



Syllabus Master's Degree Course in Medicine and Surgery

HEALTH INFORMATICS

First year, first semester (3 academic credits [CFU])

Teachers

Subject	Academic credits (CFU)	Lecturer
Health informatics	3	PULVIRENTI Alfredo

Learning outcomes

Subject	Learning outcomes
Health informatics	<p>This course introduces the principles and applications of health informatics, the interdisciplinary field that uses data, information, and knowledge to improve health care and health-related research. The course covers topics such as health data standards, electronic health records, clinical decision support, information retrieval, natural language processing, machine learning, bioinformatics, and ethical and social issues in health informatics. The course also provides hands-on experience with various tools and methods for health data analysis and visualization.</p> <p>By the end of the course, students are expected to:</p> <ul style="list-style-type: none">• Explain the concepts and challenges of health informatics• Identify and use common health data standards and formats• Analyze and visualize health data using appropriate tools and techniques• Apply information retrieval and natural language processing methods to answer health-related questions• Apply machine learning methods to discover patterns and associations in health data• Apply bioinformatics methods to analyze molecular data: genomic, transcriptomic and proteomic• Discuss ethical and social issues in health informatics

Prerequisites

Subject	Prerequisites
Health informatics	Attainment of the educational objectives set by prerequisite courses.

Course contents

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Health informatics	<ul style="list-style-type: none"> • Introduction to Health Informatics <ul style="list-style-type: none"> ○ Overview of the field and its history ○ Problems and challenges that motivate health informatics ○ Research and practice domains of health informatics ○ Examples of health informatics applications and systems • Health Data Standards and Formats <ul style="list-style-type: none"> ○ Types and sources of health data ○ Health data quality and interoperability ○ Common health data standards and formats (e.g., HL7, FHIR, SNOMED CT, LOINC, ICD) ○ Tools for working with health data standards and formats (e.g., HAPI FHIR) • Electronic Health Records, data representation and Clinical Decision Support <ul style="list-style-type: none"> ○ Definition and components of electronic health records (EHRs) ○ Data Base basic concepts: ER, Relational databases, SQL ○ Definition and types of clinical decision support (CDS) ○ CDS systems and methods • Information Retrieval and Natural Language Processing in Health Informatics <ul style="list-style-type: none"> ○ Definition and tasks of information retrieval (IR) and natural language processing (NLP) ○ IR and NLP systems and methods (e.g., PubMed, UMLS, MetaMap) ○ Applications of IR and NLP in health informatics (e.g., literature search, question answering, clinical text analysis) • Machine Learning in Health Informatics <ul style="list-style-type: none"> ○ Definition and types of machine learning (ML) ○ ML systems and methods ○ Applications of ML in health informatics (e.g., diagnosis prediction, risk stratification, outcome analysis) • Bioinformatics in Health Informatics <ul style="list-style-type: none"> ○ Molecular data; ○ Bioinformatics systems and methods ○ Applications of bioinformatics in health informatics (e.g., genomic profiling, pharmacogenomics, personalized medicine) • Ethical and Social Issues in Health Informatics <ul style="list-style-type: none"> ○ Ethical principles and frameworks for health informatics ○ Ethical issues in health informatics (e.g., privacy, security, consent, ownership)

	<ul style="list-style-type: none"> ○ Social issues in health informatics (e.g., access, equity, diversity)
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Assessment methods

Subject	Assessment methods
Health informatics	<p>The assessment of acquired knowledge is conducted by a written examinations possibly followed by an oral examination. The grade is expressed on a scale of thirty, up to a maximum of 30/30 cum laude (with honors).</p> <p>The written examination will consist of 20 multiple choice questions on the topics treated during the lectures. The examination can have a further oral interview in which there will be three questions covering at least three different topics from the course curriculum. The assessments aim to evaluate: i) the level of knowledge of the topics treated during the course; ii) the ability to apply this knowledge to solve specific problems related to Health Informatics (problem-solving and judgment autonomy); iii) clarity of presentation; iv) the use of medical-scientific language. The assessment of learning can also be conducted remotely if the conditions necessitate it.</p> <p>For the assignment of the final grade, the following parameters will be considered:</p> <ul style="list-style-type: none"> • Score 29-30 with honors: The student demonstrates an in-depth knowledge of the topics, promptly and correctly integrates and critically analyzes presented situations, independently solving even highly complex problems. They possess excellent communication skills and command medical-scientific language proficiently. • Score 26-28: The student has a good understanding of the topics, is able to integrate and critically and logically analyze presented situations, can fairly independently solve complex problems, and presents topics clearly using appropriate medical-scientific language. • Score 22-25: The student has a fair understanding of the topics, although it may be limited to the main areas. They can integrate and critically analyze presented situations, although not always in a linear fashion, and present topics fairly clearly with moderate language proficiency. • Score 18-21: The student has minimal knowledge of the topics, possesses modest ability to integrate and critically analyze presented situations, and presents topics sufficiently clearly, although their language proficiency may be underdeveloped. • Exam not passed: The student lacks the minimum required knowledge of the core content of the course. Their ability to use specific language is minimal or nonexistent, and they are unable to independently apply acquired knowledge.

