Course Title: Principles of Epidemiology

Course Code: MPH 512
Credits: 3 (2+2)
Level: 1
Prerequisites: NA
Class Location: M0 classroom (ground floor of main College of Medicine building)

Course instructor:
Dr. Rufaidah Dabbagh
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Course Description

This is a core course that is required for all MPH students. It provides the students with in-depth foundations of the science of epidemiology. The course will cover the fundamentals of host, environment and agent interactions for disease causation, the principles of study design methods for epidemiologic research and practice, calculation and interpretations of measures of disease frequency and association, basic concepts in disease surveillance and screening, and the key skills needed for planning and conducting an outbreak investigation. This course is a pre-requisite for MPH 524, MPH 598, MPH 599, as well as epidemiology elective courses.

Course Learning Objectives (CLOs)

- Define key epidemiological terms and concepts.
- To define and calculate measures of morbidity (measures of disease occurrence) and mortality.
- To identify, construct and critically assess the methodology of different study designs, including cohort, case-control, and cross-sectional studies.
- To define, calculate and interpret measures of disease association.
- Identify the sources of confounding and biases in epidemiological research, and propose methods to minimize and control for it.
- Identify and apply key steps for outbreak investigations and understand public health surveillance methods.

Course Competencies by Topic

Topic/lecture	Competency covered*
Introduction to epidemiology: History, basic terminology & concepts, dynamics of disease transmission	▪ Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussion of health issues. ▪ Apply the basic terminology and definitions of epidemiology.
Measures of disease occurrence: Morbidity and mortality, and data standardization	▪ Calculate basic epidemiology measures.
Study design methods and application: Ecologic studies Cross sectional studies Cohort studies Case-control studies Experimental studies	▪ Draw appropriate inferences from epidemiologic data. ▪ Evaluate the strengths and limitations of epidemiologic reports.
Measures of association: Relative and absolute measures	▪ Calculate basic epidemiology measures.
Causal inference	▪ Draw appropriate inferences from epidemiologic data.
Threats to external and internal validity: Random error, bias and confounding	▪ Draw appropriate inferences from epidemiologic data. ▪ Evaluate the strengths and limitations of epidemiologic reports.
Effect measure modification (EMM)	▪ Calculate basic epidemiology measures.
Principles of disease surveillance and screening	▪ Identify key sources of data for epidemiologic purposes. ▪ Identify the principles and limitations of public health screening programs. ▪ Calculate basic epidemiology measures.
Outbreak investigation	▪ Describe a public health problem in terms of magnitude, people, time, and place. ▪ Calculate basic epidemiology measures.
Ethics in epidemiology	▪ Comprehend basic ethical and legal principles pertaining to the collection, maintenance, use, and dissemination of epidemiologic data.

*The competencies where based on the competency framework for epidemiology for MPH training described by Moser et al.[1]

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[1] Moser M, Ramiah K, Ibrahim M. Epidemiology core competencies for Master of Public Health students. Public Health Rep. 2008;123 Suppl 1(Suppl 1):59-66. doi: 10.1177/00333549081230S113.

Assessment Methods

1. **Homework assignments** (30%): These will be assigned for specific topics and will be graded as 5 marks per assignment.

2. **Midterm exam** (30%): Testing understanding of basic principles, measures, and study designs. Midterm will be a combination of short answer questions (SAQs) as well as multiple choice questions (MCQs).

3. **Case analysis** (15%): Pair or group analysis of a public health outbreak investigation.

4. **Final exam** (25%): Cumulative exam covering the material for the entire semester, and will be composed of MCQs.

Teaching Strategies

- **Lectures**: Introduce core principles, supplemented with real-world examples.
- **Case Studies**: Hands-on problem-solving based on historical and current public health cases.
- **Practical sessions**: Focused on critical thinking and collaborative analysis.
- **Assignments**: Practical exercises for skill-building in epidemiological calculations and interpretations.

Required Textbooks and Resources

1- Gordis Epidemiology (6th Ed.) by David D. Celentano and Moyses Szklo, 2019.

2- Epidemiology: An Introduction (2nd Ed.) by Kenneth J. Rothman, 2012.

3- CDC. Principles of Epidemiology in Public Health Practice (3rd Ed.). Available from:

https://archive.cdc.gov/www_cdc_gov/csels/dsepd/ss1978/SS1978.pdf

4- Additional reading material (articles or webpages) that is provided by the instructor.

Recommended Advanced Reading

- Modern Epidemiology (4th Ed.) by Timothy Lash, Tyler Vanderweele, Sebastein Haneuse, Kenneth Rothman, 2021. Full text available via SDL [link].
- Epidemiology Beyond Basics (4th Ed.) by Moyses Szklo and Javier Nieto, 2019.

Code of Conduct

1- *Integrity:* cheating on homework assignments, case study or exams is not tolerated and will be penalized. Plagiarism in the form of utilizing AI tools for assignments is also strictly prohibited.
2- *Professionalism:* practicing respect and class etiquette with instructors, colleagues and other university faculty and staff is expected.
3- *Commitment:* attendance of lectures and practical sessions is fundamental to passing this course successfully. Active participation and proactiveness during class will enhance the student's learning experience.

