



## **PUBLIC HEALTH AND ENVIRONMENTAL MEDICINE 2022-2023**

Faculty: Elio Riboli, Saverio Stranges, Franca Barbic, Elena Vanni

Guest lecturers on Occupational Medicine: Giovanni Ferri (Università degli Studi di Bari) and Pierluigi Cocco (Imperial College, London).

Course Coordinator: Elio Riboli

Credits: 12

### **Overview of the course**

This course covers several topics that are highly relevant to the area of public and global health, disease.

Epidemiology and prevention. It aims at providing the conceptual bases of population public health and the bases to understand the design and methods of epidemiological investigations. 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. The course includes an introduction to health economics.

### **Textbooks in Epidemiology:**

- Epidemiology, Leon Gordis, 6th Edition, Elsevier, 2018
- Current Topics in Occupational Epidemiology, Katherine M. Venables, 1<sup>st</sup> Edition, 2013, Oxford University Press

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

### **Module Public Health**

1. Describe Definition, basic concepts, and objectives of Epidemiology, particularly with reference to:

1.1. Clinical Medicine versus Epidemiology & Public Health

1.2. Health-related phenomena,

1.3. Natural history of diseases,

1.4. Prognosis/prediction at the population and patient level

1.5. Causes and risk factors for diseases,

1.6. Interventions both preventive and therapeutic,

1.7. Providing the foundations for public health policy

2. The modern epidemiology “triangle”

- Describe the interactions between external causes, living environment with internal/metabolic and genetic factors.



### 3. Measures of disease frequency

- Illustrate the concepts and use of different measures of disease frequency.
- Present the definition and calculation of the appropriate measures of disease frequency and their interpretation.
- Discuss the distinction between the concepts of incidence and prevalence as well as their relationship with disease duration.
- Discuss the meaning and the use of person-time for the calculation of incidence rates.

In particular:

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 (disease ending by cure or death or becoming lifelong chronic) and prevalence.

### 4. Association and causation

- Illustrate the concepts of association and of causation in the context of epidemiological research. In particular:

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 factors (causal and protective) and disease risk 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

- Discuss Differences between measures of frequency and measures of association.
- Calculate appropriate measures of disease frequency and association, and interpretation of the findings.
- Distinguish the concepts of incidence and prevalence as well as their relationship.



- Calculate person-time based on a given set of data and use these data to calculate appropriate measures of disease frequency and association.

Student should be familiar with the concepts and simple mathematical representation of:

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. Strengths & weaknesses of different types of epidemiological studies. Methods of exposure assessment.

6.1. Observational

6.1.1. Cohort studies

- Describe the design and the features of cohort studies.
- Illustrate the methodological issues in defining a cohort.
- Be able to choose and calculate the appropriate measures of association.
- Illustrate the strengths and weaknesses of cohort studies.

With specific reference to:

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. Measure 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.



- Describe design features of case-control studies
  - Illustrate the methodological issues in selecting the case and control groups.
  - Choose and calculate appropriate measures of association.
  - Illustrate strengths and weaknesses of 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
- 6.2. Experimental: Randomized Clinical Trials.
- Outline the study design of a trial.
  - Describe the purpose of randomization and the use of blinding in intervention and clinical trials.
  - Discuss strengths and weaknesses of a given trial.
  - Discuss strengths and limitations of intervention and clinical trials compared with those of observational studies.

Key aspects of RCT:

- 6.2.1. Prospective
- 6.2.2. Impact.
- 6.2.3. Objectives.
- 6.2.4. Design
- 6.2.5. Participant selection
- 6.2.6. Study size
- 6.2.7. Unbiased data collection
- 6.2.8. Ethical considerations
- 6.2.9. Disease Endpoints
- 6.2.10. Data analysis
- 6.2.11. Publication and dissemination
- 6.2.12. Concept of “equipoise”



### 6.3. Hierarchy of Evidence from different epidemiological (observational and experimental) studies

#### 7. Sensitivity and specificity.

- Present and discuss the type of measurement error and misclassification in exposure and clinical assessments.

- Define false positive, false negative, true positive and true negative.

