

DEPARTMENT OF EPIDEMIOLOGY

EXIT COMPETENCIES FOR MPH GRADUATES IN GENERAL EPIDEMIOLOGY

1. DEFINITION AND HISTORICAL PERSPECTIVES

Knowledge

1. Historical Trends in the most common causes of death in the United States.
2. Historical evolution in concepts of infectious and chronic disease etiology and pathogenesis.

Skill

1. Use of vital health statistics in assessing patterns and determinants of overall and cause-specific mortality at different periods in history.

2. BASIC CONCEPTS

2.A. Biological Variability

Knowledge

1. The nature and complexity of inter-individual variability (biological, biochemical, and physiological) as it affects the study of a disease process.

2.B. Probability and Causal Inference

Knowledge

1. The criteria used to judge whether associations are causal
2. Calculating standard probability measures (e.g. rates, ratios, prevalence, incidence, case fatality rates), and understanding their uses and limitations.
3. Formulating reasonable hypotheses from research questions

2. C. Exposure and Outcomes

Knowledge

1. The concept of exposure as it refers to a potential causal factor, and the wide range of exposures (genetic, biological, environmental, social, cultural, lifestyle and behavioral factors) that may be associated with states of health and disease.
2. How the natural history of disease (e.g., a slowly-progressing disease as opposed to one that is rapidly-progressing) influences research questions and the choice of study design.

2. D. Human Physiology and Pathology

Knowledge

1. The biochemical and cellular basis for normal and pathological functioning
2. Interaction among anatomical systems and organs in health and disease.
3. The most important chronic, infectious, and degenerative diseases of humans in terms of the public's health
4. Pathobiology of major diseases integrated with the principles of epidemiology.
5. The impact of host characteristics (e.g., immune response, nutrition, presence of other diseases or infections) on disease outcomes

2. E. Risk

2.E.i. Social and Behavioral Factors

Knowledge

1. That behavioral, social, and socioeconomic factors, as well as race/ethnicity and gender, are major determinants of the incidence, prevalence, progression, and distribution of common diseases, and can have complex links to disease outcomes.
2. The patterns of the incidence, prevalence, progression, and distribution of common diseases by race/ethnicity, gender, and socioeconomic status.

2.E.ii. Physical and Biological Factors

Knowledge

1. Multiple physical (e.g., ionizing and non-ionizing radiations) and biological (e.g., microbial agents) factors in the natural history of acute and chronic illnesses.
2. Accuracy and reproducibility of measures and classifications of physical and biological risk factors, and their prevalences in populations.

2.E.iii. Genetic Factors

Knowledge

1. That genetic variation among individuals, as well as in infectious agents, gives rise to variation in disease risk.

Skills

1. Interpret studies that deal with simple relationships among genetic factors and variation in disease risk.

2. F. Population-based Epidemiology

Knowledge

1. Population patterns of disease in terms of person, place and time.
2. How indirect effects (e.g., herd immunity and the secondary spread of infection) can affect endemic and epidemic infection patterns.
3. That standard individually-based epidemiological analyses, which assume homogeneous populations and mixing patterns, can be misleading since populations and mixing patterns are heterogeneous
4. The concept of mathematical modeling for infectious diseases.
5. The concept of R_0 and how it relates to endemic and epidemic infection patterns.

3. RESEARCH METHODS

3.A. Study Designs

Knowledge

1. The difference between an experimental and an observational study
2. Basic strategies for observational studies, to include cross-sectional, case-control and cohort designs.

3. Basic strategies for experimental studies, to include randomized, controlled clinical trials and community trials.
4. The relationships between study design, sampling strategy, and methods for ascertaining information about exposure and outcome.
5. The relative strengths and weaknesses of different study designs for infectious diseases, chronic diseases and reproductive outcomes
6. The use of study protocols in any observational or intervention study.

Skills

1. Ability to identify study designs when presented with an example in the literature.
2. Ability to choose an appropriate study design and articulate a design strategy when presented with a research question.

3.B. Ethics; Human Subjects Requirements

Knowledge

1. The basic required components of informed consent, to include statement of requirements of participation, statement of risks and benefits and provision of information about who is conducting the study, as well as principles of freedom from coercion, right to refuse to participate, and right to privacy.
2. Understanding of institutional mechanisms for protecting the rights of human subjects including the definition and responsibilities of an Institutional Review Board.

