



MEDTEC SCHOOL

Course: PUBLIC HEALTH AND ENVIRONMENTAL MEDICINE

Year: 4th

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Credits: 5

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Objectives

This course covers topics that are highly relevant to the area of public health, epidemiology, clinical epidemiology, preventive medicine, and global health. It aims at providing the conceptual bases of public health and epidemiological studies, as applied to the most common and impactful disease conditions in current societies. In parallel, it covers the area of occupational and environmental medicine, addressing the epidemiology of specific occupational diseases as well as primary prevention in the worksite and the living environment.

Prerequisites

Mathematics and Biostatistics.

General knowledge of pathology, immunology and microbiology, chemistry and organic chemistry.

Doctor - Patient Communication skills

Contents

Module A: Public Health and Clinical epidemiology (36 hours, 18 slots)

1. Describe the definition, basic concepts, and objectives of Epidemiology

- 1.1. Clinical epidemiology versus Epidemiology & Public Health
- 1.2. Natural history of diseases and its relevance to preventive strategies
- 1.3. Prognosis/prediction at the population and individual level
- 1.4. Causes and risk factors for diseases
- 1.5. Interventions of primary and secondary prevention
- 1.6. Providing the foundations for public health policies

2. The modern epidemiology “triangle”

- 2.1 Describe the interactions between external causes, social determinants of health, living environment and internal/metabolic and genetic factors.

3. Measures of disease frequency

- 3.1. Count the number of cases of disease and death, concepts, and examples
- 3.2. Prevalence: point prevalence and period prevalence.
- 3.3. Incidence
 - 3.3.1. Cumulative Incidence, survival proportion
 - 3.3.2. Incidence rate
- 3.4. Death: cumulative “incidence” of death and death rate
- 3.5. Definition of “rate” and person-years
- 3.6. Relationships between incidence, disease duration and prevalence.

4. Association and causation

- 4.1. Comparison between groups (e.g. Exposed vs. unexposed or Treatment vs. Placebo).
- 4.2. Quantification of the strength of an association between risk (or protective) factors and disease incidence or disease progression or death.
- 4.3. Two different scales: Multiplicative (ratio) and Additive (difference)
- 4.4. Definition of exposure

4.5. Bradford-Hill criteria

5. Measures of association

- 5.1. Absolute effects (differences in incidence rates, cumulative incidence, and prevalence)
- 5.2. Relative effects (ratios of these measures)
- 5.3. Multiplicative and additive scales
- 5.4. Incidence Rate Difference
- 5.5. Incidence Rate Ratio
- 5.6. Relative Risk
- 5.7. Odds Ratio

6. Type of epidemiological studies, observational and experimental.

Overview of study designs, principles of data analysis from different types of study, sources of error and bias. How to define a research question. Formulating hypotheses. Choosing the study design. Strengths & weaknesses of different types of epidemiological studies. Methods of exposure assessment.

6.1. Observational studies

6.1.1. Cohort studies

- 6.1.1.1. Study design
- 6.1.1.2. Prospective versus retrospective cohort studies
- 6.1.1.3. Exposure assessment
- 6.1.1.4. Endpoints/types of outcomes
- 6.1.1.5. Measures of association in cohort studies
- 6.1.1.6. Estimating risk in cohort studies
- 6.1.1.7. How to interpret the risk (relative risk, attributable risk)
- 6.1.1.8. Lost to follow-up

6.1.2. Case-control studies.

- 6.1.2.1. Definition of cases and controls
- 6.1.2.2. Exposure assessment, exposure with two or multiple categories.
- 6.1.2.3. Measures of Associations in Case-Control Studies
- 6.1.2.4. Calculating odds-ratios
- 6.1.2.5. Interpreting odds-ratios

6.1.3. Confounding, misclassification and bias in case-control and cohort studies

6.1.4 Other observational study designs (cross-sectional, case-series, ecological studies)

6.2. Experimental: Randomized Clinical Trials (RCTs).

Outline the study design of a trial. Describe the purpose of randomization and the use of blinding in intervention and clinical trials. Discuss the strengths and weaknesses of a given trial. Discuss strengths and limitations of intervention and clinical trials compared with those of observational studies.

