



## MEDICINE AND SURGERY

**Course: PUBLIC HEALTH AND ENVIRONMENTAL MEDICINE**

**Year (1<sup>st</sup>-2<sup>nd</sup>-3<sup>rd</sup>-4<sup>th</sup>-5<sup>th</sup>-6<sup>th</sup>): 4<sup>th</sup>**

**Period (1<sup>st</sup>-2<sup>nd</sup> semester – annual): 2<sup>nd</sup> semester**

**Credits: 12**

### Objectives

This course covers a number of topics that are highly relevant to the area of global public health, epidemiology and prevention, with a focus on major chronic and infectious disease. It aims at providing the conceptual bases of population health including 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.

### Contents

#### 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 life-long 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, 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

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. End-points/types of outcome

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 randomisation 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 value and their relationship to disease prevalence and exposure prevalence

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

#### **8. Confounding.**

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 for 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 particular 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.

## **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 particular 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

## **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 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 on 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 work-place 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 exposure of the disease
- How to make an occupational interview
- To search the causality relationship between occupational exposure and disease
- To approach a clinical case of occupational respiratory disease, cancer, skin disease, hepatic disease, hematological disease, neurological disease.
- To evaluate the effects of physical risk exposure
- To evaluate the fitness for work after cardiovascular disease
- 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. Working in groups activities with short presentations by the students during the course

**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**

7.1 Distribution of migrant workers around the world

7.2 Refugees

7.3 Trafficked Workers

7.4 Occupational Health Disparities

**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 address 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 address 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 working tasks presentation, analysis of the videos by the students ("working in group") and discussion with the teacher.

9.2.1 Noise

9.2.2 Vibrations

9.2.3 Microclimate

9.2.4 Physical stress.

9.2.5 Electromagnetic fields.

9.2.6 Artificial optical radiation.

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

9.2.12 Work-related stress.



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

- 10.1. Upper respiratory tract disorders: COPD and occupational asthma.
- 10.2. Occupational lung diseases: lung fibrosis due to the hard metal exposure.
- 10.3. Occupational lung diseases: silicosis and silico-tuberculosis, asbestosis.
- 10.4. Occupational lung diseases: rare cases.
- 10.5. Occupational cancer: mesothelioma, leukaemia, bladder cancer, hepatocarcinoma.
- 10.6 Occupational Skin Disorders: a case of contact allergic dermatitis. *This topic will be addressed with the contribution of Clinical Dermatologist.*
- 10.7 Occupational cardiovascular diseases: how to manage a case of myocardial infarction in workplace.

## **11. Occupational Toxicology**

- 11.1 Basic Principles of Toxicology (Video presentation)
- 11.2 Toxicology General (Video presentation)
- 11.3 Interactive discussion on videos contents
- 11.4 Selected occupational activities and potential toxic exposure.
- 11.4 Toxicokinetic and Toxicodynamic, Toxicity levels (NOAEL, LOAEL, LD50)
- 11.5 Threshold Limit Values in Occupational Environment (TLV)
- 11.6 Dose-response curve for non-carcinogen and for carcinogen
- 11.7 Environmental monitoring, Biological Monitoring, Health Surveillance
- 11.8 Metals, Solvents, Pesticides

## **12. Noise and vibration**

- 12.1 Noise-induced acoustic damages
- 12.2 Occupational hearing loss diagnosis
- 12.3 Extra-auditive effects of noise
- 12.4 Other causes of hearing loss in adults and differential diagnosis.
- 12.5 Hand-arm vibration diseases
- 12.6 Whole-body vibration diseases

## **13. Occupational Musculoskeletal diseases**

- 13.1 Occupational Back pain
- 13.2 Shoulder, Elbow, and Hand Injuries
- 13.3 Lower Extremities Injuries

## **14. Microclimate in workplace.**

- 14.1 Moderate Environment
- 14.2 Extreme Environment: Hot and Cold

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

- 15.1 Cardiovascular autonomic profile and working activity
- 15.2 ANS and air pollution
- 15.3 Work stress and psychological risk factors
- 15.4 Shift work and night work

## **16. Fitness for work**

- 16.1 The model of reflex syncope



16.2 Cardiovascular autonomic diseases and work ability

16.3 Drugs and alcohol in the workplace

16.4 Health and transport safety: fitness to drive.

### **17. Regulation, Medical and Disease Surveillance**

17.1 Risk assessment and risk management

17.2 Regulation on Occupational Medicine

17.3 European Directives

17.4 Goals of regulation: insurance, compensation, epidemiology, medica-legal

## **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 stake-holders

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 economical performance of a company in general and of a hospital in particular

7. A hospital in fact is a company with the specific objective of delivering health care

## **Teaching Methods**

### **Lectures**

### **Module Occupational medicine**

#### **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:

1. *Occupational diseases prevalence in different countries.*

The students will be asked to search on the most common occupational disease in their country or Italian region. The results will be summarized by one student for each group (Power Point Presentation 3 slides) starting from the second part of the course.

2. *Occupational interview in the hospital wards.*

Each group of students 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 from one patient and ought to make consideration about the potential role of their working activity/exposure in promoting the actual disease.

3. *Up-date from scientific literature on Occupational Medicine.*



Each group of students will receive one paper recently published on main issues addressed during the course. They ought read it critically, summarize background, methods, and results, consider novelty, make questions and provide their opinion about the article (argument, clarity, methodology, etc..). One student for each group will present the results to the class. 15' student group presentation and interactive discussion with the teacher

### **Verification of learning**

The exam will include 33 multiple choice questions, covering the topics presented and discussed during the course. There will be four possible choices per question, with one correct answer. The general rules for marking are: up to 30 corrected answers (out of 33) will correspond to a note ranging from 0 to 30, 33 corrected answers will correspond to 30 *cum laude*

### **Texts**

Module Public Health

Recommended textbook

📖 Epidemiology, Leon Gordis, 6th Edition, Elsevier, 2018

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

### **Occupational medicine textbooks:**

1. Lange Medical book, 5th Edition, 2015,

Edited by J LaDou and Robert J Harrison

<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 12