##### 7.1. The diagnostic test metrics.

##### 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. Receiver Operator Characteristics (ROC) curve and its interpretation

#### 8. Confounding.

The student should be able to:

##### 8.1. Define confounding in medical research.

##### 8.2. Present the conditions for an external variable to be a confounder in a given study.

##### 8.3. Illustrate the “causal definition” of a confounder.

##### 8.4. Illustrate how to identify a potential confounder.

##### 8.5. Illustrate how to control a potential confounder in study design and data analyses.

##### 8.6. Describe the different types of confounding in relation to their effect on the relative/odds ratio estimate.

#### 9. Attributable risk and disease prevention.

- Define, calculate, and interpret the measures of attributable risk.

- Define the differences between relative and absolute measures of risk.

- Present and discuss the "prevention paradox".

With specific reference to:

##### 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 sub-group strategies and population wide strategies. Advantages and disadvantages. The “prevention paradox”.

10. Epidemiology of chronic diseases.

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.

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

Neurodegenerative diseases

- Discuss the Epidemiology of neurodegenerative diseases, with special reference to Cognitive decline,

Dementia and Parkinson disease

Cardiovascular and metabolic diseases

- Discuss the Epidemiology of cardiovascular diseases, including coronary heart disease, cerebrovascular disease, hypertension, and type 2 diabetes.

Mental disorders

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

Chronic kidney diseases

- Discuss the Epidemiology of major chronic kidney disease, as well as their interplay with other chronic conditions.

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

With reference to:



- Limitation of a single study
- Characteristics of a systematic review: design, protocol, study selection criteria, data analyses methods.
- Assessing biases in each study
- Attrition bias. Definition.
- Publication bias. Definition.
- Selection bias.

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 chronic diseases, in comparison to communicable diseases and injuries.
- 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 and its impact on the burden of chronic diseases.

With specific reference to

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

**Evaluation of Public Health, Epidemiology and Global Health:** 20 multiple choice questions as a part of the final exam.



## Module of Occupational Medicine

### Overview:

Occupational Medicine is an important component of Public Health aimed 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 our health, and vice versa, how our health status can modify our work ability. Occupational Medicine is a multi-disciplinary branch of Medicine that encompasses and integrates a broad range of disciplines, including general medicine, toxicology, industrial hygiene, and legislation.

The overarching aim of the Occupational Medicine module is to enable the medical students to understand the basic principles of occupational medicine, risk assessment, and 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, and promotion of health 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. The complex process of making a diagnosis of occupational disease will also be 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 addressed starting from Clinical Case Reports presentation and by interactive discussion with the students. Finally, the "fitness for work" will also be addressed by using an advanced system of health monitoring that optimizes the time in which ill or injured workers can safely return to work. The original clinical model pointed out by our research group on the return to work after syncope will be proposed.

"Working in groups activities" as described below and videos recording during real jobs activities in workplace will be proposed.

### Learning goals of Occupational Medicine Module:

- To know the basis and methodology of occupational medicine
- How to suspect a potential role of occupational risk exposure in promoting the disease
- How to make an occupational interview
- To search for the causality relationships between occupational exposure and disease
- To approach clinical cases of occupational respiratory disease, cancer, skin disease, hepatic disease, Hematological disease, neurological disease.
- To evaluate the effects of occupational risk exposure
- To evaluate the fitness for work after acute or chronic diseases
- To build a research project starting from a question coming from workplace





*Teaching methods:*

1. Frontal lectures
2. Clinical Case discussion
3. Video reproducing and interactive discussion
4. Multidisciplinary lessons with other specialists and experts
5. Working in groups activities with short presentations by the students during the course

**Textbooks suggested:**

1. LaDou, Joseph; Harrison, Robert. **CURRENT Diagnosis & Treatment Occupational & Environmental Medicine, 6th Edition**. McGraw Hill LLC. Edizione del Kindle. Lange Medical book, 6th Edition, 2021