- 6.2.1. Objectives
- 6.2.2. Concept of “equipoise”
- 6.2.3. Design
- 6.2.4. Participant selection
- 6.2.5. Study size
- 6.2.6. Randomization
- 6.2.7 Blinding
- 6.2.8. Unbiased data collection

- 6.2.9. Ethical considerations
- 6.2.10. Disease Endpoints
- 6.2.11. Data analysis
- 6.2.12. Publication and dissemination

7. Diagnostic accuracy.

- 7.1. Study design
- 7.2. Sensitivity and specificity.
- 7.3. Positive predictive values and negative predictive values, and their relationship to disease prevalence and exposure prevalence
- 7.4 Likelihood ratios and their use at the bedside
- 7.4. Receiver Operator Characteristics (ROC) curve and its interpretation

8. Confounding.

- 8.1. Define confounding in medical research
- 8.2. Illustrate how to identify a potential confounder
- 8.3. Illustrate how to control for a potential confounder in study design and data analyses
- 8.4. Describe the different types of confounding in relation to their effect on the relative/odds ratio estimate

9. Attributable risk and preventive strategies.

- 9.1. Types and purpose of measures of attributable risk
- 9.2. Relative and absolute measure of risk.
- 9.3. Calculation and interpretation of measures of attributable risk
- 9.4. Attributable risk among the exposed
- 9.5. Population attributable risk
- 9.6. Strategies for prevention. High-risk subgroup strategies and population wide strategies. Advantages and disadvantages. The “prevention paradox”.

10. Epidemiology of major diseases.

10.1 Ageing and multimorbidity

Discuss the ageing phenomenon, as well as major determinants of ageing-related diseases, including the occurrence of multiple chronic diseases, also known as multimorbidity.

10.2 Cancer

Present the major characteristics of the incidence of different cancers around the world, with reference to cancers of the lung, breast, colon and rectum, stomach, liver, cervix uteri, and nasopharynx.

Present and discuss the Major time trends of different cancers over the past 50 years.

10.3 Cardiovascular and metabolic diseases

Discuss the epidemiology of major cardiovascular and metabolic diseases, including coronary heart disease, cerebrovascular disease, hypertension, and type 2 diabetes.

10.4 Neurodegenerative diseases

Discuss the epidemiology of major neurodegenerative diseases, with special reference to Cognitive decline and Dementia and their interplay with other chronic disease.

10.5 Mental disorders

Discuss the concept of mental health continuum, as well as the epidemiology of major mental disorders, including depression and anxiety.



10.6 COVID pandemic world epidemiology

Global Epidemiology of COVID-19 and worldwide variations in Public Health responses.

11. Systematic reviews and meta-analyses.

Discuss the need for conducting systematic reviews and meta-analyses.

Define and explain the use of systematic reviews and meta-analysis.

Discuss practical problems and limitations of systematic reviews and meta-analyses

Interpret the findings presented in published systematic reviews and meta-analyses

Critically appraise published systematic reviews and meta-analysis

11.1. Data synthesis

11.2. Forest plot (interpretation)

11.3. Heterogeneity in meta-analyses results. Interpretation.

12. Global health: the worldwide epidemiological transition.

Describe the global burden and regional distributions of major diseases.

Discuss the burden of disease attributable to individual and combinations of major risk factors for chronic diseases, including social determinants of health.

Define and discuss the concept of the epidemiological transition.

12.1 Decline in age-specific mortality between 1970 and 2010 in the world.

12.2 Decline in under-five years of age mortality

12.3 Decline in adult and overall mortality

12.4 Measuring disease burden using health gap

12.5 DALY: Disability Adjusted Life Years. Definition and interpretation.

12.6 YLL: Years of Life Lost (due to premature death), definition and interpretation

12.7 YLD: Years Lived with Disability: Definition and interpretation

12.8 Leading causes of death worldwide

12.9 Leading causes of DALYs worldwide

12.10 Burden of disease attributable to specific risk factor



Module B: Occupational and Environmental Medicine (24 hours, 12 slots)

Occupational Medicine aims to prevent mortality, morbidity, and disability burden attributable to occupational risk factors exposure. Given that people spend most of their time at work, it is pivotal for any physician to know and understand the complex interplay between ‘workplace’ and ‘health’: how hazardous exposures at work can affect health, and vice versa, how health status can modify the individual work ability. Occupational Medicine is a multi-disciplinary branch of medicine that encompasses and integrates a broad range of disciplines, including epidemiology, general medicine, toxicology, industrial hygiene, and legislation.

The overarching aim of the Occupational Medicine module is to enable medical students to understand the basic principles of occupational medicine, risk assessment, health, and safety regulations to recognize and prevent the work-related public health burden.