Course Schedule

Date, Time	Lecture	Reading reference
13/1/2025 8:00-10:00	***Introduction to epidemiology:*** - History - Basic terminology & concepts - Dynamics of disease transmission	Gordis. Ch 1, 2 Rothman. Ch 1, 2
13/1/2025 10:15-12:00	***Practical introduction to epidemiology:*** Exercises and reflection on reading	CDC. Principles of Epidemiology in Public Health Practice. pp. 1-71. Available from: link
20/1/2025 8:00-10:00	***Measures of disease occurrence:*** Morbidity & Mortality	Gordis. Ch 3, 4 Rothman. Ch 4
20/1/2025 10:15-12:00	***Practical measures of disease occurrence:*** Exercises for calculation	
27/1/2025 8:00-10:00	***Study design 1:*** Ecologic studies Cross sectional studies Homework assignment 1	Gordis. Ch 10 Rothman. Ch 5 pp.104-105
27/12/2025 10:15-12:00	***Practical Study design 1:*** Reading article and exercise on assessment of cross-sectional studies	
3/2/2025 8:00-10:00	***Study design 2:*** Cohort studies I	Gordis. Ch 9 Rothman. Ch 5 pp. 69-87
3/2/2025 10:15-12:00	***Practical study design 2:*** Reading article and exercise on assessment of cohort studies	
10/2/2025 8:00-10:00	***Study design 3:*** Cohort studies II Homework assignment 2	Gordis. Ch 9 Rothman. Ch 5 pp. 69-87
10/2/2025 10:15-12:00	***Practical study design 3:*** Reading article and exercise on assessment of cohort studies	
17/2/2025	***Study design 4:***	Gordis. Ch 10, 13

8:00-10:00	Case-control studies Comparing cohort to case-control studies Homework assignment 3	Rothman. Ch 5 pp. 87-104; 106-107
17/2/2025 10:15-12:00	*Practical study design 4:* Reading article and exercise on assessment of case-control studies	
24/2/2025 8:00-10:00	*Measures of association:* Relative and absolute measures Attributable measures	Gordis. Ch 11, 12 Rothman. Ch 5 pp. 58-68
24/2/2025 10:15-12:00	*Practical measures of association:* Exercises on interpretation of results from reports and calculation of these measures	
3/3/2025 10:00-11:10	*Experimental study design 5:* Randomized and non-randomized trials Concepts of randomization, blinding, stratification	Gordis. Ch 7, 8 Rothman. Ch 13 pp. 242-249
3/3/2025 11:10-11:50	*Practical experimental study design 5:* Reading article and exercise on assessment of experimental studies, and calculation of measures of efficacy and efficiency	
10/3/2025 10:00-11:10	*Causal inference I:* Causation Introduction to direct acyclic graphs (DAGs)	Gordis. Ch 14 Rothman. Ch 3, Ch 5 pp. 57-58
10/3/2025 11:10-11:50	*Practical causal inference:* Exercise on development and interpretation of causal diagrams	
	Ramadan and Eid Break	
7/4/2025 8:00-10:00	*Threats to external and internal validity:* Random error Bias Confounding Homework assignment 4	Gordis. Ch 15 Rothman. Ch 7
7/4/2025 10:15-12:00	*Practical threats to external and internal validity:* Identification of threats of internal validity by study design	
14/4/2025 9:00-11:00	*Midterm exam*	
14/4/2025 10:15-12:00	*Effect measure modification (EMM)* Homework assignment 5	Gordis. Ch 15 Rothman. Ch 11
21/4/2025 8:00-10:00	*Practical effect measure modification (EMM)* Identification of type of EMM (multiplicative vs. additive scale)	
21/4/2025 10:15-12:00	*Principles of disease surveillance:* Disease surveillance Screening	Gordis. Ch 5, 18 Rothman. Ch 13 pp. 235-241

28/4/2025 8:00-10:00	***Practical principles of disease surveillance:*** Measures of diagnostic accuracy (sensitivity, specificity, positive predictive value, negative predictive value)	
5/5/2025 8:00-10:00	***Outbreak investigation:*** Homework assignment 6: Outbreak investigation module from CDC Case analysis for outbreak investigation (due 28 May, 5:00 pm)	Rothman. Ch 5 pp. 51-53 CDC. Principles of Epidemiology in Public Health Practice. pp. 72-80. Available from: link CDC chapter: link
5/5/2025 10:15-12:00	***Practical outbreak investigation:*** Step-by-step application of an outbreak investigation	
12/5/2025 8:00-10:00	***Standardization of data*** Internal vs. external standardization	Rothman. Ch 10 pp. 188-192
12/5/2025 10:15-12:00	***Practical standardization of data:*** Interpreting standardized data from reports and exercises on calculation of standardized data	
19/5/2025 8:00-10:00	***Ethics in epidemiology***	Gordis. Ch. 20
19/5/2025 10:15-12:00	***Practical revision preparation for final***	
26/5/2025 9:00-10:30	***Final Exam***	