

Al-Farabi Kazakh National University Faculty Medicine and HealthCare
Education program on specialty:
“8D10101 Public Health “Research Methods”

**PROGRAM OF THE FINAL EXAM FOR COURSE
“ADVANCED EPIDEMIOLOGY”**

5 credits

Author:

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TMC OF COURSE IS CONFIRMED

On Academic Council of Medicine and Public Care Faculty

Protocol N , .

Reviewed and recommended at the meeting of Epidemiology,

Biostatistics and Evidence-Based Medicine

Department from «04 » 01. 2025, Protocol N

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Recommended by the faculty methodical bureau

« 04 » 01 2025., Protocol N 1

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PROGRAM OF THE FINAL EXAM ON COURSE

“RESEARCH METHODS”

5 credits

This course will provide a comprehensive overview of selected research and quantitative methods used in conducting health services research. The course will address all phases of the research process, from generating research questions and hypotheses to study design, sampling, measurement, data collection, and data analysis. The proper use of statistical methods and computer applications for secondary data analysis will also be covered. This course serves as a foundational step in developing your research project.

Upon completion of the course, the student will be able to

1. To demonstrate knowledge of the process of generating scientific theory.
2. To possess knowledge and skills in selecting research to address population health issues.
3. To determine the appropriate epidemiologic designs and types for addressing public health issues.
4. Be able to plan and write a research proposal.
5. Be able to conduct research using the knowledge and skills acquired in this course.

List of examination items for preparation to exam

MODULE 1 INTRODUCTION TO EPIDEMIOLOGY

S 1. History, concepts, and principles of epidemiology. Measures of disease occurrence.

Epidemiology is the study of how diseases spread and can be controlled in populations.

Science originated with Hippocrates; modern epidemiology began with John Snow's investigation into cholera, focusing on the distribution (who, where, when) and determinants (causes) of diseases. The main principles include observation, hypothesis testing, and intervention. Concepts of causality, probability and the Iceberg phenomenon.

S2. Population Health.

It focuses on improving health outcomes for entire groups rather than individuals by addressing social, economic, and environmental factors that affect health. It utilizes policies, prevention programs, and community interventions to reduce health disparities.

S 3. Measures of Disease Frequency in Public Health.

It means using Quantitative tools to assess how often diseases occur in populations, using rates such as incidence, prevalence, Mortality Rate, Attack Rate, and ratios, which represent the proportion of people exposed who get sick.

S4. Descriptive and Analytical Epidemiology.

There are two main approaches to studying diseases. Descriptive Epidemiology examines disease patterns (who, where, when) using case reports and surveys. Analytical Epidemiology tests hypotheses (why/how) using cohort, case-control, and experimental studies.

S 5. Outbreak Investigation.

The process of identifying and controlling disease outbreaks. Steps: Confirm outbreak, define cases, collect data, analyze patterns, test hypotheses, and implement control measures.

The goal of the outbreak investigation is to stop the spread and prevent future outbreaks.

MODULE 2 MEASURE IN EPIDEMIOLOGY

S.6. Design of Epidemiological Studies: Observational Studies.

Studies in which researchers observe exposures and outcomes without intervening. Types of studies: Descriptive (Case reports, surveys [who, where, when]) and Analytical studies that examine associations (cohort, case-control studies). The purpose of epidemiological studies is to identify risk factors and disease patterns in natural settings.

S.7. Design of Epidemiological Studies: Analytical studies. Measure of exposure.

Studies that test hypotheses about disease-exposure relationships. There are types of Cohort Studies that follow exposed vs. unexposed groups over time. Case-control studies compare cases (those with a disease) with controls (those without a disease) to examine past exposures. Measure of Exposure: Quantified via questionnaires, biomarkers, or environmental data.

S 8. Experimental studies: RCT, non-RCT. Measure of outcome.

Studies where researchers assign interventions to assess effects: Randomized Controlled Trial (RCT) which is the Gold standard; random assignment to intervention/control groups. Non-RCT: Quasi-experimental designs (no randomization, e.g., community trials). The measure of outcome is provided using clinical endpoints (survival, symptom improvement) or surrogate markers.

S. 9. Screening in Public Health.

Detecting diseases in asymptomatic individuals to enable early intervention using the WHO criteria: The Disease must be serious, treatable, and have a detectable preclinical phase. Examples: Mammography (breast cancer), PSA tests (prostate cancer). Challenges are presented as False positives, overdiagnosis, and cost-effectiveness.

