Al-Farabi Kazakh National University Faculty Medicine and Health Care
Education program on specialty
8D 10101 Public Health

**PROGRAM OF THE FINAL EXAM IN DISCIPLINE
OF COURSE "ADVANCED EPIDEMIOLOGY"**

6 credits

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PROGRAM
OF THE FINAL EXAM ON COURSE
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Study topics for the exam: The final exam will be in writing form. The thematic content covers all types of work: topics of lectures and seminars, as well as assignments for independent work of master's students.

Outcome of learning:

1. Demonstrate knowledge of Epidemiology and epidemiologic studies.
2. Possess knowledge and skills to solve Population Health.
3. Determine the appropriate epidemiologic designs and types for addressing public health issues.
4. Be able to plan and write a research proposal.
5. Conduct research using the knowledge and skills acquired in this course.

Based on the results of studying the course, the master's student should be able to:

- Describe and provide examples of measures of morbidity and mortality used in epidemiology.
- Interpret and calculate basic epidemiological measures used to describe the health of a population, including measures of morbidity and mortality.
- Find and interpret health indicator data.
- Distinguish between observational and experimental study designs.
- Define and describe the different types of errors, biases, and confounding that may exist in an epidemiological study.
- Write a research proposal, including the problem statement, background, hypotheses, and methods for conducting the proposed research.
- Create a questionnaire.
- Downloads and studies IBM SPSS program
- Search for publications and write a literature review on the problem.
- Conduct research (creation of a questionnaire, collection).
- Creates a database and performs statistical processing of the results.
- Draw up the results of the study.

List of examination items for preparation to exam

Module I. Concepts and Methodological Approaches in Epidemiology

Class 1: Concepts and Modern Tendencies in Epidemiology

This class introduces the definition and core purpose of epidemiology: the study of the distribution and determinants of health-related states in populations. We will explore the historical evolution of the field, from John Snow to modern applications. The session will

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conclude with a discussion of current trends, including the role of big data, genomics (molecular epidemiology), climate change, and the epidemiology of chronic, non-communicable diseases.

Class 2: Rates, Risks, Measures of Associations and Impact

How do we quantify disease in a population? This class focuses on the fundamental tools for measurement. We will define and calculate key rates (incidence, prevalence, mortality) and measures of risk. The core of the session will be dedicated to understanding measures of association (Risk Ratio, Odds Ratio) and measures of public health impact (Attributable Risk, Population Attributable Fraction), which help us determine the strength of an exposure-disease relationship.

Class 3: Design of Epidemiological Studies: Descriptive Studies

Before we can test hypotheses, we must describe the problem. This class covers descriptive study designs, which are used to characterize disease occurrence according to the basic dimensions of person, place, and time. We will discuss case reports/series, cross-sectional studies, and ecological studies, highlighting their role in generating hypotheses and informing public health resource allocation.

Class 4: Design of Epidemiological Studies: Analytic Studies

Moving from description to hypothesis testing, this class introduces analytic study designs. We will focus on the two main types of observational studies: cohort studies, which follow a group forward in time to see who develops a disease; and case-control studies, which look backward to compare exposures in those with the disease (cases) and those without (controls). We will compare their strengths, weaknesses, and appropriate applications.

Class 5: Experimental Studies: RCT, Non-RCT

To establish causality, we often turn to experiments. This session defines experimental studies, where the investigator actively assigns an exposure or intervention. We will focus on the Randomized Controlled Trial (RCT), the gold standard for evidence, discussing key features like randomization, blinding, and placebo controls. We will also touch upon non-randomized experimental designs (e.g., community trials, field trials) and when they are used.

Class 6: Diagnostic and Screening Tests

Epidemiology provides the tools to evaluate how well a test identifies disease. This class covers the critical concepts of validity and reliability. We will define and calculate the key metrics of test performance: sensitivity (ability to identify true positives), specificity (ability to identify true negatives), and predictive values (positive and negative predictive value), which tell us how to interpret a test result in an individual.

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Class 7: Population Health

Epidemiology is the core science of population health. This class broadens our view from specific diseases to the overall health of a community. We will explore the key determinants of health, including social, economic, and environmental factors. We will discuss the concepts of health equity, health disparities, and the use of epidemiological data to guide health policy and prevention strategies at the population level.

Class 8: Bias and Confounding in Studies

All studies are susceptible to error. This class is a critical examination of the main threats to a study's validity. We will define and differentiate between random error (chance) and systematic error (bias). We will explore the three main types of bias (selection bias, information bias) and, most importantly, confounding—a situation where the effect of one factor is mixed up with another, leading to a distorted estimate of association.

Class 9: Experimental Studies. RCT and Non-RCT

(This appears to be a duplicate of Class 5. It could be used for a deeper dive or as a review).

Building on the introduction in Class 5, this session provides a more detailed examination of experimental epidemiology. We will critically appraise the components of an RCT, analyzing factors like allocation concealment, intention-to-treat analysis, and generalizability. We will also explore the practical and ethical considerations that lead to the use of non-RCT designs, such as stepped-wedge and cluster-randomized trials, in real-world public health settings.

Class 10: Statistical Methods in Epidemiology

Data without analysis is just numbers. This class provides an overview of the statistical toolkit used by epidemiologists. We will cover fundamental concepts like hypothesis testing, p-values, and confidence intervals. The session will introduce basic statistical tests for comparing groups (e.g., chi-square test, t-test) and provide a conceptual introduction to regression modeling, the primary tool for controlling for confounding in complex data analysis.