ISBN 978-1-26-014344-7

<http://www.langetextbooks.com/0071808159.php?c=home>

2. Fitness for Work Edited by John Hobson, Julia Smedley; Publisher: Oxford University Press 2019, English.

EAN: 9780198808657

TOPICS

**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 behaviors, broader social and environmental determinants.

**3. The global burden of work-related accidents and illness.**

3.1 Global estimates of occupational accidents and work-related illnesses

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

**4. The methodological approaches to occupational diseases**

4.1 Clinical presentation of occupational disease and the occupational and environmental history taking.

4.2 Immediate or short-term effects of occupational/environmental exposure

4.3 Latent or long-term effects of occupational/environmental exposure

4.4 The Occupational and environmental history

4.5 The temporal relationship between symptoms and exposure



4.6 The Hierarchy of Occupational Exposure Assessment

**5. Documenting and quantifying occupational and environmental exposures.**

5.1 Measure the exposure to assess the level of risk and/or relationship to any symptoms.

5.2 Environmental monitoring

5.3 Biological monitoring

**6. Making a causal connection between exposure and illness.**

6.1 The Hill's criteria used for recognition and compensation of occupational diseases.

6.2 How to demonstrate a causal association.

6.3 Research methods on Occupational Medicine

**7. Migration & Occupational Health**

**8. Occupational Infections**

8.1 Human to Human (blood-borne viruses HBV, HCV, HIV)

8.2 Human to Human (Tuberculosis)

8.2 Occupational Infection by Sars-Cov2 and COVID19. This topic will be addressed by a multidisciplinary approach with the contribution of Microbiologist and Infectious disease specialist.

8.3 Occupational Infection Animals to Human (Zoonosis) This topic will be addressed by a multidisciplinary approach with the contribution of Microbiologist and Infectious disease specialist.

8.4 Travel- associated infectious diseases.

**9. How to identify occupational risks 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 Cement Plant, analysis of the videos by the students and discussion with the teacher.

9.2.1 Noise, auditory and extra-auditory effects

9.2.2 Vibrations. Total body and hand-arm.

9.2.3 Microclimate

9.2.4 Physical stress.

9.2.7 Gas, vapors, and powder exposure including quartz.

9.2.8 Shift work with night work.



9.2.9 Manual handling

9.2.10 Video-terminal activity

9.2.11 Hazardous jobs

**10. Sars-Cov2 infection and Covid19 in workplace:** multidisciplinary lesson with pathologist and infection disease teachers.

### **11. Occupational Medicine through clinical cases**

11.1. Upper respiratory tract disorders: COPD and occupational asthma.

11.2. Occupational lung diseases: lung fibrosis due to hard metal exposure, silicosis and silico-tuberculosis, asbestosis.

11.3. Occupational lung diseases: rare cases.

11.5. Occupational cancer: lung cancer, haematopoietic cancer, bladder cancer, hepatic cancer.

11.6 Occupational Skin Disorders: a case of contact allergic dermatitis. This topic will be addressed with the contribution of Clinical Dermatologist.

11.7 Occupational cardiovascular diseases: how to manage a case of myocardial infarction in workplace.

### **12. Occupational Toxicology and chemical risks**

12.1 Basic Principles of Toxicology

12.3 Toxic-kinetic and Toxic-dynamic, Toxicity levels (NOAEL, LOAEL, LD50)

12.4 Threshold Limit Values in Occupational Environment (TLV)

12.5 Dose-response curve for non-carcinogen and for carcinogen

12.6 Environmental monitoring, Biological Monitoring, Health Surveillance

12.7 Metals, Solvents, Pesticides

### **13. Noise and vibration**

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 Occupational Back pain

14.2 Shoulder, Elbow, and Hand Injuries

14.3 Lower Extremities Injuries

**15. Microclimate in workplace.**

15.1 Moderate Environment

15.2 Extreme Environment: Hot and Cold

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

16.1 Cardiovascular autonomic profile and working activity.

16.2 Work stress and psychological risk factors

16.3 Shift work and night work

**17. Fitness for work**

17.1 The model of reflex syncope

17.2 Cardiovascular autonomic diseases and work ability

17.3 Drugs and alcohol in the workplace

**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

**Working in groups activities will be started in the second part of the course.**

Groups of 12-15 students coming from different countries will be created to address the three following tasks, each task will be accomplished by 4-5 students of the group.

1. Occupational diseases prevalence in different countries.

The students will be asked to search on the most common current occupational disease in their country or in 2-3 Italian regions. The results will be presented by the students in charge (Power Point Presentation 5').