S. 10. Bias, confounding, and errors.

Factors that distort study results or interpretations. Bias: Systematic error (e.g., selection bias, recall bias). Confounding: Extraneous variable affecting exposure-outcome relationship (e.g., age, smoking). Errors: Random means it is due to chance (reduced by larger samples). Systematic: Flaws in design/execution (addressed via blinding, randomization).

MODULE 3 EXPOSURE AND OUTCOME-ORIENTED EPIDEMIOLOGY

S.11. Statistical Methods in Epidemiology.

Statistical Methods in Epidemiology

Application of statistical techniques to analyze disease patterns and risk factors in populations.

Key methods include descriptive statistics (Mean, median, prevalence, incidence) and Inferential Statistics (Confidence intervals, p-values, regression models). Common Tests: Chi-square, t-tests, logistic regression (for odds ratios), Cox regression (survival analysis). The purpose is to assess associations, control for confounders, and determine significance.

S. 12. Clinical Epidemiology.

Integration of epidemiological methods into clinical practice to improve patient outcomes.

It focuses on diagnosis, prognosis, treatment efficacy, harm assessment, and the use of tools (RCTs, systematic reviews, and meta-analyses). The foundation is Evidence-based medicine (EBM) and clinical decision-making.

S. 13. Exposure-Oriented Epidemiology: Infectious Diseases

Study of how infections spread and are influenced by exposures (e.g., pathogens, behaviors). Key concepts in epidemiology include transmission Routes (direct, person-to-person vs. indirect, vector-borne or waterborne) and the Reproductive Number (R_0), which measures contagiousness. Methods: Outbreak investigations, seroprevalence studies, molecular epidemiology.

S. 14. Zoonotic Diseases Epidemiology.

Study of diseases transmitted between animals and humans (e.g., rabies, Lyme disease, COVID-19).

The specificities of this type of epidemiology are the presence of drivers as climate change, deforestation, and wildlife trade. One Health Approach is integrating human, animal, and environmental health for prevention. There are challenges as emerging pathogens and antimicrobial resistance.

S. 15. Exposure-Oriented Epidemiology: Non-Communicable Diseases

Study of chronic diseases (e.g., diabetes, cancer) associated with behavioral, environmental, or genetic factors. Risk Factors are smoking, poor diet, physical inactivity, and pollution. It uses Cohort studies and risk prediction models. Global Burden: NCDs cause ~70% of deaths worldwide (WHO).

Typology and approximate content of examination tasks:

Each exam ticket includes 3 questions on the above course topics.

- 1) key competency; 2) general competency related to a certain circle of subjects and educational areas; 3) subject competency is private in relation to the two previous ones, having a specific description and the possibility of forming educational subjects.

Block	Example question	Determining the level of competencies

Block 1. Questions aimed at identifying cognitive competencies.	Concept of causality in Epidemiology.	PhD student demonstrates knowledge of conception in Advanced Epidemiology.
Block 2. Questions defining system competencies.	Design of Epidemiologic studies: principle, methods, questions and measures.	PhD student demonstrates knowledge and skills in design of epi studies.
Block3. Questions regarding the definition of functional competencies.	Estimate of sensitivity and specificity of screening test.	PhD students measures rates, proportion, ratio, risk for Population.

Grades:

Grade	Digital equivalent points	points, % content	Assessment according to the traditional system
A	4.0 _	95-100	Excellent
A-	3.67	90-94	
B+	3.33	85-89	Good
B	3.0	80-84	
B-	2.67	75-79	
C+	2.33	70-74	
C	2.0	65-69	Satisfactorily
C-	1.67	60-64	
D+	1.33	55-59	Unsatisfactory
D	1.0	50-54	

Required and Recommended Reading

Required reading:

1. Wolfgang, A. Handbook of Epidemiology. Vol.1//Ahrens Wolfgang, Peugeot Iris. - 2 ed.- Springer Reference, 2014.- 469 p.
2. Principles and methods of Epidemiology. 3-d Edition. R. Dicker Office of epidemiologic program CDC, USAID. -2012.-457 P.
3. Aschengrau A., Essentials of Epidemiology in Public Health, 3rd Edition, 2008
4. Rothman K., Modern Epidemiology, 3rd Edition, 2008

Recommended reading:

5. Hennekens, C., & Buring, J. (1987). Epidemiology in Medicine, Boston/Toronto: Little, Brown and Company.
6. Kelsey, J., Whittemore, A., Evans, A. & Thompson, D. (1996). Methods in Observational Epidemiology, Second Edition, New York: Oxford University Press.

Electronic source:

1. www.who.org
2. www.cdc.gov
3. www.medline
4. www.cockraine.library
5. www.PubMed