UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Microbiology and Clinical Microbiology

2627-1-I0104D005-I0104D00502

Aims

Clinical microbiology is a fundamental discipline within healthcare education, as it provides the essential basis for understanding pathogenic microorganisms, their modes of transmission, their interactions with the human body, and the related diagnostic, therapeutic, and preventive implications. For nursing and midwifery professions, knowledge of clinical microbiology is a key element to ensure patient safety, prevent healthcare-associated infections, and actively participate in infection surveillance and control strategies.
This course aims to provide an updated and practical overview of clinical microbiology, using a competence-based teaching approach that integrates theory and practice, in line with the professional needs of students enrolled in Nursing and Midwifery degree programs

Course Objectives
The main objectives of the Clinical Microbiology course for Nursing and Midwifery students are as follows:
a) Provide fundamental knowledge about clinically relevant microorganisms
The course aims to develop solid and up-to-date knowledge of the general and specific characteristics of bacteria, viruses, fungi, and parasites, with a particular focus on microorganisms involved in nosocomial, neonatal, and obstetric infections.
b) Understand the mechanisms of microbial pathogenicity
Students will gain skills in the pathophysiology of infections, understanding how microorganisms interact with the immune system and the mechanisms they use to colonize, invade, and damage the host.
c) Introduce the main microbiological diagnostic techniques
The course will present laboratory techniques for microorganism identification, including basic principles of antibiograms, molecular diagnostics, and microbiological surveillance.
d) Highlight the role of nurses and midwives in infection prevention and management
Through the analysis of clinical cases and care scenarios, the central role of healthcare professionals will be explored in preventing healthcare-associated infections, correctly using personal protective equipment, promoting sanitation, and educating patients.
e) Promote a culture of safety and antimicrobial resistance awareness
The course aims to raise awareness among students about the growing emergency of antibiotic resistance and the appropriate use of antibiotics, with reference to national and international guidelines.

Knowledge and Understanding
By the end of the course, students should have acquired a clear and solid theoretical understanding of the fundamentals of clinical microbiology. In particular, they should be able to:

- Describe the structure and classification of major microorganisms (bacteria, viruses, fungi, and parasites);
- Understand the mechanisms of replication, transmission, and pathogenicity of microorganisms;
- Recognize major infections caused by clinically relevant pathogens;
- Describe microbiological identification methods and criteria for infection diagnosis;
- Understand the basic principles of epidemiology in hospital and community infections;
- Distinguish different types of antibiotic resistance and strategies to limit their spread.
  Understanding will be supported by a clear and progressive presentation of concepts, with frequent references to real clinical cases and care scenarios.

Ability to Apply Knowledge and Understanding
A key educational goal for healthcare professions is not only to know but to apply knowledge in clinical and care settings. At the end of the course, students will be able to:

- Identify at-risk behaviors in patient care that may lead to infection transmission;
- Apply infection prevention measures (hand hygiene, PPE management, environmental sanitation, isolation procedures);
- Collaborate with microbiology laboratories in the collection, preservation, and transportation of biological samples;
- Recognize clinical signs and symptoms of infection, with particular attention to surgical site, urinary, respiratory, and genital tract infections;
- Support patient and family education on hygiene and prevention practices;
- Participate in infection surveillance programs related to healthcare.
  Through simulations, classroom exercises, and case discussions, students will be expected to apply what they have learned, developing skills useful from the earliest internships.

Autonomy of Judgment
A transversal objective of the course is to promote the development of critical judgment, which is essential for making informed and safe decisions in daily clinical practice. Students will be encouraged to:

- Critically evaluate scientific sources in the field of microbiology;
- Recognize the importance of microbiology in defining the diagnostic-therapeutic pathway of the patient;
- Understand the limits of their competencies and know when to consult with other professionals (physicians, microbiologists, pharmacists);
- Recognize early signs of infection and assess appropriate responses;
- Reflect on the effectiveness of adopted preventive measures and suggest evidence-based improvements.
  Autonomy of judgment will be stimulated through open-ended questions, small-group exercises, and guided discussions.

Learning Skills

Finally, the course aims to develop in students a strong capacity for independent learning, which is essential for keeping pace with the ongoing evolution of knowledge in microbiology and healthcare. Students will acquire tools to:

- Study autonomously and effectively using teaching materials, textbooks, scientific articles, and online resources;
- Stay updated on topics related to infections, antimicrobial resistance, and prevention protocols;
- Develop a critical and reflective attitude toward care practices;
- Participate in training events, refresher courses, and continuing professional development activities.
  Learning skills will be supported through self-assessment opportunities, tutoring, bibliographic guidance, and recommendations for the critical reading of scientific sources.