Examples of common questions and/or exercises

Subject	Examples of common questions and/or exercises
Health informatics	<ul style="list-style-type: none"> • Consider the scenario of a hospital, in which patients are hospitalized, are cared for by physicians, nurses and other professionals reporting to different operating units (e.g., cardiology), have a computerized medical record and are treated with medications: a) Designing the conceptual model of the database needed to manage the department; b) Assuming the use of a relational database, define the logical model of the database itself.

- Given the following HL7 message, answer the questions below:

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MSH|^~&|ADT1|MCM|LABADT|MCM|202309151228||ADT^A01|MSG00001|P|2.4EVN
|A01|202309151228||
PID|||12001||Jones^John^^Mr.||19670824|M|||123 West
St.^Denver^CO^80020^USA|||||PV1|||W^389^1^MCM||||004777^LEBAUER^SIDNEY^J
.||SUR|||ADM|A0|
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Questions:

- What is the message type and event type of this message?
 - What is the version of the HL7 standard used in this message?
 - What is the patient's name, date of birth, and gender?
 - What is the patient's address?
 - What is the name and identifier of the attending physician?
- Read the following paragraph and identify the terms that belong to the categories of disease, therapy, or procedures. Use brackets to mark the terms and label them with the corresponding category. Paragraph: "A new study has found that transcranial magnetic stimulation (TMS) can help reduce chronic pain in patients who have not responded well to other treatments. TMS is a non-invasive technique that uses magnetic fields to stimulate nerve cells in the brain. The researchers applied TMS to the primary motor cortex of 32 patients with fibromyalgia, a condition that causes widespread pain and fatigue. They found that after four weeks of daily sessions, the patients reported significant improvements in their pain levels, mood, and quality of life. The study suggests that TMS may be a safe and effective alternative or adjunctive therapy for patients with chronic pain."

Reference texts

Subject	Textbooks
Health informatics	<ul style="list-style-type: none"> Health Informatics: Practical Guide. William Hersh Editor, 2022 An Introduction to Healthcare Informatics, Building Data-Driven Tools. Peter Mccaffrey, 2020, Elsevier. Introduction to Bioinformatics, Fifth Edition. Arthur Lesk, Oxford University Press 2019. <p>Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.</p>

Course format

Subject	Textbooks
Health informatics	The teaching will primarily be conducted through in-person lectures with a blend of theory and practical exercises. In the event that teaching is delivered in a blended or remote mode, necessary adjustments may be introduced compared to what has been previously stated, in order to adhere to the planned program as outlined in the Syllabus.

Attendance

Subject	Textbooks
Health informatics	Mandatory attendance.

Course schedule

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Health informatics	<ul style="list-style-type: none"> • Topic 1: Introduction to Health Informatics - Chapters 1-3 Health Informatics: Practical Guide • Topic 2: Health Data Standards and Formats - Chapters 4-5 Health Informatics: Practical Guide, Chapters 9,10 An Introduction to Healthcare Informatics, Building Data-Driven Tools. • Topic 3: Information Retrieval and Natural Language Processing in Health Informatics - Chapter 11 Health Informatics: Practical Guide and Chapters 2-3 An Introduction to Healthcare Informatics, Building Data-Driven Tools. • Topic 4: Information Retrieval and Natural Language Processing in Health Informatics - Chapters 8, 10,14 Health Informatics: Practical Guide. • Topic 5: Machine Learning in Health Informatics - and Chapters 14-18 An Introduction to Healthcare Informatics, Building Data-Driven Tools. • Topic 6: Bioinformatics in Health Informatics – Chapters 2,4,7,8,9 Introduction to Bioinformatics, Chapter 16 • Topic 7: Ethical and Social Issues in Health Informatics – Chapter 22 Health Informatics: Practical Guide.