The course of Occupational Medicine addresses the prevention and management of occupational and environmental injury, illness and disability, health promotion and productivity of workers, their families, and communities. Occupational and environmental medicine use similar skills and focus on the recognition and prevention of hazardous exposures in the workplace. The complex process of making a diagnosis of occupational disease will be also addressed. This will be done by furnishing theoretical and practical tools to the students, particularly by emphasizing the role of a detailed occupational history taking. Chemical, physical, biological, and psychosocial risks in the workplace will be introduced. Finally, some basics on “fitness for work” evaluation will be presented.

Learning goals of the Occupational Medicine Module:

- To know the basis and methodology of Occupational Medicine
- Searching for the role of occupational exposure in promoting diseases and disability
- How to make the occupational history-taking
- How to suspect and recognize the most common occupational diseases.
- How to evaluate the fitness for work and return to work after acute diseases or injuries and with chronic diseases

1. Introduction and history of Occupational Medicine

2. The WHO healthy workplace model

2.1 The comprehensive way of thinking and acting that addresses work-related physical and psychosocial risks, promotion and support of healthy behaviours, and broader social and environmental determinants.

2.2 The Total Worker Health model by NIOSH

3. The global burden of work-related accidents and occupational diseases.

3.1 Fatal work-related diseases in WHO regions (High-income countries and Low and middle-income countries)

3.2 Using epidemiological data for estimating the burden of occupational disease

4. Risks and hazards in the workplace; documenting and quantifying occupational and environmental exposures.

4.1 Definition of hazard and risk

4.2 Risk assessment in the workplace

4.3 Environmental monitoring

4.4 Biological monitoring

4.5 Threshold Limit Values in Occupational Environment (TLV)

5. Methodological approach to occupational/environmental diseases

- 5.1 Clinical presentation of occupational disease and occupational and environmental history taking.
- 5.2 Immediate or short-term effects of occupational/environmental exposure
- 5.3 Latent or long-term effects of occupational/environmental exposure
- 5.4 The Occupational and environmental history
- 5.5 The temporal relationship between symptoms and exposure
- 5.6 The Hierarchy of Occupational Exposure Assessment

6. New technologies and Artificial Intelligence in Occupational Medicine

- 6.1 New devices for monitoring cardiovascular and respiratory parameters during working activity
- 6.2 New devices for protecting from hazardous agents, musculoskeletal overload, safety injuries: the role of exoskeleton in working place
- 6.3 Artificial Intelligence and syncope at work.

7. Research methods on Occupational Medicine: from laboratory to occupational epidemiology

- 7.1. GRADE Guidance: the GRADE evidence-to-decision framework for environmental and occupational health
- 7.2. The role of occupational epidemiology: examples from back pain, silica exposure, migrants, older workers, and occupational cancer.
- 7.3. The autonomic nervous system as a link between environmental/occupational stimuli and health. New challenges on cardiovascular monitoring in the workplace

8. Making a causal connection between exposure and illness.

- 8.1 The Hill's criteria for recognition and compensation of occupational diseases.
- 8.2 How to demonstrate a causal association in single cases.

9. Occupational risks assessment in a real workplace: The “Cement Plant Model”.

- 9.1 Presentation of Cement plant production cycle
- 9.2 Video recordings of some working tasks in a cement plant, analysis of the videos by the students and discussion with the teacher.
 - 9.2.1 Noise
 - 9.2.2 Vibrations: total body and hand-arm.
 - 9.2.3 Microclimate
 - 9.2.4 Physical stress
 - 9.2.7 Gas, vapours, and powder exposure including quartz.
 - 9.2.8 Shift work with night work
 - 9.2.9 Manual handling
 - 9.2.10 Video-terminal long-term activity
 - 9.2.11 Hazardous jobs

10. Occupational Infections

- 10.1 Human to Human: blood-borne viruses and tuberculosis



- 10.2 Sars-Cov2 and COVID-19 in workplace, health care setting and others.
- 10.3 Animal to Human: the more common occupational zoonosis
- 10.4 Travel-associated infectious diseases
- 10.5 Vaccines and other prophylaxis in workers

11. Occupational Medicine through clinical cases

- 11.1. Upper respiratory tract disorders: COPD and occupational asthma.
- 11.2. Occupational lung diseases: silicosis, asbestosis, hard metal lung disease, rare new cases.
- 11.3 Occupational Skin Disorders: a case of contact allergic dermatitis.