Skills

1. Ability to write a proposal to an Institutional Review Board.
2. Ability to write informed consent statements.

3.C. Sampling Theory and Procedures

Knowledge

1. The principle representative and non-representative sampling methods (simple random; those stratified on exposure, outcome, or third variables; multistage, etc.), and the risks of sampling bias associated with each.
2. Defining statistical target populations given different sampling procedures, and distinguishing these statistical target populations from the inference target populations
3. Strategies for sample selection based on characteristics defining current or past inclusion in a target population.
4. Epidemiological parameter estimates that can be inferred to the statistical target population given different sample stratification procedures.
5. Distinguishing sample selection biases from observational biases and confounding.

3.D. Statistical Analysis and Interpreting Results

Knowledge

1. Distinguishing measures of disease or exposure frequency which express incidence, cumulative risk, or prevalence.
2. An understanding of the relationship between incidence and cumulative risk when disease rates are constant.
3. The data needs and analytic methods for calculating standard epidemiological measures (e.g., prevalence, incidence, risk ratios, cumulative risk).
4. To distinguish variables from parameters and to identify the roles of variables and parameters in

data analysis models relating exposure to disease.

Skills

1. Managing a dataset, analyzing the data from it appropriately, interpreting the results, and presenting the whole analysis in a clear and coherent fashion.

3.E. Measurement

Knowledge

1. That measures can be identified to reflect the molecular, cellular, organ, total body, and external environment (physical, social, economic, political, and cultural) levels of organization.
2. The implications of random and systematic measurement error for study design, data collection, data interpretation and inference.
3. Indices for describing the amount, extent, and impact of disease. (e.g., incidence and prevalence, severity of symptoms, disability).
4. Measurement issues that arise from the nature of the case-definition (e.g., one based on an infectious agent rather than on the clinical manifestations).

3.F. Data Collection

Knowledge

1. Existing sources of data (e.g., NHANES, SEER) which can be used in epidemiological research, and understanding the database structure and how the data were collected.
2. The strengths and limitations of using existing databases, usually collected for multiple purposes, as contrasted to custom-designed data collection to answer a specific question
3. The logistical requirements for collecting original data, including type and quality of instrument design, its implementation, and the role for data management

Skills

1. Collecting original data that can be analyzed to test a hypothesis.

3.G. Bias, Random Error, Confounding, and Effect Modification

Knowledge

1. Random error, and methods for accounting for it in study design and analysis.
2. Selection bias and reporting bias, and how these biases may occur.
3. Design strategies for reducing the probability of bias in epidemiologic studies.
4. Methods for evaluating the possibility of bias in epidemiologic studies.
5. Confounding and effect modification, and the analytical approaches for assessing bias, confounding, and effect modification in epidemiologic studies.

Skills

1. Computing p-values and confidence intervals.
2. Evaluating confounding and interaction using multiple linear and logistic regression methods

3.H. Computer Packages in Data Analysis

Skill

1. Use of computer packages for data entry and data analysis, to include spreadsheets, SAS, SPSS, STATA, and Epi Info.

3.J. Data Management

Knowledge

1. Different types of data (qualitative and quantitative), the scale used to measure the data (nominal, ordinal, interval, and ratio scales), and how the scale used relates to data coding, data entry, and generating a codebook.
2. Standard practices for data coding, data entry, generating codebooks for an epidemiological dataset, data verification, cleaning, and editing.

4. SCIENTIFIC COMMUNICATION

Knowledge

1. The hierarchy of the quality of information: RCTs to personal opinion.
2. The style conventions of scientific writing and oral presentations.

Skills

1. Computer literacy, to include word processing, databasing, spreadsheets, graphics, the web, literature searching, and simple data analysis.
2. Critical reading: ability to read a scientific paper in epidemiology and accurately assess its strengths, weaknesses, and likely contribution to knowledge.
3. Writing a grant proposal in NIH format, to include a budget.
4. Making oral presentations.

5. EPIDEMIOLOGY IN PUBLIC HEALTH PRACTICE

Knowledge

1. The legal responsibilities, minimum public health program requirements, and accreditation standards for communicable disease surveillance and outbreak investigation.
2. The use and analysis of different surveillance systems.
3. Outbreak investigation: criteria for different pathogens (e.g. VPDs, zoonotic, STDs, food borne, etc) and the relative use of epidemiological, clinical, and laboratory information specific to each
4. Outbreak investigation: the use of immunizations and post-exposure prophylaxis.
5. Criteria for deciding whether a disease is suitable for screening
6. How the pathobiology of chronic diseases create different demands on surveillance or screening programs.
7. Attributes of community assessments, including sociodemographic characteristics, health resources, and risk profiles of individuals and communities.