2. Occupational interview in the hospital wards.

The students in charge will be asked to identify one patient admitted in Hospital wards (Cancer Center: Internal Medicine Center, Cardio Center, and Neuro Center), collect the occupational history by using the tools furnished in the first part of the course and ought to make consideration about the



potential role of their working activity/exposure in promoting the actual disease. The results will be presented by the students in charge (Power Point Presentation 5’).

### 3. Update from scientific literature on Occupational Medicine.

Each group of students will choose one article recently published on the main issues addressed during the course.

They ought to read it critically, summarize background, methods, and results, consider novelty, make questions, and provide their opinion about the article (argument, clarity, methodology, etc.). The results will be presented by the students in charge (Power Point Presentation 5’).

#### **Evaluation of Occupational Medicine:**

The working in group activity will provide a final score that will represent 30% of the final evaluation on Occupational Medicine (0-3 for each component of the group). The other 70% will be evaluated for each student by the multiple-choice questions, i.e., by 7 multiple-choice questions as a part of the final exam.

The students are invited to prepare for the exam by using also the textbook suggested (LaDou, Joseph; Harrison, Robert. **CURRENT Diagnosis & Treatment Occupational & Environmental Medicine, 6th Edition** (Current Occupational and Environmental Medicine) (p.i). McGraw Hill LLC. Lange Medical book, 6th Edition, 2021.

Section I: Chapters **1,2,3** (Role of the Physician),4,5.

Section II: Chapters **7,8,9,13** (Cold, Heat, Nonionizing radiation, Ionizing radiation; atmospheric pressure disorders; Vibrations).

Section III: Chapters **14, 15** (Occupational Lung Diseases Caused by Inflammation Activation; Classification of immune hypersensitivity disorders), **16,17,18** (OCCUPATIONAL & ENVIRONMENTAL CONDITIONS OF THE UPPER AIRWAY, Occupational & Environmental Allergic Rhinitis; Occupational & Environmental Irritant Rhinitis; Sinonasal Cancer; Laryngeal Pathology), **19** (Introduction; Occupational Asthma; Hypersensitivity pneumonitis; Inhalation fever; metal induced lung diseases), **20** (CARDIOVASCULAR ABNORMALITIES CAUSED BY CARBON MONOXIDE; CARDIOVASCULAR ORGANIC NITRATES; SOLVENTS & CHLOROFLUOROCARBONS; ORGANOPHOSPHATE & CARBAMATE INSECTICIDES; HEAVY METALS; PARTICULATE MATTER), **21,22** (ACUTE and CHRONIC OCCUPATIONAL KIDNEY DISEASES). **23, 24, 25, 26** (USES OF GENETIC TOXICOLOGY IN OCCUPATIONAL AND ENVIRONMENTAL MEDICINE).

Section V: Chapters **34,35,36,37,38, 40** (EVALUATION OF HEALTH HAZARDS IN THE WORKPLACE), **41** (POPULATION-BASED OCCUPATIONAL DISEASE SURVEILLANCE), 43 (Biological monitoring), 44 (CBRNE Introduction)

Section VI: Chapters **49** Climate change and worker health; **53** Building related illnesses; **54** Multiple chemical sensitivity syndromes.

#### **Module Applied Economics in Public Health**

Funding, running, and managing a company in the health care sector.



The aim of the course is to give you the basics to understand the life of a company. :

Starting a company

How can it survive?

How can it be successful?

How can an employee or a consultant contribute to the success or wellbeing of the company?

1. The founding of a company and the role of the stakeholders.
2. The economic life of a company
3. Running the company: the management team, revenues and costs
4. The management system
5. The active role of a physician in managing a company
6. During this course we will explore the instruments of measuring the economic performance of a company in general and of a hospital.
7. A hospital in fact is a company with the specific objective of delivering health care

**Evaluation of Applied Economics in Public Health:** 3 multiple choice questions.

## **Final Assessment score 0-33**

The final exam will be composed of 30 multiple choice questions (#20 on Public Health, Epidemiology and Global Health, #7 on Occupational Medicine and #3 on Applied Economics). The final score will be obtained by adding 0-3 points from working in group activity on Occupational Medicine.

30-31 will correspond to 30/30

32-33 will correspond to 30/30 cum laude.