12. Occupational Toxicology and chemical risks

- 12.1 Basic Principles of Toxicology (Video presentation)
- 12.2 Biologically based exposure assessment for epidemiology (exposure-dose and dose-effect relationships)
- 12.3 Static and dynamic models in occupational toxicology
- 12.3 Toxic-kinetic and Toxic-dynamic, Toxicity levels (NOAEL, LOAEL, LD50)
- 12.7 Metals, Solvents, Pesticides

13. Noise and vibration diseases

- 13.1 Noise-induced acoustic damages
- 13.2 Occupational hearing loss diagnosis
- 13.3 Extra-auditory effects of noise
- 13.4 Other causes of hearing loss in adults and differential diagnosis.
- 13.5 Hand-arm vibration diseases
- 13.6 Whole-body vibration diseases

14. Occupational Musculoskeletal diseases

- 14.1 Introduction to occupational back pain
- 14.2 Occupational shoulder, elbow, and hand injuries
- 14.3 Lower extremities Injuries

15. Microclimate in the workplace: effects on health and performance

- 15.1 Indoor microclimate and cognitive performance: an experimental study using new technologies for recording and data analysis.
- 15.2 Introduction to extreme environment: hot and cold

16. Autonomic Nervous System (ANS) and Work-related stress

- 16.1 ANS and air pollution
- 16.3 Work stress and psychological risk factors
- 16.4 Shift work and night work

18. Regulation, Medical and Disease Surveillance

- 18.1 Risk assessment and risk management
- 18.2 Regulation on Occupational Medicine
- 18.3 European Directives
- 18.4 Goals of regulation: insurance, compensation, epidemiology, medical-legal



Teaching Methods

1. Frontal lectures
2. Clinical Case discussion
3. Video reproducing and interactive discussion
5. Group-work activities with short presentations by the students during the course that will be a part of the final evaluation.

Groups of 4-5 students will address the following tasks:

1. Critical appraisal of a scientific article and discussion of the public health and/or occupational health implications. Evaluation score 0-3
2. Occupational interview (occupational history taking) in hospital wards. Evaluation score 0-3

The results of the above activities will be presented by the single team to the other students and teachers.

Students are encouraged to actively participate in the lectures with questions and comments.

Attendance policy

Attendance in presence of at least 75% of the lessons of each module is mandatory to have access to the final evaluation.

The students should attend in presence to at least 75% of the scheduled activities.

Attendance in presence at the lessons will be certified and verified using the system provided by Humanitas University.

During the lectures, the teachers may double-check the actual presence of the students who signed in the system, in case of absence of a student who is registered as present, they will be referred to the Counsellor.

The students who for any reason, including health issues, will not be able to attend at least 75% of the lessons, will be required to complete additional assignments to be admitted to the final exam. The nature of the additional assignments will be at the discretion of the teachers.

Assessment

Final Evaluation

The individual final evaluation grade will be computed as the sum of the grades for the individual exam result and the one for the group activities, as follows.

Exam:

The exam will be planned according to the academic calendar. It will consist of a test composed of 27 multiple-choice questions:

1. Epidemiology and Public Health 18 questions, threshold to pass 9/18.
2. Occupational and Environmental Health 9 question, threshold to pass 5/9

Evaluation score 0-27

Group activities (as described above in teaching methods):

Evaluation score 0-6

If the sum of the scores is ≤ 29 , the sum of the scores will constitute the final grade.

If the sum of the scores is 30 or 31: the final grade will be 30/30.

If the sum of the scores is ≥ 32 : the final grade will be 30/30 with Laude.



Textbooks

Module A: Public Health and clinical epidemiology:

1. Epidemiology, Leon Gordis, 6th Edition, Elsevier, 2018
2. Users' Guides to the Medical Literature: A Manual for Evidence-Based Clinical Practice, 3rd ed

Module B: Occupational Medicine:

3. Lange Medical book, 6th Edition, 2021,
Edited by J LaDou and Robert J Harrison ISBN 978-1-26-014344-7
<http://www.langetextbooks.com/0071808159.php?c=home>
4. Fitness for Work Edited by John Hobson, Julia Smedley; Publisher: Oxford University Press
2019, English. EAN: 9780198808657
5. Psychosocial Occupational Health; Joannes Siegrist and Jian Li; Oxford University Press, 2024
https://r.search.yahoo.com/_ylt=AwrkLjO2Ke1mA2kSUKzc5oIQ;_ylu=Y29sbwNpcjIEcG9zAzIEdnRpZAMEc2VjA3Ny/RV=2/RE=1726847542/RO=10/RU=https%3a%2f%2facademic.oup.com%2fbook%2f55896/RK=2/RS=ekxCGKIHxzoldimWNV5Zn16qbio-
6. Current Topics in Occupational Epidemiology, Katherine M. Venables, 1st Edition, 2013, Oxford University Press

Additional targeted readings and relevant background references will be distributed during the course.