledge and intelligence to inform health needs assessments.
99. Describe the role of risk communication and health journalism to protect the health

of the population during a major incident / infectious disease outbreak.

100. Communicate risk and research findings effectively to patients.

Week 10

Lobs covered during lectures and tutorials:

101. Describe and give examples of epidemiological research studying and addressing the social determinants of health.
102. Describe strategies to reduce health inequalities.
103. Describe the use of health equity audits.
104. Recognise the range of policy sectors that influence population health.
105. Explain how public health can have a role in policy-making to address the wider determinants of health.
106. Describe the key elements and use of health impact assessments.
107. Identify health inequalities in the USA.
108. Discuss the potential causes and impact of health inequalities in the USA.
109. Describe interventions to reduce health inequalities in the USA.
110. Describe the impact of the built environment on public health and health inequalities.
111. Discuss the role of environmental interventions in the design of buildings and cities to promote population health and wellbeing.

Week 11

Lobs covered during lectures and tutorials:

112. Describe the principles and practice of health promotion and primary prevention, including models of behaviour change and health in all policies and sectors.
113. Give examples of community level prevention (e.g., cigarette taxes, soda taxes, smoke-free cities and buildings, school policies, access to healthy food, transportation, clean air and safe environments).
114. Describe the principles and practise secondary, tertiary and quaternary disease prevention.
115. Describe the role of lifestyle medicine in the promotion of health and management of chronic non-communicable disease.
116. Assess lifestyle risk factors while taking clinical histories.
117. Apply lifestyle medicine approaches as part of the prevention and treatment of chronic disease.

Week 12

Lobs covered during lectures and tutorials:

118. Discuss the aims and objectives of screening.
119. Discuss the rationale for selection of a screening test.
120. Describe the properties of screening tests (validity, accuracy and reliability)
121. Describe different types of screening programmes and their evaluation.
122. Discuss the screening concepts of confirmatory testing, appropriateness, lead-time

bias and length bias.

123. Contrast screening and diagnostic tests.

124. Calculate the sensitivity, specificity, positive and negative predictive value of a screening test.

125. Describe the interpretation of reference values.

126. Describe basic probability theory (multiplication rule / addition rule), prediction / decision rules, decision trees, likelihood ratios (application of Bayes theorem), post-test and pretest.

127. Define and give examples of the application of clinical epidemiology.

128. Describe the US healthcare system.

129. Calculate, apply and interpret sensitivity, specificity, and predictive values.

Course Contents:

- Introduction to Epidemiology and Public Health.
- Review Lecture I: Assessing morbidity and mortality in populations: measures of disease frequency & life expectancy.
- Review Lecture II: Assessing morbidity and mortality in populations: measures of disease frequency & life expectancy.
- Measures of mortality in populations.
- Direct and indirect standardisation.
- Descriptive and observational analytic epidemiological studies and their role in providing evidence for public health.
- Assessing associations and identifying disease/mortality determinants.
- Assessing impact of determinants in populations.
- Measures of association.
- Assessing impact of determinants in populations.
- Interpretation of study findings.
- Statistical testing of hypotheses.
- Missing data, efficacy and effectiveness.
- Exercises to evaluate causality and internal and external study validity.
- Sample USMLE questions.
- Interventional analytic epidemiological studies and their role in providing evidence for public health.
- Evidence based medicine.
- Systematic Reviews and Meta-analyses in the context of Public Health.
- Critical appraisal of epidemiological research.
- Exercises to identify appropriate epidemiological study designs to specific research questions (including sample USMLE questions).
- Epidemiological paradigms I: adult life risk factors.
- Epidemiological paradigms II: early life biological programming.
- Epidemiological paradigms III: life-course approaches.
- Preconception Health & Care.
- Genetic epidemiology.
- Descriptive and analytic epidemiology of major chronic conditions I: cardiometabolic and cerebrovascular conditions.
- Descriptive and analytic epidemiology of major chronic conditions II: cancer.

- Descriptive and analytic epidemiology of major chronic conditions III: dementia and Parkinson's disease.
- Descriptive and analytic epidemiology of major chronic conditions IV: respiratory and musculoskeletal disease.
- Demographic change, population ageing and health.
- Applied environmental epidemiology.
- Interactive case study – Smoking and lung cancer.
- Descriptive and analytic epidemiology of major infectious conditions I: common communicable diseases in the developed world.
- Descriptive and analytic epidemiology of major infectious conditions II: common communicable diseases in the developing world.
- Infectious Disease Epidemiology I: disease transmission.
- Infectious Disease Epidemiology II: disease surveillance and outbreak investigation.
- Infectious Disease Epidemiology III: organisation of infection control.
- Interactive case study: Outbreak investigation.
- Interactive case study: Health Needs Assessments.
- Role of risk communication & health journalism in public health and clinical medicine.
- Social epidemiology.
- Health inequalities.
- Health policy.
- Tackling health inequalities.
- Healthy places.
- Primary disease prevention and health promotion.
- Secondary disease prevention.
- Tertiary and quaternary disease prevention.
- Interactive case study: Lifestyle medicine.
- Exercises and sample USMLE questions on levels of prevention.
- Screening.
- Statistical aspects of screening.
- Clinical epidemiology & US health care.
- Exercises and sample USMLE questions related to screening.

Learning Activities and Teaching Methods:

Lectures, Tutorials.

Assessment Methods:

Midterm Exam and Final Exam. Assessment is by Single Best Answers (SBAs) and Short Answer Questions (SAQs).

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Sim F, McKee M	Issues in public health, (2 nd edition)	Open University Press	2011	978-0335244225

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
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Hennekens CH, Buring JE.	Epidemiology in Medicine	Little, Brown & Co	1987	0316356360
Guest C, Ricciardi W, Kawachi I, Lang I.	Oxford Handbook of Public Health Practice (3 rd edition)	Oxford University Press	2013	978- 0199586301
Carneiro I, Howard N	Introduction to epidemiology (2 nd edition)	Open University Press	2011	978- 0335244614
Jennie Naidoo/ Jane Wills	Foundations for Health Promotion (4 th edition)	ELSEVIER		978070205442 6