Class 11: Field Epidemiology. Outbreak Investigation

When disease strikes suddenly, epidemiologists are the detectives on the scene. This class covers the principles and practice of "shoe-leather" epidemiology. We will walk through the classic steps of an outbreak investigation, from confirming the diagnosis and establishing a case definition to generating hypotheses, conducting contact tracing, and implementing control measures, using real-world examples like foodborne illness or infectious disease outbreaks.

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Class 12: Epidemiology of Infectious Diseases

This class applies the principles learned so far specifically to communicable diseases. We will explore key concepts unique to infectious disease epidemiology, such as the chain of infection, herd immunity, and the basic reproduction number (R_0). We will examine the dynamics of disease transmission and discuss the public health tools used for prevention and control, including surveillance, vaccination, and quarantine.

Class 13: Zoonotic Diseases Epidemiology

Approximately 60% of known infectious diseases and up to 75% of new or emerging infectious diseases originate from animals. This final class focuses on the epidemiology of zoonotic diseases—those transmitted between animals and humans. We will explore the "One Health" concept, which recognizes the interconnected health of people, animals, and the environment. Case studies of diseases like rabies, avian influenza, and Lyme disease will be used to illustrate the complex factors driving their emergence and spread.

Typology and approximate content of examination tasks:

STANDART in IC UNIVER. The exam format is offline.

The form of the final control (exam): WRITTEN- CASE STUDY

The form holding the final control (exam)	Use weary platform m	For whom recomme nded	Availability proctoring, video recordings, check for plagiarism.	Tickets/ Questions automatical generation	Check Works
STANDARD: Offline 1. Question is on theoretical item. Example: Conception on causality in development of diseases. 2. Question - Using epidemiological methods in Public Health. Example: Cohort study in Non-Infectious Diseases. 3 Question – Statistical Methods and Measurement in Advanced Epidemiology. Example: 1. Of 2,872 persons who had received radiation treatment in childhood because of an enlarged thymus, cancer of the thyroid developed in 24 and a benign thyroid tumor developed in 52. A comparison group consisted of 5,055 children who had received no such treatment (brothers and sisters of the children who had received radiation treatment). During the follow-up period, none of the comparison group developed thyroid cancer, but benign thyroid tumors developed in .	IC UNIVER	For PhD stude nts	Proctoring now. Video recording at Individual work - not required. Mandatory check For plagiarism in the works of students. Provided automatic checking work for plagiarism with using 2 services: Antiplagiarism (mandatory) and StrikePlagiarism (if necessary). One check of teaching staff for 1 job. Using antiplagiarism systems PTS can provide possibility of verification work for a student - 1 attempt (configured in the system by the teacher).	Yes	1. Teacher evaluates answers of PhD student.

Calculate the relative risk for benign thyroid tumors?						

Grading

Traditional Grades	Scores	Requirements
Excellent	90-100	The work was done independently and at a high scientific and methodological level. The text of the answer shows that the student is able to evaluate and process learned scientific methods and methods of activity, and is also able to offer concepts, models and use new methods and tools of professional activity. The paper presents an independent vision of the problem and the corresponding argumentation. The work was done neatly, the student has professional terminology and writing skills for scientific papers.
Good	75-89	The work as a whole was well written, but the author did not disclose or did not fully cover certain issues of the topic. The author's vision of the problem and argumentation is not presented in the work. The paper made some inaccuracies, but they do not relate to the main content of the work. The answer reveals knowledge and understanding of the material by no less than 75%.
Satisfied	50-74	The task as a whole has been completed, but the author has not demonstrated the skills of analyzing the problem, individual issues of the topic have not been disclosed or missing. The author's vision of the problem is not presented in the work. The author does not have sufficient knowledge of the methodology of scientific research. In the answer there were inaccuracies related to the main content of the question.
Unsatisfied	0-49	The task is not completed, or completed less than 50%, The task is not completed correctly.

Required and Recommended Reading

Required reading:

1. Aschengrau A., Essentials of Epidemiology in Public Health, 3rd Edition, 2008

Recommended reading:

1. Gordis: Epidemiology, 5th Edition, Saunders 2013
2. Rothman K., Modern Epidemiology, 3rd Edition, 2008
3. Pickles A. Epidemiological Methods in Life Course Research, 1st Edition, 2007
4. Webb P and Bain C. Essential Epidemiology: An introduction for Students and Health Professionals. Second Edition. Cambridge University Press. 2011.

5. Wolfgang, A. Handbook of Epidemiology. Vol.1//Ahrens Wolfgang, Peugeot Iris. - 2 ed.- Springer Reference, 2014.- 469 p.
6. Principles and methods of Epidemiology. 3-d Edition. R. Dicker Ooffice of epidemiologic program СДС, USAID. -2012.-457 P.

7. Principles of Epidemiology in Public Health Practice. Third Edition. An introduction to Epidemiology and Biostatics.US, CDC, Atlanta. -2012.-6-75 p.
8. Hennekens, C., & Buring, J. (1987). Epidemiology in Medicine, Boston/Toronto: Little, Brown and Company.
9. Kelsey, J., Whittemore, A., Evans, A. & Thompson, D. (1996). Methods in Observational Epidemiology, Second Edition, New York: Oxford University Press.
10. www.who.org
11. www.cdc.gov
12. www.medline
13. www.cockraine.library
14. www.PubMed