Contents

Diagnosis of microbial infections: specimen collection, direct and indirect clinical diagnosis. Bacterial and viral infections of the respiratory system: streptococcal angina, influenza virus, bacterial and viral pneumonia. Urinary tract infections: cystitis and pyelonephritis. Reproductive diseases: syphilis, gonorrhea, non-gonococcal urethritis, HPV and Herpes. Bacterial and viral infections of the central nervous system: bacterial and viral meningitis, polio, viral encephalitis. Diseases of the gastrointestinal (staphylococcal intoxication, salmonella, E. coli gastroenteritis, pseudomembranous colitis caused by Clostridium Difficile, Helicobacter and peptic ulcers, viral infections (hepatitis, viral gastroenteritis). Microbial infections of the skin and eyes: Bacteria (staphylococcus, streptococcus, pseudomonas), viruses (HPV, herpes virus), fungi (Candida). Sepsis (some examples).

Detailed program

Introduction to Clinical Microbiology: the birth of microbiology as a science, the discovery of microorganisms and antibiotics.
Role of microorganisms in human life: symbiotic, saprophytic, opportunistic, and pathogenic microorganisms. The significance of the human microbiota and its alterations as a cause of disease.
Classification of microorganisms: bacteria, viruses, fungi, and parasitic protozoa.
Overview of bacterial cell morphology and metabolism. Classification of bacteria and major bacterial groups relevant to human health (Staphylococci, Streptococci, Anaerobes, Enterobacteriaceae, Pseudomonadaceae, Mycobacteria).
Overview of viral morphology and replication. Major DNA and RNA viruses relevant in clinical practice (HIV, hepatotropic viruses, Herpesviruses, respiratory viruses, viruses with epidemic and pandemic potential).
Overview of major pathogenic fungi and yeasts.
Overview of main human parasites and protozoa.

Mechanisms of microbial pathogenicity: adhesion to host cells (via pili, fimbriae, adhesion proteins); tissue invasion; toxin production (exotoxins and endotoxins); evasion of the immune system (capsule, antigenic variation, immune response suppression); antibiotic resistance.

Modes of transmission of infections: direct contact: skin, mucous membranes, secretions (e.g., herpes, HIV); indirect contact: contaminated surfaces or instruments (e.g., Clostridium difficile); airborne transmission: droplets or aerosols (e.g., influenza, COVID-19); fecal-oral route: ingestion of contaminated water or food (e.g., Salmonella, rotavirus); parenteral route: needles, transfusions, wounds (e.g., hepatitis B and C); vertical transmission: mother to fetus (e.g., toxoplasmosis, syphilis, cytomegalovirus).

Major infections of: the central nervous system, the upper and lower respiratory tract, the gastrointestinal system, bones and soft tissues, with particular focus on the issue of sepsis and its appropriate diagnostic and clinical management.

Basic microbiological diagnostics: collection and proper preservation of biological specimens; culture testing and Gram staining; biochemical tests to determine metabolic characteristics of microorganisms; antibiotic susceptibility testing (antibiogram) to determine antibiotic sensitivity; molecular diagnostics to directly detect DNA/RNA of viruses or bacteria; immunological tests to detect specific antigens or antibodies (e.g., ELISA, rapid tests).

Diagnosis and management of healthcare-associated infections (HAIs) that arise during or after hospitalization and were neither present nor incubating at the time of admission.
Antibiotic resistance and its impact on clinical practice.

Infection prevention: hand hygiene (the primary preventive measure according to WHO); proper use of personal protective equipment (PPE); environmental cleaning and surface disinfection; safe management of invasive devices (catheters, feeding tubes, needles).

Prerequisites

None

Teaching form

The course adopts an integrated approach that combines theory and practice, aiming to stimulate active student participation and facilitate the acquisition of skills applicable in clinical settings.
Interactive Lectures
Lectures will be delivered in person with the use of multimedia tools (PowerPoint or PDF slides), supplemented by clinical examples, case discussions, and multiple-choice questions to stimulate critical thinking. The lecturer's role will not be limited to content delivery but will also include guiding students in the interpretation of clinical situations.
Updated Educational Slides
Slides used during lectures will be made available to students, serving as visual and conceptual support for individual study. Materials will be designed to highlight key concepts, illustrate pathophysiological mechanisms, summarize major microbial species, and provide practical tools for professional application.
Integrated Approach with Other Disciplines
Clinical microbiology will be connected across other subjects in the degree program, such as hygiene, pharmacology, pathology, and nursing/midwifery care, in order to build an integrated and coherent body of knowledge.

Textbook and teaching resource

Learning material (slides of the lessons) is available at the e-learning platform of the course.
Recommended textbook:

- Cevenini R., Sambri V. (2004) Microbiologia e microbiologia clinica - Per i Corsi di Laurea in professioni sanitarie, Padova, Piccin.

Semester

I year, II semester

Assessment method

FOR THE ENTIRE INTEGRATED COURSE:

Written test composed for each module by 7 multiple choice quizzes and 1 open-ended question. The exam is passed by obtaining a passing grade in all 4 modules.

Office hours

Request an appointment with the teachers by email.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY