TECHNISCHE HOCHSCHULE DEGGENDORF

# Module Guide
# Master Digital Health

Faculty European Campus Rottal-Inn
Examination regulations ---
Date: 10.06.2021 11:09

# Table of Contents

# MDH-01 Fundamentals of Medicine and Computer Science (FMC)

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|---|---|
| Module code | MDH-01 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| Modul?gruppe | Fundamentals Module |
| Course number and name | MDH-01 Fundametals of Medicine and Computer Science (FMC) |
| Lecturers | Prof. Dr. Georgi Chaltikyan<br>Christian Roth<br>Prof. Dr. Thomas Spittler |
| Semester | 1 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
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## Module Objective

* This module provides fundamental knowledge, skills and competences necessary for all Digital Health specialists. It consists of two equal parallel tracks: students with prior degree in computer and information sciences follow the track "Fundamentals of

Medicine", while students with prior degree in biomedical and health sciences follow the track "Fundamentals of Computer Science".

**Fundamentals of Medicine:**

The overall goal of the module is to enable the student with little or no previous knowledge in biomedicine to understand the construction and major functions of the human body; to recognize the most important functional relationships in normal and diseased human body as a basis for preventive and therapeutic interventions.

After completing the module, the students will have achieved the following learning objectives:

**Professional competences:**

- Knowledge of basic anatomy, physiology and medical terminology;
- Knowledge of the most important biomedical subjects and specialties;
- Knowledge of the most common diseases and conditions;
- Basic knowledge of diagnoses and therapies;
- Understanding of disease management and health promotion.

**Methodical expertise:**

- Understand, analyze and synthesize information about health and disease;
- Communicate with medical professionals (understand their thought structure and speak about the management of a particular patient);
- Discuss important clinical and public health issues, such as treatment and prevention of some diseases.

**Personal competences:**

- Construct simple descriptions of structure and functions of the human body;
- Capture and transmit the medical terminology.

**Social competences:**

- Working in small groups discussing and presenting overview and case studies of particular diseases or conditions.

**Fundamentals of Computer Science:**

The overall goal of the module is to familiarize the student with little or no previous knowledge in computer science with the structure and the major functions of hardware and software technologies, in order to give them an understanding of all aspects of computing systems. The students will explore all layers of a computer system: the information and hardware layers, the programming layer, the operation systems layer, the applications layer, and the communication layers. In addition to the theoretical foundations, the students will obtain simple practical skills.

After completing the module, the students will have achieved the following learning objectives:

**Professional competences:**

- Knowledge and understanding of the different parts of a computer system;

- Understanding of abstraction and abstraction layers in software/hardware development;
- Knowledge of the main concepts of software development and IT processes;
- Knowledge of database systems and database design. Students will be able to identify to create relational database designs that avoid data loss and data inconsistency. They are able to explain how a relational database stores data.
- Understanding of the different parts of an operating system;
- Knowledge about network topology and technology.

**Methodical expertise:**

- Ability to design and implement simple computer programs;
- Ability to create queries for relational databases, to read and write SQL queries;
- Ability to execute object orientated analysis and design, to explain and use certain object-oriented patterns like Facade or Factory;
- Ability to transfer theoretical knowledge of computer science to real world use cases of medical engineering and hospital IT.

**Personal competences:**

- Ability to understand the complexity of development and IT projects and products. The students will be able to recognize that often there are no ?one fits all? solutions. They will be able to show that design decisions have often pros and cons, and to identify and analyze those pros and cons.
- Students learn by practical examples that different persons have often very different understanding about same things. They will be able to identify different understandings and to avoid misunderstandings by creation of formalized documents.

**Social competences:**

- Working in small groups designing and implementing small programming tasks.

## Applicability in this and other Programs

**Fundamentals of Medicine:**

The module provides a basis for all healthcare-related modules, and can be used in all study programs in the field of Applied Health Sciences.

**Fundamentals of Computer Science:**

The module provides a basis for all IT-related modules, and can be used in all study programs in the field of Applied Computer Sciences.

## Entrance Requirements

No special requirements.

## Learning Content

**Contents of the Module:**

**Fundamentals of Medicine:**

1 Overview of Biomedical Terminology and Disciplines: Biological and medical language; Origin and structure of medical terms; Common roots and combining forms; Common suffixes and prefixes; Formation of plural; Special features: acronyms, eponyms; The scope of biomedical or health sciences; Basic disciplines; Clinical medical specialties; Special and Interdisciplinary fields.
2 The Human Body: from Cell to Organism: Structure of the living organisms; Functions of the living organisms; Basics of metabolism; Molecular composition; Cell structure and function; Genes and heredity; Basics of embryology; Tissues of the human body; Organs and organ systems; Body parts, cavities and planes.
3 The Framework of Medicine and Healthcare: Historic highlights and recent advances in medicine; Health: definitions, components, approaches, promotion; Disease: definitions, terminologies, categories, classification; Basics of clinical practice; History and physical examination; Diagnostic modalities; Treatment and rehabilitation; Prevention (prophylaxis); Medical professions and careers.
4 Overview of Organ Systems: Basic Anatomy and Physiology, Common Diseases, Diagnostic Tests, and Treatment Modalities:
    4.1 Musculoskeletal System;
    4.2 Nervous System;
    4.3 Skin and Sense Organs;
    4.4 Cardiovascular System;
    4.5 Blood, Lymph and Immune System;
    4.6 Respiratory System;
    4.7 Digestive System;
    4.8 Endocrine System and Metabolism;
    4.9 Urinary System;
    4.10 Reproductive System.
5 Special topics in Medicine and Surgery: Accidents and Injuries; Tumors and Oncology; Infection / Inflammation / Sepsis; Organ Transplantation.
6 Biomedical Innovation and Research, Current Trends and Future of Medicine: stem cells, genetics and personalized medicine, AI, 3D-printed organs.

**Fundamentals of Computer Science:**

**1. Introduction:** Computing systems in layers; History of computing; Computing as a tool and a discipline.

**2. Information Layer:** Numbers and computing; Positional notation; Data and computers; Representing numeric data; Representing text; Representing audio; Representing images and graphics; Representing video.

**3. Computer Hardware Layer:** Computers and electricity; Hardware, Firmware, Software; Gates; Circuits; Circuits as memory; Integrated circuits; CPU, GPU; Individual computer components; Stored-program concept; Embedded systems; Parallel architectures.

**4. Software Development and Programming:** Computer operations; Machine language; Assembly language; Problem solving and algorithms; Expressing algorithms; Abstract data types and subprograms (stacks, queues, lists, trees, graphs, subprograms); Requirements engineering; Design and refactoring principles; High-level programming languages; Notations and syntax; Procedural programming; Object-oriented programming; Software architecture: design patterns, UML, model driven architecture, aspects of scalability.

**5. Operating Systems Layer:** Roles and parts of operating systems; Hardware abstraction; Memory management; Process management; CPU scheduling; File systems; Directories; Disk scheduling; Kernel architectures.

**6. Application Layer and Databases:** Managing information; Spreadsheets; Database management systems; Principles of relational databases; Normal form; Tables, Keys and Joins; SQL, T-SQL; NoSQL Databases; Knowledge representation; Artificial Intelligence; Robotics; Simulation; Graphics; Gaming; Other applications.

**7. Networks:** Network abstraction layers; Network topology; IP based networks; Domain specific networks (PAN, CAN); General network protocols; Network hardware;

**8. Product and IT development processes:** Traditional development models; History of lean management and lean development; Principles of lean product development; Agile (software) development.

## Teaching Methods

Combination of lectures, seminars, case studies, class discussions, exercises, group work, student presentations, and lab training.

## Remarks

**Medicine for Non-Physicians:**

Visit to a healthcare facility (optional).

## Recommended Literature

**Medicine for Non-Physicians:**

- Davi-Ellen Chabner: ?The Language of Medicine?, 11th edition. Elsevier, 2014. ISBN: 978-1455728466.
- Davi-Ellen Chabner: ?Medical Terminology: A Short Course? 7th edition. Elsevier, 2015. ISBN: 978-145575830-2.
- J. Moini: ?Anatomy and Physiology for Health Professionals?, 3rd edition. Johns & Bartlett Learning, 2020. ISBN: 978-1284151978.
- G. S. Thompson: ?Understanding Anatomy & Physiology: A Visual, Auditory, Interactive Approach?, 2nd Edition. Davis, 2015. ISBN: 978-0803643734.
- Renate Huch, Klaus D. Jürgens: ?Mensch, Körper, Krankheit: Anatomie, Physiologie, Krankheitsbilder?, 7th edition. Urban & Fischer Verlag/Elsevier GmbH, 2015. ISBN: 978-3437267932.
- Interactive 3D-learning platform of human anatomy, physiology BioDigital Human.
- Online medical knowledge and information resources: Medscape, WebMD.

**Computer Science for Medics:**

- Nell Dale / John Lewis (2019): Computer Science Illuminated. 7th edition. JBL.
- Edward K. Blum / Alfred V. Aho (2011), Computer Science: The Hardware, Software and Heart of It, Springer Science+Business Media New York.
- Jeff Sutherland / JJ Sutherland (2015), Scrum: The Art of Doing Twice the Work in Half the Time, Random House Business.
- Mary Poppendieck / Tom Poppendieck (2006) Implementing Lean Software Development ? From Concept to Cash, Addison Wesley.
- Donald G. Reinertsen (2009), The Principles of Product Development Flow: Second Generation Lean Product Development, Celeritas Publishing.
- Robert C. Martin (2008), Clean Code: A Handbook of Agile Software Craftsmanship, Prentice Hall.

# MDH-01 Fundametals of Medicine and Computer Science (FMC)

## Type of Examination

written ex. 90 min.

# MDH-02 International & Global Health (IGH)

| | |
|---|---|
| Module code | MDH-02 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| Modul-gruppe | Health Care |
| Course number and name | MDH-02 International & Global Health (IGH) |
| Lecturers | Prof. Dr. Georgi Chaltikyan<br>Anna Schmaus-Klughammer |
| Semester | 1 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
| | Major Global Health Issues, Healthcare Law and Ethics |

## Module Objective

**Learning Outcomes of the Module:**

The students will learn all relevant issues concerning International and Global Health and Healthcare Law and Ethics. They will review the determinants of health and how health status is measured. Students will also review the burden of disease, who is most affected by different disease burdens, risk factors, and key measures to address the burden of

disease. Students will also learn how the law governs the delivery of healthcare in different countries. They will learn the ethical frameworks of healthcare.

After completing the module International and Global Health the students will have achieved the following learning objectives:

Professional competences:

- Understanding healthcare in a broader context;
- Knowledge of key public health concepts, including: the demographic and epidemiological transitions, the burden of disease, the impact of key health conditions on individuals and on communities, and critical issues in the organization and delivery of health services;
- Knowledge of the determinants of health and risk factors for conditions of importance to international health systems;
- Knowledge of the most important components of healthcare delivery, of the structure and functioning of healthcare systems;
- Knowledge of important legal and regulatory framework of healthcare, including the General Data Protection Regulations (GDPR) and malpractice litigations;
- Knowledge of the ethical framework of healthcare and health research;
- Knowledge of the ethical approach in the use of Digital Health.

Methodical expertise:

- Discuss with confidence the burden of disease in various regions of the world, how it varies both within and across countries, and how the disease burden can be addressed in cost-effective ways;
- Analyze key challenges that are likely to arise in the coming decades in addressing the health in different high-, middle-, and low-income countries;
- Application of healthcare law to practical cases;
- Application of ethics in healthcare to practical cases;

Personal competences:

- Ability to analyze the structure and understand the meaning of commonly used international and global health terms;
- Ability to analyze the structure and understand the meaning of commonly used healthcare law terms;
- Present a health issue in a particular country or area in the world, or a global health issue, in a comprehensive way.

Social competence:

- Working in small groups discussing and presenting various healthcare management issues and challenges in different countries.

## Applicability in this and other Programs

A foundational module for understanding of most important issues in health and healthcare in international and global context.

Can be used in other study programs related to healthcare.

## Entrance Requirements

None

## Learning Content

1 Principles and Goals of Public and Global Health: the terms health, public health, and global health; parameters, activities, principles, approaches, and operations of public health; examples of public health efforts; critical concepts and key terms in global health; important global health issues and activities; Sustainable Development Goals and their relation to global health; central messages of studying international and global health.
2 Health Determinants, Measurements and Trends: the determinants of health; health indicators and key terms related to measuring health status and the burden of disease; concepts of health-adjusted life expectancy (HALE) and disability-adjusted life years (DALYs), and the burden of disease; the leading causes of death and the burden of disease in low-, middle-, and high-income countries, and their key risk factors; the demographic and epidemiologic transitions.
3 Health, Education, Poverty and the Economy: the links between health and education; connections between health, productivity, and earnings; key relationships between health, the costs of illness, and the impact of health expenditure on poverty; connections between health and equity; relationships between expenditure on health and health outcomes; public and private health expenditures; cost-effectiveness analysis as a tool for making investment choices in health; two-way relationship between health and development.
4 Communicable Disease: the burden of communicable diseases worldwide; the determinants of selected communicable diseases, including emerging and reemerging infectious diseases; key concepts concerning the prevention, transmission, and treatment of those diseases; the costs and consequences of communicable diseases of importance; case studies of successful interventions against communicable diseases; key challenges to the future prevention and control of these diseases; COVID-19 pandemic.
5 Non-Communicable Diseases: the burden of non-communicable diseases worldwide; the most important risk factors for the burden of non-

communicable disease; the costs and consequences of non-communicable diseases, tobacco use, alcohol use disorders, mental health disorders, and others; the measures that can be taken to address the burden of non-communicable diseases in cost-effective ways; case studies of successful interventions against non-communicable diseases; key challenges to the future prevention and control of these diseases.

6 Unintentional Injuries: the most important types of unintentional injuries; the burden of disease related to those injuries; how that burden varies by age, sex, region, and type of injury; the costs and consequences of unintentional injuries; the measures that can be taken to address the burden of unintentional injuries in cost-effective ways; case studies of preventing unintentional injuries; key challenges to the future prevention and control of unintentional injuries.

7 Introduction to Health Systems: the main functions of the health system; how health systems are organized; categories of health systems based on finances and access; Universal Health Coverage; various health expenditure measures; the main "building blocks" of health systems; key health system issues and how they might be addressed; the framework for the evaluation of health systems.

8 Fundamentals of Law in Healthcare: introduction; EU law; international healthcare law; international healthcare regulations and declarations; protection of sensitive health information; Health Insurance Portability and Accountability Act (HIPAA), USA; General Data Protection Regulation (GDPR) and its implications in healthcare and in digital health; professional regulations; malpractice litigation; cross-border practice; legal frameworks of digital health services in EU and other areas; technology liability; intellectual property rights.

9 Fundamentals of Ethics in Healthcare: the importance of ethical and human rights issues in health; the foundations for health and human rights; history of ethical issues in medicine and healthcare: the principles of non-maleficence and beneficence, the Nuremberg Code, the Declaration of Geneva, the Declaration of Helsinki, other historical examples and considerations; research with human subjects; ethical aspects of human subjects research; ethical issues in making investment choices in healthcare; ethics in health informatics and digital health, IMIA Code of Conduct; case studies; challenges for the future: artificial intelligence and superintelligence.

**Additional Topics:**

1 Environmental Health: the importance of environmental health; key concepts; key environmental health burdens; the burden of environmentally related diseases; the costs and consequences of key environmental health problems reducing the burden of disease; case studies; future challenges.

2 Nutrition and Global Health: the importance of nutrition; definitions and key terms; data on nutrition; the determinants of nutritional status; gauging nutritional status; key nutritional needs; overweight and obesity; nutritional needs throughout the life course; the nutritional state of the world; nutrition, health, and economic development case studies; addressing future nutrition challenges.
3 Women?s Health: the importance of women?s health; key definitions; the determinants of women?s health; the burden of health conditions for females; leading causes of death and DALYs, males and females compared; selected health burdens for females; the costs and consequences of women?s health problems; case studies; addressing future challenges; further measures to enhance the health of women.
4 Child and Adolescent Health: the importance of child and adolescent health; key terms; adolescence and young adulthood as transitional and critical periods; mortality and the burden of disease; risk factors for neonatal, infant, child and adolescent deaths; the costs and consequences of child and adolescent morbidity and mortality; immunization: a best buy in global health; case studies; addressing key challenges in child and adolescent health.

## Teaching Methods

Lectures, seminar discussions, group work, case studies, student presentations.

## Remarks

Guest lecture by an external expert (optional)

## Recommended Literature

- Richard Skolnik: Global Health 101, 4th edition, Jones & Bartlett Learning (JBL) 2019;
- Kathryn H. Jacobsen: Introduction to Global Health, 3rd edition, Jones & Bartlett Learning (JBL) 2019;
- Richard K. Riegelman: Public Health 101: Improving community health. Jones & Bartlett Learning (JBL) 2019;
- James A. Johnson, Carleen Stoskopf, Leiyu Shi: Comparative Health Systems: Global Perspectives, 2nd edition, Jones & Bartlett Learning (JBL) 2018.
- Margie Lovett-Scott and Faith Prather: Global Health Systems: Comparing Strategies for Delivering Health Services, Jones & Bartlett Learning (JBL) 2014;

- Jonathan Montgomery: Healthcare Law, 2nd Edition, Oxford University Press.
- eHealth: Legal, Ethical and Governance Challenges, Editors: George Carlisle, Whitehouse, Diane, Duquenoy, Penny (Eds), Springer-Verlag, Berlin Heidelberg

# MDH-03 Digital Health Fundamentals (DHF)

| | |
|---|---|
| Module code | MDH-03 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| Modul-gruppe | Digital Health |
| Course number and name | MDH-03 Digital Health Fundamentals (DHF) |
| Lecturers | Prof. Dr. Georgi Chaltikyan<br>Anna Schmaus-Klughammer |
| Semester | 1 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
| | Digital Health, eHealth and Telemedicine, Case Studies in Telemedicine |

## Module Objective

Digital Health has become the wide-scope umbrella term when addressing and discussing the application of modern Information and Communication Technologies in clinical practice, healthcare administration, management, research and education, and regulation. Digital Health is a rapidly evolving domain as new technologies are implemented. Various Digital Health, eHealth, and telehealth / telemedicine technologies are more and more

often utilized in healthcare systems around the world, resulting in increasing quality, availability and equity of health services.

In Low- and Middle Income Countries (LMICs) Digital Health enables physicians to collaborate with their peers from other countries. Individual clinicians in remote areas are able to exchange diagnoses and opinions with expert doctors. They feel part of their profession and of an international group of colleagues. Continuing Medical Education (CME) via telemedicine in remote areas improves local care and overcomes professional isolation of healthcare personnel.

This module provides the fundamental Knowledge of current practices and available services in Digital Health, eHealth and telemedicine, as well as the basic Digital Health project and program development and implementation skills, and thus is a foundational module in the study program.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence**:

- Knowledge of the main concepts, types, applications and services of Digital Health;
- Knowledge of the current state of DigitalHealth in different regions and countries of the world;
- Familiarity with the underlying technology in Digital Health;
- Knowledge of logistical and organizational aspects of Digital Health;
- Understanding of the benefits, opportunities, challenges and barriers to implementation of Digital Health;
- Knowledge of inherent ethical, legal, and financial issues in Digital Health and of relevant legal frameworks in different countries;
- Knowledge of the difference of Digital Health in High Income Countries (HICs) and Low and Middle Income Countries (LMICs).
- Knowledge about Case Studies in Low- and Middle Income Countries (LMICs) and Industialized Countries

**Methodological expertise:**

- Application of the principles of setup, operation and maintenance of Digital Health services;
- Ability to design Digital Health projects for different scenarios;
- Ability to work with typical telemedicine software e.g. case.io and Campus Medicus, and with Digital Health devices and applications;

**Personal competence:**

- Ability to perform and present SWOT analysis of Digital Health projects and programs;
- Ability to reflect on different ethical, legal, and financial issues in Digital Health, and to analyze relevant legal frameworks in different countries;

- Critical discussion of the available evidence of effectiveness, including cost-effectiveness, of Digital Health.

**Social competence:**

- Interdisciplinary and interpersonal collaboration when working together in small groups on discussing examples of Digital Health projects.

## Applicability in this and other Programs

The module is foundational to building knowledge, skills and competences in Digital Health. It is closely interrelated with the module MDH-08 ? Digital Health Applications.

The specialization modules in the 2nd Semester build on this module.

The module can be used in other study programs in Applied Health Sciences.

## Entrance Requirements

None

## Learning Content

1 Overview of Digital Health: definitions and terminology; classification of Digital Health; history of Digital Health, eHealth and telemedicine; setup, types, tools, formats, applications, and services of Digital Health; major current trends in Digital Health, eHealth and telemedicine; the rationale, benefits and opportunities, challenges and barriers to adoption of Digital Health, eHealth and telemedicine; facts and figures about Digital Health, eHealth and telemedicine; the main players, projects and programs in Digital Health; the future developments.

2 Technological Aspects of Digital Health: requirements for technology; healthcare data and information; telecommunication basics; wired and wireless telecommunication; Internet and computer networks; videoconferencing equipment; special telemedicine devices; telemedicine software; telemedicine site setup.

3 Organizational Aspects of Digital Health: Digital Health, eHealth and telemedicine project and program management (needs assessment, planning and development, implementation and monitoring, evaluation and reporting); factors of success and failure; Digital Health, eHealth and telemedicine good practices.

4 Clinical Telemedicine Services: features of real-time (synchronous) telemedicine; features of store-and-forward (asynchronous) telemedicine; general teleconsultations; specialty telemedicine: teleradiology, telepathology, teledermatology, telecardiology and ECG; tele-neurology and

tele-stroke; teleophthalmology and tele-ENT; acute care and emergency telemedicine; tele-psychiatry; telesurgery.

5 Ethical, Legal and Economic Aspects of Digital Health: patient-physician relationship as applies for telemedicine; informed consent; confidentiality and privacy; quality of care; standards; adequacy and quality of data; continuum of care; data security; liability; licensure; record keeping; guidelines and protocols; telemedicine legislation; reimbursement policies and practices.

6 Evidence in Digital Health: effectiveness and cost-effectiveness of various eHealth and telemedicine technologies; current and future research on eHealth and telemedicine.

7 Case Studies: chances and challenges in implementation of Telemedicine Projects. Intercultural and interdisciplinary aspects in implementation of Telemedicine Projects.

## Teaching Methods

Combination of lectures, seminars, presentations, and a practical/project part

## Remarks

- Working with telemedicine platforms case.io and Campus Medicus;
- Hands-on training with Digital Health devices and applications;
- Guest lecture by an external Digital Health expert (optional);
- Visiting a user of a telemedicine platform in Germany (optional);
- Online discussion with a user of a telemedicine platform in LMICs (optional).

## Recommended Literature

- Rajendra Pratap Gupta (2021): Digital Health ? Truly Transformational. Wolters Kluwer.
- Gogia S (2020): Fundamentals of Telemedicine and Telehealth. Elsevier. https://doi.org/10.1016/B978-0-12-814309-4.00004-5
- Hoyt R.E., Hersh W.R. (2018): Health Informatics: Practical Guide. 7th edition. Endorsed by AMIA.
- Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- Fong B., Fong A.C.M., Li C.K. (2011): Telemedicine Technologies: Information Technologies in Medicine and Telehealth. Wiley, Chichester (UK).
- Wootton R., Patil N.G., Scott R.E., Ho K. (2009): Telehealth in the Developing World. Royal Society of Medicine Press, London/Glasgow.

- Graschew G. and Rakowsky S. (2011): Telemedicine Techniques and Applications. InTech.
- Dale, N., Lewis, J. (6th Edition). Computer Science Illuminated. ISBN-13: 978-1284055917

# MDH-04 Digital Health Technology (DHT)

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|---|---|
| Module code | MDH-04 |
| Module coordination | Prof. Dr. Thomas Spittler |
| Modul-gruppe | Digital Health |
| Course number and name | MDH-04 Digital Health Technology (DHT) |
| Lecturers | Christian Roth<br>Prof. Dr. Thomas Spittler |
| Semester | 1 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
| | Digital Health Technology |

## Module Objective

Students gain in-depth knowledge of the analysis, interpretation and design of complex digital systems. Networked software infrastructures and interoperable applications in the field of digital health are developed in detail.

After completing the module, the students will have achieved the following learning targets:

**Professional competence:**

- Students evaluate architectural decisions.

- They develop concepts and procedures of the software development process for applications in digital health.
- They order software development processes on the basis of specific national and international framework conditions.
- They derive strategies for software systems in the field of digital health.
- They apply software systems and software tools.

**Methodological expertise:**

- The students can formalise and abstract problems.
- They can apply software development methods.
- They acquire experience in the use of software tools

**Personal competence:**

- Students are able to understand aspects, concepts and technologies that are often used in medical and health care environments.
- By working in a team, students can achieve their own goals and take on leadership roles or become involved in the project team

**Social competence:**

- Students are capable of precise and goal-oriented communication as a result of working on a complex product in a team.

## Applicability in this and other Programs

This module is fundamental to the most Medical Informatics competences; it is closely interrelated with the module 5 - Standards, Terminology and Classification in Medicine.

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## Entrance Requirements

Essential knowledge in Software Programming in a modern language like python or Java.

## Learning Content

1 Essentials of Software Architecture
  1.1 Architectural Thinking
  1.2 Architectural Characteristics
  1.3 Overview of Architecture Design
2 Software Engineering Design
  2.1 Agile and Model-Driven Approaches
  2.2 Frameworks
  2.3 Software Test
  2.4 Human Factor

3 IT-Management
  3.1 Management of Information Systems
  3.2 IT Governance and IT Alignment
  3.3 Requirements Management and Requirements Engineering
4 Information and Communication Technologies
  4.1 Wireless Communication
  4.2 Wireless Networks
  4.3 Sensors in Healthcare
  4.4 IoT
  4.5 Quantum Technologies
  4.6 Blockchain Technologies
  4.7 Grid Computing
  4.8 Artificial Intelligence
  4.9 Use Cases in Digital Health
5 Smart and assistive Technologies for Digital Health

## Teaching Methods

Combination of lectures, seminars, practical work, and students presentations.

## Remarks

- Working with Software tools installed on the Campus
- Guest lectures by experts in the field
- Field visits to hospitals and clinics.

## Recommended Literature

- Richards, M., & Ford, N. (2020). Fundamentals of Software Architecture: An Engineering Approach. O'Reilly.
- Fricker, S. A., Thümmler, C., & Gavras, A. (Eds.). (2015). Requirements engineering for digital health. Springer International Publishing.
- Syed-Abdul, S., Zhu, X., & Fernandez-Luque, L. (Eds.). (2020). Digital health : Mobile and wearable devices for participatory health applications. ProQuest Ebook Central https://ebookcentral.proquest.com
- Fong, Bernard, et al. Telemedicine Technologies : Information Technologies in Medicine and Digital Health, John Wiley & Sons, Incorporated, 2020. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=6198567.
- Pang, C. (Ed.). (2020). Software Engineering for Agile Application Development. IGI Global. http://doi:10.4018/978-1-7998-2531-9

# MDH-05 Digital Health Coding (DHC)

| | |
|---|---|
| Module code | MDH-05 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| Modul-gruppe | Digital Health |
| Course number and name | MDH-05 Digital Health Coding (DHC) |
| Lecturer | Prof. Dr. Georgi Chaltikyan |
| Semester | 1 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
| | Data Standards, Terminologies and Classifications, Case Studies in Digital Health Data Standards |

## Module Objective

Medicine and healthcare are extremely data-, information-, and knowledge-reach domains, which use hundreds of thousands of terms, concepts, definitions, descriptions, and their interrelationships in vocabularies, nomenclatures, and classification systems. Proper functioning of healthcare systems critically depends on the ability to process information in a meaningful way, which necessitates development of terminology sets and classification systems. In the Digital Health era universally accepted data standards are especially

crucial for exchange of health information between care settings, regions and countries, and globally.

The overall aim of this module is to introduce the students to the principles of information representation in healthcare, and to familiarize them with important healthcare data coding standards, terminologies, and classification systems.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Understanding of the characteristics of medical language;
- Knowledge of common biological and medical terms and principles of their composition;
- Understanding of the main instruments in healthcare data representation (terminology, vocabulary and nomenclature, classification and taxonomy, ontology, thesaurus), and of the differences between them;
- Understanding of the requirements for standardization and formalization of medical language, and the main principles of developing and maintaining controlled medical vocabularies;
- Knowledge of the most common terminologies, classifications, and coding systems used in medicine and healthcare: ICD and other WHO Classifications, SNOMED-CT, DRG, CPT and OPS codes, LOINC, Medical Subject Headings (MeSH), and UMLS, among others;
- Knowledge of the various uses of terminology and classifications systems.

**Methodical expertise:**

- Application of various medical coding techniques in different healthcare institution settings;
- Working with major terminology servers;
- Working with dedicated terminology resources in the healthcare domain;
- Retrieving and analyzing terms and concepts or codes related to various organs and systems.

**Personal competence:**

- Ability to analyze the structure and understand the meaning of commonly used medical terms;
- Ability to describe and critically discuss the standards, terminologies, and classification systems used in various healthcare settings and countries.

**Social competence:**

- Working in groups on small projects related to usage of various terminology servers.

## Applicability in this and other Programs

This module is closely interrelated with the module MDH-7 ? Digital Health Information Systems.
It can also be used in any other study program in the field of Health Informatics.

## Entrance Requirements

None

## Learning Content

1 Overview of Medical Terminology: Need for standards and interoperability; syntax and semantics; definitions of terminology, vocabulary, nomenclature, classification, taxonomy, thesaurus, ontology; the biological and medical language; origin and structure of medical terms; most common roots, suffixes and prefixes; properties of medical language; medical terminology describing the human body; terminology of organ systems and their diseases.
2 Standardizing Healthcare Data: healthcare terminology standards; differences between terminology and classification; problems in standardizing terminologies; requirements for standardizes terminologies; desiderata for controlled terminologies; completeness of a terminology system; types of standardized terminology and classification systems.
3 International Statistical Classification of Diseases and Related Health Problems (ICD): description, purposes ad uses of ICD, WHO Family of International Classifications; history and evolution of ICD; general information on ICD-10; composition of ICD-10; coding in ICD-10; ICD-11; ICD-10-GM; the ICD modifications in the US: ICD-9-CM vs. ICD-10-CM.
4 Systematized Nomenclature of Medicine (SNOMED): history and evolution of SNOMED; structure of SNOMED; limitations of SNOMED; SNOMED RT; general information on SNOMED CT; composition of SNOMED CT; uses of SNOMED CT; limitations of SNOMED CT; resources on SNOMED CT.
5 Diagnosis-Related Groups (DRG), Current Procedural Terminology (CPT), and OPS: general information and uses of DRG; history and evolution; structure and development of DRG; German G-DRG System: evolution, structure, usage; US CPT coding system; Healthcare Common Procedure Coding System (HCPCS); German OPS coding system.
6 LOINC, GALEN, MEDCIN, RxNorm: general information on LOINC; structure of LOINC; LOINC names, scope, development; RELMA; LOINC resources; GALEN; MEDCIN; RxNorm.

7 ICF and ICHI: introduction and general concept of ICF; application of ICF; Structure of ICF; strengths and limitations of ICF; general information on ICHI; history and current state of ICHI.
8 UMLS and MeSH: general information on UMLS; purpose and uses of UMLS; structure of UMLS; UMLS Metathesaurus; UMLS Semantic Network; UMLS SPECIALIST Lexicon; UMLS services and tools; limitations of UMLS; general information on MeSH; structure and uses of MeSH; UMLS and MeSH Resources.
9 Aligning and Mapping of Healthcare Code Sets, Terminologies and Classification Systems: discovering common ground between different sets and systems; purpose of data maps; typical content and structure of maps; principles and process of map development; map validation and maintenance; example: mapping SNOMED-CT to ICD-10.
10 Usage of Vocabulary, Terminology and Classification Systems: EHR applications; administrative applications; interoperability issues; implementation issues (standard selection; data mapping; subsets, value sets and reference sets, terminology binding and the information model).

## Teaching Methods

Combination of lectures, presentations, case studies and practical exercises.

## Remarks

- Working with terminology servers of ICD, SNOMED CT, LOINC;
- Guest lecture by an external expert (optional);
- Online introductory course on SNOMED CT by the IHTSDO (optional).

## Recommended Literature

- Giannangelo K. (2019): Healthcare Code Sets, Clinical Terminologies, and Classification Systems. AHIMA Press, Chicago.
- Hoyt R.E., Hersh W.R. (2018): Health Informatics: Practical Guide. 7th edition. Endorsed by AMIA.
- Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- Benson T, Grieve G. (2016): Principles of Health Interoperability ? SNOMED CT, HL7 and FHIR. 3rd edition. Springer-Verlag, London.
- Chabner D.-E. (2015): Medical Terminology: A Short Course. 6th Edition. Elsevier Saunders, Maryland Heights.
- WHO FIC educational and supporting documentation downloadable from the WHO website (specific links available through lecture scripts).

- SNOMED CT educational and supporting documentation downloadable from the SNOMED International website (specific links available through lecture scripts).

# MDH-06 Contemporary Health Research (CHR)

| | |
|---|---|
| Module code | MDH-06 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| Modul-gruppe | Research & Methodology |
| Course number and name | MDH-06 Contemporary Health Research (CHR) |
| Lecturers | Prof. Dr. Georgi Chaltikyan<br>Anna Saibold |
| Semester | 1 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written student research project |
| Weight | 5/90 |
| Language of Instruction | English |
| | Contemporary Health Research: Evidence-Based Medicine to Medicine of 4P; Biomedical Statistics |

## Module Objective

Modern practice of medicine heavily relies on the evidence obtained through high quality research on etiology and pathogenesis, diagnosis and treatment of diseases and conditions. The concept of Evidence-Based Medicine (EBM) introduced in 1980s provides foundation for scientifically proven practice of medicine, and implies incorporation of the best available evidence, together with the clinician?s knowledge and expertise, and patient?s expectations, into the process of medical decision-making. Understanding of EBM and other evolving concepts in contemporary health research (such as personalized

medicine or 4P medicine), as well as sound knowledge of the most common statistical research methods and ability to use them in practice, are critical for Digital Health specialists in understanding and managing medical and healthcare decision support.

The overall aim of this module is to introduce the students to the principles and practices of modern health research, and to familiarize them with the methods used to generate, retrieve, analyze, appraise and report healthcare research data.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Knowledge of the concept, goals and principles of modern healthcare research, recent advances and potential future developments, strengths and weaknesses;
- Knowledge of the types of clinical studies and of the levels of evidence;
- Knowledge of the sources of medical scientific literature and EBM resources;
- Understanding of the principles of critical appraisal of the results of clinical studies;
- Fundamental knowledge of analysis and interpretation of medical datasets;
- Fundamental knowledge and application of descriptive statistical approaches;
- Fundamental knowledge and application of inferential statistics approaches;

**Methodical expertise:**

- Formulation of a healthcare research question in a PICO(TS) format;
- Application of various methods of retrieval of medical scientific literature, search strategies and techniques;
- Application of methods of critical appraisal of medical research papers (validity, results and applicability);
- Application of various types of descriptive statistical methods;
- Application of various types of inferential statistical methods;
- Ability to present data in appropriate graphical form;
- Use of statistic software (R, R Studio);

**Personal competence:**

- Realistic assessment of the strengths, abilities and limitations of different types of research evidence in the decision making process;
- Ability to critically discuss advantages and disadvantages of different study designs;
- Ability to understand and describe medical datasets;

**Social competence:**

- Interdisciplinary and interpersonal collaboration when working in small groups on retrieving and analyzing evidence on particular clinical or public health question.

## Applicability in this and other Programs

This module provides knowledge, skills and competences in modern biomedical and health research, necessary for evidence-based practice of Digital Health.

It can be used in any other study program in Applied Health Sciences (e.g. IT in Healthcare).

## Entrance Requirements

Basic knowledge of biomedical sciences.

## Learning Content

1 Basics of Evidence Based Medicine: introduction, definitions, history of Evidence Based Medicine; concept; recent developments; importance of EBM in medical practice, education, research and administration; the process and steps in EBM.
2 Formulating Medical Decision Query: major steps in EBM; formulating a question; background vs. foreground questions; PICO question algorithm; PICO variations; types of clinical questions/studies (diagnosis, therapy, prognosis, harm/etiology, economic); importance of formulating a query.
3 Online Medical Information Resources and Information Retrieval: the process of finding the evidence; medical knowledge resources; medical textbooks online; scientific medical journals; MEDLINE; evidence review resources; drug databases; diseases databases; composite resources; search engines, strategies.
4 Critical Appraisal of Evidence: the evidence pyramid; types of study design: number of one study, case-control studies, cohort studies, randomized controlled studies, crossover studies, systematic reviews and meta-analyses, other study designs; levels of evidence; validity of evidence; reliability of evidence; results assessment in diagnosis studies: Incidence and Prevalence, Sensitivity, Specificity, Positive and Negative Predictive Value, Likelihood Ratio, Pretest and Posttest Probability and Odds; results assessment in therapy studies: Relative Risk and Relative Risk Reduction, Absolute Risk Reduction, Number Needed to Treat/Harm, Odds Ratio; relevance (applicability) of evidence; statistical significance and p value; precision values (Confidence Interval); applicability assessment: therapy studies, diagnosis studies; appraisal of systematic reviews; appraisal of qualitative research; appraisal of clinical decision analyses; appraisal of economic analyses; appraisal of prognosis studies; appraisal of harm/ etiology studies.

5 Application and Evaluation of Evidence: criticism and limitations of EBM; most recent developments in biomedical and health research; omics and Personalized Medicine; future of biomedical and health research; 4P medicine.
6 Clinical Practice Guidelines (CPGs): developing CPGs; strength of recommendation; individual application of CPGs; quality of guidelines; barriers to implementation of Clinical Practice Guidelines; CPG strategies; CPG resources.
7 Basics of data analysis: types of data; usage of R/R Studio: Console, Scripts, Plots; analyzing, interpreting and presenting a medical dataset;
8 Descriptive statistics: measures of center and spread; normal distribution; graphics; analyzing relations: correlation;
9 Inferential statistics: inferences; hypothesis testing (one-sided; two-sided); significance and error levels; types of error.

## Teaching Methods

Combination of lectures, seminars, practical exercises and students presentations.

## Remarks

Guest lecture and demonstration of decision support system (optional).

## Recommended Literature

- Jacobsen K. (2020): Introduction to Health Research Methods: A Practical Guide. 3rd edition. Jones & Bartlett Learning (JBL), Burlington, MA.
- Forester J.G., Blessing J.D. (2020): Introduction to Research and Medical Literature for Health Professionals. 5th edition. Jones & Bartlett Learning (JBL), Burlington, MA.
- Hoyt R.E., Hersh W.R. (2018): Health Informatics: Practical Guide. 7th Edition. Endorsed by AMIA.
- Bland M. (2015): An Introduction to Medical Statistics. 4th edition. Oxford University Press.
- Greenhalgh T. (2014): How to Read a Paper: The Basics of Evidence-Based Medicine. John Wiley & Sons, Chichester, West Sussex, UK.
- Hunink M.G.M., Weinstein M.C., et al. (2014): Decision Making in Health and Medicine: Integrating Evidence and Values. Cambridge University Press.
- Sox H.C., Higgins M.C., & Owens D.K. (2013): Medical Decision Making. John Wiley & Sons, Chichester, West Sussex, UK.

- Prasad K. (2013): Fundamentals of Evidence Based Medicine. Springer India, Heidelberg / New York / Dordrecht / London.
- Straus S.E., Howerton L.J., Richardson W.S., Haynes R.B. (2010): Evidence-Based Medicine: How to Practice and Teach It. Elsevier, Oxford/ Edinburgh.

# MDH-07 Digital Health Information Systems (DHS)

| | |
|---|---|
| Module code | MDH-07 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| | Digital Health |
| Course number and name | MDH-7 Digital Health Information Systems (DHS) |
| Lecturers | Prof. Dr. Georgi Chaltikyan<br>Stefan Kahlert |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
| | Medical Documentation Systems; Health Information Systems (HIS) |

## Module Objective

Maintaining patient records is among the core workflow processes in healthcare delivery. With introduction and development of Health Information Technologies healthcare systems around the world are transitioning from traditional paper-based medical records to computer-based records and care management systems. Comprehensive, secure and interoperable Electronic Health Record (EHR) is the central functional component of a

digital Health Information System (HIS) and is critical for enhancing quality and efficiency of healthcare delivery, while Health Information Exchange (HIE) provides frameworks for electronic movement of records between care settings, providers, regions and countries, thus supporting continuity of care.

The overall aim of this module is to introduce the students to the main features and processes in the management of digital Health Information Systems, and to modern digital solutions for healthcare workflow management.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Knowledge of the main principles and parts of medical documentation;
- Knowledge of the structure and function of an Electronic Health Record and its main components;
- Understanding of the approaches to EHR interoperability and general knowledge of the HL7 standards;
- Knowledge of the main components and functions of the Clinical Information Systems;
- Understanding of the main principles of Health Information Exchange;
- Understanding of the role of EHR in public health and medical research.

**Methodological expertise:**

- The students can build or modify simple EHR using open source or simulation systems;
- The students can compile simple projects on development of a Hospital Information System or a Practice Management System.

**Personal competence:**

- Ability to critically discuss the advantages and disadvantages of EHR, and to reflect on critical issues on EHR deployment and implementation, such as the impact of usability on EHR adoption;
- Ability to reflect on the role of EHR in improving patient safety;
- Ability to analyze and discuss the role and potential of EHR in clinical, population and public health.

**Social competence:**

- Group work on sample Electronic Health Records and Hospital Information Systems.

## Applicability in this and other Programs

This module is fundamental to the most Digital Health competences; it is closely interrelated with the module MDH-05 ? Digital Health Coding.

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## Entrance Requirements

Basic knowledge in biomedical, information and computer sciences; knowledge of healthcare management and healthcare terminology standards is a plus.

## Learning Content

1 Principles of Medical Documentation: Medical record keeping and approaches to clinical documentation (SOAP); Legal aspects of medical record keeping; Overview of the main components of a medical record (patient chart): administrative component, demographics, clinical documentation component: chief complaint, history and medication list, physical examination, assessment and problem lists, diagnoses, order entries, laboratory and instrumental tests, care plan, progress notes, discharge summaries; Source-oriented vs. problem-oriented medical records.
2 Electronic Health Records (EHR): Overview, rationale, need, benefits (added value) and challenges of EHR; Healthcare data structure, architecture, and elements; Major structural components of HIS and core EHR functionalities; Computerized Physician Order Entry (CPOE) and e-prescribing, Clinical Decision Support Systems (CDSS); EHR types and examples; regulation, accreditation and certification; Adoption of EHR in different areas and countries.
3 Interoperability of Health Records, Health Information Exchange (HIE): Definitions, need, importance and classification of interoperability; Overview of current interoperability standards; XML standard; HL7: history and current state, management and evolution; HL7 v2, v3 RIM, Clinical Document Architecture (CDA), FHIR; Challenges of sharing healthcare data, technical, legal and ethical aspects of HIE, privacy and security, semantic interoperability; IHE, OpenEHR, national and international HIE initiatives and systems.
4 Hospital Information Systems (HIS)Practice Management Systems (PMS): History of development of health information management and systems; Main processes and factors, business processes, computerization strategies, structure- and process-oriented approaches, major components of HIS; Information systems of primary care physicians and specialists, main components and functions of Practice Management Software; HIS project management and evaluation, procurement of HIS.

5 Health Information Technology and Patent Safety, Quality and Value: What is safety, quality and value, EHR to improve safety, quality and value; Organizations and programs supporting patient safety; Patient safety reports, technologies to decrease medication errors; Barriers to improving patient safety through EHR implementation; Evaluation and research on the role of HIT in improving patient safety.
6 The Role of EHR in Public Health, and Public Health Informatics (PHI): The role of informatics in public health; Information systems to support public health functions; Surveillance and case management systems; Public Health Information Network (PHIN); Geographic Information Systems (GIS); Types and sources of public health data, public health data tools and statistics, global Public Health Informatics, challenges in PHI; The role of the workforce, clinics, hospitals, and health systems.
7 Secondary Use of Medical Documentation: Introduction into Translational Bioinformatics and information systems for biomedical research; Clinical Research Informatics and information systems for clinical research; Clinical Data Warehouses (CDWs) and data mining; Challenges; projects and programs in research informatics; introduction to data analytics.

## Teaching Methods

Combination of lectures, seminars, practical work, and students presentations.

## Remarks

- Working with EHR and HIS system installed on the Campus
- Guest lectures by experts in the field
- Field visits to hospitals and clinics.

## Recommended Literature

- Hoyt R.E., Hersh W.R. (2018): Health Informatics: Practical Guide for Healthcare and Information Technology Professionals. 7th Edition. Lulu.
- Nelson R., Staggers N. (2018): Health Informatics: An Inter-professional Approach. Elsevier, St. Louis, USA.
- Braunstein Mark L. (2015): Practitioner?s Guide to Health Informatics. Springer, Switzerland.
- Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg
- Fenton S.H., Biedermann S. (2014): Introduction to Healthcare Informatics. AHIMA Press, Chicago.

- Braunstein Mark L. (2014): Contemporary Health Informatics. AHIMA Press, Chicago.
- Open Source EHR Systems: www.mycare2x.org, www.open-emr.org
- Commercial Ambulatory EHR System MEDISTAR by CompuGroup Medical (CGM).

# MDH-08 Digital Health Applications (DHA)

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| Module code | MDH-08 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| | Digital Health |
| Course number and name | MDH-08 Digital Health Applications (DHA) |
| Lecturer | Prof. Dr. Georgi Chaltikyan |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written student research project |
| Weight | 5/90 |
| Language of Instruction | English |
| | Digital Health Products, Applications and Services; Case Studies in Digital Health Applications |

## Module Objective

From mobile health and fitness apps to wearables and nanosensors, and from virtual reality to personalized medicine, various Digital Health applications are disrupting traditional models of healthcare delivery, empowering patients and consumers, and introducing unprecedented change into the global healthcare landscape. The major driving forces behind the current explosive growth of mobile and consumer Digital Health applications are technological advances and developments, and people´s expectations of a better control of their health and disease.

The module addresses various application systems of Digital Health across different specialties and care settings, such as wearable sensors and monitoring devices, medical imaging techniques, mobile health and distant monitoring systems, home telehealth, surgical robotics, artificial intelligence and machine learning, and others, and also focuses on consumer Digital Health applications, presenting and discussing the near future trends such as personalized medicine.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Knowledge of the main technological solutions used to obtain patient data;
- Knowledge of the main developments and trends in the field of mobile health and remote patient monitoring;
- Familiarity with the most common health and fitness apps;
- Knowledge of the different types and technology used in remote monitoring in health and disease;
- Familiarity with common consumer Digital Health applications and personal health record services;
- Knowledge of the medical imaging formats and processing and understanding of PACS architecture and workflow;
- Understanding of the usage of novel and emerging Digital Health technologies in medicine and healthcare (such as VR, AR, robotics, AI and ML);
- Understanding of the legal requirements and regulation processes of Digital Health technologies.

**Methodical expertise:**

- Ability to design a simple Digital Health project for a health provider using available information about existing commercial products;
- Ability to create a requirements and specifications set for a direct-to-consumer Digital Health platform or a personal health record;
- Ability to work with medical images using a DICOM viewer.

**Personal competence:**

- Analysis of the factors of success and failure of various Digital Health projects, applications and services;
- Critical discussion of the current challenges and opportunities in mobile and wireless Digital Health applications.

**Social competence:**

- Working together with fellow-students in small groups on designing and developing sample Digital Health product.

## Applicability in this and other Programs

This module is closely interrelated with the module MDH-03 ? Digital Health Fundamentals (DHF).
This module can be used in any other study program in the field of Applied Health Sciences such as Health Informatics.

## Entrance Requirements

None

## Learning Content

**1. Mobile Health Applications:** evolution of mobile technology in medicine and healthcare; common mHealth applications and services; benefits and limitations of mHealth; business cases and stakeholders; regulatory, legislation and security aspects of mHealth; current trends and possible future developments; case studies of mHealth applications.
**2. Wireless Monitoring for Health and Disease**: concepts and definitions; distant patient monitoring; rationale for and benefits of remote patient care; telecare, Ambient Assisted Living (AAL) and other ?smart home? and independent living techniques; future perspectives: advances in wearables and sensors; case studies of distant monitoring devices and software.
**3. Consumer Digital Health Applications**: direct to consumer Digital Health solutions; personal Health Records (PHR) and patient web portals; electronic patient to physician communication; consumer health information portals; future trends: Personalized and Precision Medicine; case studies of various consumer eHealth applications.
**4. Medical Imaging Informatics:** types of medical imaging technologies; digital image acquisition, storage and communication; compression standards and DICOM; image processing; Picture Archiving and Communication Systems (PACS); PACS architecture, functionalities and workflow; traditional PACS versus web-based and mobile PACS; case studies of medical imaging informatics.
**5. Enhanced Medical Intervention, Virtual and Augmented Reality:** evolution of intervention techniques and approaches; overview of technological solutions improving the quality of therapeutic intervention; visualization technique, surgical navigation, VR / AR in medicine; robotic assistance systems; innovation and the future of enhanced medical intervention; case studies of virtual and augmented reality applications.
**6. Artificial Intelligence in Medicine and Healthcare**: history and development of artificial intelligence; overview of different medical AI techniques: "classical" machine learning, neural networks, deep learning, natural language processing; use of AI technologies in various fields of clinical medicine and healthcare administration, education

and research; future of artificial intelligence in medicine and healthcare; case studies of AI and ML in Healthcare.

**7. Legal and Regulatory Aspects of Digital Health Applications:** regulation and certification of medical technologies and devices; legal frameworks and standards in the European Union; technology assessment, selection and procurement; case studies of legal and regulatory aspects of Digital Health applications.

## Teaching Methods

Combination of lectures, seminars, case study presentations, and a practical/project part.

## Remarks

- Working with a DICOM viewer software
- Working with mobile health devices and applications
- Guest lectures by external expert (optional)
- Invited case studies by various Digital Health companies (optional)

## Recommended Literature

- Gupta R.P. (2021): Digital Health ? Truly Transformational. Wolters Kluwer.
- Gogia S (2020): Fundamentals of Telemedicine and Telehealth. Elsevier. https://doi.org/10.1016/B978-0-12-814309-4.00004-5
- Jude H.D., Balas V.E. (2019): Telemedicine Technologies: Big Data, Deep Learning, Robotics, Mobile and Remote Applications for Global Healthcare. Elsevier.
- Topol E. (2019): Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. 1st Edition. Basic Books, NY (US).
- Hoyt R.E., Hersh W.R. (2018): Health Informatics: Practical Guide. 7th edition. Endorsed by AMIA.
- Istepanian R.S.H., Woodward B. (2017): m-Health: Fundamentals and Applications. Wiley, New Jersey
- Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- Fong B., Fong A.C.M., Li C.K. (2011): Telemedicine Technologies: Information Technologies in Medicine and Telehealth. Wiley, Chichester (UK).
- Wootton R., Patil N.G., Scott R.E., Ho K. (2009): Telehealth in the Developing World. Royal Society of Medicine Press, London/Glasgow.
- Graschew G. and Rakowsky S. (2011): Telemedicine Techniques and Applications. InTech.

# MDH-09 Health Economy & Management (HEM)

| | |
|---|---|
| Module code | MDH-09 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| | Health Care |
| Course number and name | MDH-09 Health Economy & Management (HEM) |
| Lecturer | Prof. Dr. Georgi Chaltikyan |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written student research project |
| Weight | 5/90 |
| Language of Instruction | English |
| | Management of Health Services and Systems;<br>Countrynalysis™ of Global Health Systems |

## Module Objective

### Learning Outcomes of the Module:

The students will learn all relevant parts of management in healthcare organizations and health systems. They will understand that the future leaders of healthcare systems need to be able to integrate theory and practice and to have the adaptability and flexibility that comes from really understanding the nature of management and leadership. The students will learn different scenarios of healthcare insurance systems. They will simulate the outcome of changes in the structure of insurance systems.

The module includes on overview of the structure of healthcare systems in selected countries worldwide. The focus is on the developmental history of the national healthcare systems, financing, and delivery infrastructure.

After completing the module International Healthcare the students will have achieved the following learning objectives:

**Professional competences:**

- Knowledge of the basic principles and constituents of health economics;
- Knowledge of different approaches to the production, funding, and distribution of health care using health economics and econometrics techniques;
- Knowledge of various healthcare services (primary, acute care, chronic and integrated care, mental care, social and long-term care);
- Knowledge of healthcare funding methods, including transactions between providers who transfer resources to patients, and transactions between patients or third parties who transfer resources to providers;
- Knowledge of healthcare costs and classification into direct, indirect and intangible costs;
- Knowledge of the main modalities of economic evaluation in health care, and of Health Technology Assessment (HTA);
- Knowledge of the main structural and operational characteristics of the healthcare systems in different high-, middle, and low-income countries.

**Methodical expertise:**

- Application of macro- and microeconomics methods to analysis and evaluation of health services and systems in various countries and settings;
- Outline the key actors and organizations in health systems globally and in selected countries, and the manner in which they operate to address critical health issues;
- Usage of various economic evaluation and HTA modalities such as cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis.

**Personal competences:**

- Ability to analyze the structure and understand the meaning of evaluations of health economies and management of health services;
- Present a health system of a particular country in a comprehensive way.

**Social competence:**

- Working in small groups evaluating and presenting various healthcare management issues and challenges in different countries.

## Applicability in this and other Programs

A foundational module for understanding of the functioning and management of health services and health systems.

Can be used in other study programs related to healthcare.

## Entrance Requirements

None

## Learning Content

1 Introduction to healthcare management and health economics: management and leadership in healthcare; the study of Healthcare Management; the subject of Health Economics; History of Healthcare Management and Health Economics; Elements of Healthcare Management and Health Economics.
2 Demand and Supply in Healthcare: health and healthcare; healthcare as an economic goods; wants, demands and needs; macroeconomics and microeconomics; demand and supply in healthcare; demand functions; the determinants of demand; price and income elasticity of demand; understanding investment in health care; profit maximization models; structure, conduct and performance in healthcare industry.
3 Markets, Market Failure, Role of Government, & Health Insurance: the efficiency of competitive markets; using perfectly competitive markets to allocate resources; firms, markets, and industries in health care sector of the economy; government intervention in health care; market failure in health care; is healthcare a public good; uncertainty and risks in healthcare; history and terminology in health insurance; types and modalities of health insurance; the demand for health insurance.
4 Management of Health Services and Health Systems: healthcare services; Primary Health Care Services; Acute Care Services; Chronic and Integrated Care; Mental Health Services; Social and Long-Term Care Services; introduction to health systems; components of health systems; categorization of health systems; history and current state of Universal Health Coverage; health expenditure measures; total health expenditure; public health expenditure; private health expenditure; out-of-pocket health expenditure; per capita health expenditure in different countries and areas around the world; major trends in health expenditure and financing; major health systems issues.
5 Financing and Purchasing in Healthcare: funding methods and healthcare costs; allocating resources for healthcare; purchasing and contracting healthcare; capital in the health systems: buildings, facilities, equipment; healthcare workforce; governance and accountability in healthcare.
6 Health Technology Assessment & Economic Evaluation in Healthcare: what is economic evaluation? principles of economic evaluation in health care;

Health Technology Assessment (HTA); Cost-Effectiveness Analysis (CEA); Cost-Benefit Analysis (CBA); Cost-Utility Analysis (CUA); Cost-Minimization Analysis (CMA); economic evaluation applied to health care programs; decision analysis.

**Review of International Health Systems:**

1 Healthcare in Germany;
2 Healthcare in USA;
3 Healthcare in Canada;
4 Healthcare in UK;
5 Healthcare in France;
6 Healthcare in Japan;
7 Healthcare in Russia;
8 Healthcare in India;
9 Healthcare in Brazil;
10 Healthcare in Select African countries.

## Teaching Methods

Lectures, seminar discussions, group work, case studies, student presentations.

## Remarks

Guest lecture by an external expert (optional)

## Recommended Literature

- Kieran Walshe and Judith Smith: Healthcare Management, 3rd edition, Open University Press, McGraw-Hill Education, 2017;
- Bernard J. Healey: Introduction to Health Care Services: Foundaitons and Challenges, Wiley, 2015;
- James A. Johnson, Carleen Stoskopf, Leiyu Shi: Comparative Health Systems: Global Perspectives, 2nd edition, Jones & Bartlett Learning (JBL) 2018;
- Sherman Folland, Allen C. Goodman, Miron Stano: The Economics of Health and Healthcare, 8th edition, Routledge, 2017;
- Frank A. Sloan and Chee-Ruey Hsieh: Health Economics, 2nd edition, MIT Press, 2016;
- Jay Bhattacharya, Timothy Hyde, Peter Tu: Health Economics, Palgrave Macmillan, 2014;
- Margie Lovett-Scott and Faith Prather: Global Health Systems: Comparing Strategies for Delivering Health Services, Jones & Bartlett Learning (JBL) 2014.

# MDH-10 Digital Health Data Protection (DHD)

| | |
|---|---|
| Module code | MDH-10 |
| Module coordination | Prof. Dr. Thomas Spittler |
| | Digital Health |
| Course number and name | MDH-10 Digital Health Data Protection (DHD) |
| Lecturers | Christian Roth<br>Prof. Dr. Thomas Spittler |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | written ex. 90 min. |
| Duration of Examination | 90 min. |
| Weight | 5/90 |
| Language of Instruction | English |
| | |

## Module Objective

**Learning Outcomes of the Module:**

The use of data in the field of digital health places high demands on security and is subject to strict legal framework conditions. In addition to the identification of suitable concepts and methods, research-relevant questions and results are also part of the module. Furthermore, techniques and tools in the secure handling of health data in the context of digital health use cases are taught.

After completing the module, the students will have achieved the following learning targets:

**Professional competence:**

- The students use concepts and methods for the appropriate handling of health data.
- They apply modern encryption methods or concepts for anonymisation and pseudonymisation.
- They identify threats and vulnerabilities in digital health use cases.
- They analyse research results, for example in the area of overarching identity management, quantum cryptography, security of wearables and sensors.
- You analyse risks in the combination of health data (e.g. Big Data analysis) and derive measures to protect health data.
- They contrast techniques and tools in handling health data.

**Methodological expertise:**

- The students create documents for risk analysis and justify their risk assessment.
- They select methods for threat and vulnerability analysis or Big Data security.
- They review the current scientific status and develop it further.
- They transfer theoretical knowledge regarding IT security, data protection and cyber forensics to use cases in the real world.
- They are able to independently develop and use suitable sources of information to solve problems.

**Personal competence**:

- The students will be able to recognize that there is no 100 percent security. They will be able to explain that IT security is not a simple product but a complex process that supervises the internal IT infrastructure, teaches users and collects information about external IT security developments and threats.
- Students will be able to understand and explain why well qualified and instructed users are a very important support to secure the IT infrastructure, the user, customer or patient data and the intellectual property of the organization.
- They develop discussion skills and techniques.

**Social competence:**

- Students are capable of precise and goal-oriented communication as a result of working on a complex product in a team.
- Students will be able to recognize that users are often the biggest backdoor of the IT infrastructure. Nevertheless, the IT department must help users to fulfill their work in an efficient and secure way. Otherwise users will find ways around specified way. The user is always part of the solution.

## Applicability in this and other Programs

This module is fundamental to the most Medical Informatics competences; it is closely interrelated with the module 5 - Standards, Terminology and Classification in Medicine.

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## Entrance Requirements

Essential knowledge in Software Programming in a modern language like python or Java.

## Learning Content

1 Access Control and Identity Management
2 Applied Cryptography
  2.1 Encryption of Messages and Volumes
  2.2 Digital Signatures
  2.3 Blockchain
  2.4 Impact of Quantum Computing on Crypto Systems and Quantum Cryptography
3 Risk Assessment and Threats
  3.1 Detection and Analysis of Threats
  3.2 Assessment of Risks
  3.3 Measure and Threat Avoidance
  3.4 Backup Strategies and Business Continuity
4 Digital Forensic and Cyber Security
  4.1 Computer and Mobile Device Forensic
  4.2 Network Forensic
  4.3 Forensic Process and Techniques
  4.4 Data Preparation and Database Analysis
  4.5 Multi Layer Security and Containments
  4.6 Competition between Virus/Trojans and Anti-Virus-Software/Firewalls
  4.7 Privacy and Social Hacking
5 Legal Regulations and Standards for Privacy and Data Security
6 Scientific Research
  6.1 Network Theory in the field of Cyber Security
  6.2 Investigation of Blockchain based Solutions vs. Trust Center Approach
  6.3 Security of wearables and sensors
7 Use Cases
  7.1 Identity Management and Identity Propagation
  7.2 Smart Contracts (Blockchain)

## Teaching Methods

Combination of lectures, seminars, practical work, and student presentations.

## Remarks

- Working with Software tools installed on the Campus
- Guest lectures by experts in the field
- Field visits to hospitals and clinics.

## Recommended Literature

- Edward K. Blum / Alfred V. Aho (2011), Computer Science: The Hardware, Soft- ware and Heart of It, Springer Sci- ence+Business Media New York.
- Marshall Kirk McKusick / George V. Ne- ville-Neil / Robert N. M. Watson (2014) The Design and Implementation of the FreeBSD Operating System (Second Edition), Addison-Wesley.
- Christof Paar / Jan Pelzl / Bart Preneel (2009) Understanding Cryptography ? A Textbook for Students and Practition- ers, Springer
- John R. Vacca (2013), Cyber Security and IT Infrastructure Protection, Syngress.
- John Gomez, Colin Konschak (2015), Cyber-Security in Healthcare, Sensato.
- Sebastian Klipper (2015), Information Security Risk Management (Edition kes, 2. Auflage), Springer Vieweg (German)
- Gupta, S., Banerjee, I. & Bhattacharyya, S. (2019). Big Data Security. Berlin, Boston: De Gruyter. https://doi.org/10.1515/9783110606058
- Singh, B., Saini, B. S., Singh, D., & Pandey, A. (Eds.). (2019). Medical Data Security for Bioengineers. IGI Global. http://doi:10.4018/978-1-5225-7952-6
- Lopez, D., & Durai, M. (Eds.). (2018). HCI Challenges and Privacy Preservation in Big Data Security. IGI Global. http://doi:10.4018/978-1-5225-2863-0
- Wilson, Y., Hingnikar, A. (2019) Solving Indentity Management in Modern Applications. Spinger. https://www.springer.com/gp/book/9781484250945
- Hassanien, A., Elhoseny, M. (2019). Cybersecurity and Secure Information Systems. Springer. https://www.springer.com/gp/book/9783030168360
- Mittelbach, A., Fischlin, M. (2021). The Theory of Hash Functions and Random Oracles. Springer. https://www.springer.com/gp/book/9783030632861

# MDH-11 FWP-1: Digital Health Management (DHM

| | |
|---|---|
| Module code | MDH-11 |
| Module coordination | Prof. Dr. Dominik Böhler |
| | Specialization Module 1 |
| Course number and name | MDH-11 FWP-1: Digital Health Management (DHM) |
| Lecturers | Prof. Dr. Dominik Böhler<br>Anna Schmaus-Klughammer |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | compulsory elective course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | Projekt |
| Weight | 5/90 |
| Language of Instruction | English |
| | Management of Digital Health Processes, Projects and Programs, International Project Management |

## Module Objective

This is one of the four elective specialization modules that aim to develop Digital Health competences in various subspecialist fields:

MDH-11 Digital Health Management (DHM) - Program and Project Management, Regulatory, Reimbursement
MDH-12 Digital Health Data Analytics and AI (DHI) - Data Science, Data Engineering

MDH-13 Digital Health Entrepreneurship (DHE) - Product Management, Business and Startup Development

MDH-14 Digital Health Programming (DHP) - Software Engineering, Software Development

Digital transformation of the health system has become a priority for healthcare leaders all over the world. WHO recommended all members states developing strategies and policies towards digitalization of their health systems. Achieving transformational potential of Digital Health in improving equity, quality, accessibility, affordability, and acceptability of health services, will require sound theoretical knowledge, as well as practical skills and competences in designing, developing and implementing innovative digital health services at institutional, local, regional, national and international levels.

This module aims at developing a practical and hands-on understanding of how to manage a Digital Health program, project or product, with a special focus on detailed understanding of regulatory frameworks and reimbursement in the target market. The training in this module is organized in the context of an innovation project conducted with a cross-functional team (students work in small groups).

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Students know the strategic framework of developing of Digital Health projects and programs at institutional, local, regional, national and international levels
- Students will know the five main project management points (goal, time frame, team building, tracking, ending)
- Students know how the reimbursement system in their chosen target market works
- Students know how to manage regulatory affairs in their chosen target market
- Students understand and apply the necessary documentation and legal framework

**Methodological expertise:**

- Applying the knowledge of program and project management in real-world scenarios in Low and Middle Income Countries (LMICs) and in High Income Countries (HICs)
- Understanding and applying the major legal norms and frameworks in both regulatory and reimbursement
- Creating both pathways for regulatory and reimbursement and align them with other functions in the team
- Understand and apply regulatory and reimbursement strategies in an agile business model generation project

**Personal competence:**

- Students understand and apply conflict and negotiation strategies
- Students are able to discuss complex legal and ethical issues in Digital Health
- Students are able to reflect and discuss their own preferences

**Social competence:**

- Students experience working in a cross-functional team
- Students understand how a joint vision develops under uncertainty

## Applicability in this and other Programs

This is one of 4 specialization electives necessary for developing practical skills and competences in Digital Health domain. It can also be offered in other postgraduate programs in Health Sciences.

## Entrance Requirements

Completed modules on Digital Health Fundamentals, Global and International Health.

## Learning Content

1 Introduction to Digital Health Project, Program and Product Management
2 Personal Vision and Leadership
3 Teams and Teambuilding
4 Strategic Development
5 Agile Project Management
6 Designing and Developing Digital Health Project, Program or Product
7 Implementing and Monitoring Digital Health Project, Program or Product
8 Reimbursement Models in Digital Health Project, Program or Product
9 Managing Regulatory Affairs in Digital Health
10 Building innovative Digital Health solutions

## Teaching Methods

Team-based project work is the main teaching method, with lecturing, tutoring and guidance by the teachers. Students will join a cross-functional team developing a Digital Health product or program. They will work in the role of a project manager / medical lead. The teams will follow a 2-week sprint pattern in their agile development process. During the final presentation the project work will be graded.

## Remarks

Guest lecture by a prominent Digital Health Manager (optional)

## Recommended Literature

- Digital health platform handbook: building a digital information infrastructure (infostructure) for health. Geneva: World Health Organization and International Telecommunication Union, 2020. https://apps.who.int/iris/bitstream/handle/10665/337449/9789240013728-eng.pdf?sequence=1&isAllowed=y.
- WHO guideline: recommendations on digital interventions for health system strengthening. Geneva: World Health Organization; 2019. https://www.who.int/reproductivehealth/publications/digital-interventions-health-system-strengthening/en/.
- American Medical Association Digital Health Implementation Playbook, 2018. https://www.ama-assn.org/system/files/2018-12/digital-health-implementation-playbook.pdf.
- American Medical Association Telehealth Implementation Playbook, 2020. https://www.ama-assn.org/system/files/2020-04/ama-telehealth-playbook.pdf.
- California Telehealth Resource Center: The CTRC Telehealth Program Developer Kit, 2014. https://www.careinnovations.org/wp-content/uploads/1-CTRC-Telehealth-Program-Developer-Kit.pdf.

**Project/Product Management:**

- Kuster, J., Huber, E., Lippmann, et al. (2015). Project Management Handbook, Management for Professionals, Springer-Verlag Berlin Heidelberg
- Edge, J. (2018). Agile: An Essential Guide to Agile Project Management, The Kanban Process and Lean Thinking + A Comprehensive Guide to Scrum. Luxemburg: CreateSpace Independent Publishing Platform
- Kunow, A. (2019). Project Management & Business Coaching: Agile project management - target-oriented and efficient with active body language & comprehensive communication. Buchum, Germany: KISP Bücher.
- Cagan, Marty. Inspired: How to Create Tech Products Customers Love, John Wiley & Sons, Incorporated, 2017. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=5152848.
- Banfield, Richard, et al. Product Leadership: How Top Product Managers Launch Awesome Products and Build Successful Teams, O'Reilly Media, Incorporated, 2017. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=4858079.

- Moussa, Mario, et al. Committed Teams: Three Steps to Inspiring Passion and Performance, John Wiley & Sons, Incorporated, 2016. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=4413730.
- Sutherland, J. (2015). Scrum: the art of doing twice the work in half the time. London: Random House Business Books.
- Wysocki, R. (2014). Effective project management: traditional, agile, extreme. Indianapolis, IN: Wiley

**Regulatory:**

- Johner, Christian, et al. Basiswissen Medizinische Software : Aus- und Weiterbildung zum Certified Professional for Medical Software, dpunkt.verlag, 2020. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=6379308.

# MDH-12 FWP-2: Digital Health Data Analytics & Artificial Intelligence (DHI)

| | |
|---|---|
| Module code | MDH-12 |
| Module coordination | Prof. Dr. Mouzhi Ge |
| | Specialization Module 2 |
| Course number and name | MDH-12 FWP-2: Digital Health Data Analytics & Artificial Intelligence (DHI) |
| Lecturer | Prof. Dr. Mouzhi Ge |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | compulsory elective course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | Projekt |
| Weight | 5/90 |
| Language of Instruction | English |
| | |

## Module Objective

In the era of big data analytics and personalized healthcare, healthcare institutions are dealing with tremendous amounts of data. These data are Electronic Health Records (EHR) moving and can originate from various sources, such as healthcare Electronic Health Records (EHR), unstructured data from different health medical imaging and multimedia archives, or raw-data feeds from wearable health sensors. Digital Health Data Analytics and Artificial Intelligence are used to optimize healthcare processes and reduce the critical decision-making time, This is to improve operational effectiveness in healthcare

domain. The merge of Digital Health and Artificial Intelligence also leverages point of care diagnostics, decision support, computer aided detection, quantification of disease burden, computer-aided diagnosis. Therefore, it creates new challenges for data science researchers and practitioners to address Big Data analytics in Healthcare.

The overall aim of this module is to introduce the students to the main features and processes of data science in digital health and how digital health support systems can be designed and implemented in practice.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Knowledge of the main principles of Big Data processing;
- Knowledge of the data flow and main components in Big Data Architecture;
- Understanding of the Data Quality Management and Data Cleansing;
- Understanding of Unsupervised Learning algorithms such as clustering algorithms;
- Understanding of Supervised Learning algorithms such as binary classification, multi-class classification and segmentations;
- Understanding of model selections and real-world application contexts.
- Interpretability of AI

**Methodological expertise:**

- The students can evaluate machine-learning algorithms with offline, online, and user study evaluation methodologies.
- Application of narrow AI: Simple lesion annotation in medical imaging
- The students can build functioning decision support systems in various application domains such as recommender systems in movie, music, or book etc.

**Personal competence:**

- Ability to critically discuss the advantages and disadvantages of machine learning models, big data architectures and evaluation criteria;
- Ability to reflect on fairness, trust and responsibility of AI;
- Ability to analyse and discuss the ethical issues in AI.

**Social competence:**

Group work on building recommender system by assigning different building blocks to team members.

## Applicability in this and other Programs

This module is one of the 4 elective specialization modules (FWPs) in the second semester; it is closely interrelated with the MDH-04 Digital Health Technology (DHT) and MDH-08 Digital Health Applications (DHA).

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## Entrance Requirements

Basic knowledge in programming; knowledge of mathematics and statistics; knowledge of computing algorithms.

## Learning Content

1 Big Data Architecture for Healthcare: importance of major components of Big Medical data processing; Data selection; data pre-processing component; data extraction; data LTE: data processing, data analysis, data visualization, data lake; data storage; data asset; data as a service; big data in digital health.
2 Data Quality Management: overview, rationale, need, benefits (added value) and challenges of data quality management; healthcare data quality management; data quality dimensions; data cleaning methods; total data quality management model; healthcare data quality application and model development; data quality governance in healthcare; open data for digital health.
3 Unsupervised Machine Learning: the importance of clustering; overview of current clustering algorithm; probabilistic methods in unsupervised; intuitions and details of the unsupervised learning algorithms; evaluation metrics of the unsupervised learning algorithms; application of unsupervised machine learning in healthcare; collaborative filtering algorithms in healthcare; content-based algorithms in healthcare.
4 Supervised Machine Learning: development history; main processes and factors for supervised machine learning; data cleaning for labels in supervised machine learning; data wrangling in supervised machine learning; supervised machine learning algorithms; application of supervised machine learning in healthcare; evaluation of supervised learning algorithms, Deep Learning, CNN.
5 Recommender Systems in Healthcare: introduction to recommender systems; collaborative filtering recommendation; content-based recommendation; knowledge-based recommendation; hybrid recommendation approaches; explanations in recommender systems; explainable AI; group recommendations; evaluating recommender systems; case study ? personalized recommendations for healthcare; recommender systems and the next-generation Digital Health; context-aware healthcare decision support systems; interoperability with EHRs.

6 Evaluation of Healthcare AI algorithms: evaluation metrics of healthcare AI algorithms; domain-specific evaluation for healthcare AI; offline evaluation, user studies for evaluating healthcare AI algorithms; the evaluation role of AI in digital health; AI to support public health functions; ethical issue evaluation in digital health AI; global AI development for digital healthcare; challenges in Public Health AI; intelligent health systems; future trends.

## Teaching Methods

Combination of lectures, seminars, project work, supervised problem based learning and student presentations.

## Remarks

- Working with real-world datasets and joining open AI challenges
- Guest lectures by experts in the field
- Building real-world recommender systems for digital health

## Recommended Literature

- Stuart Russell and Peter Norvig, Artificial Intelligence (2020): A Modern Approach, Fourth edition, Publisher: Prentice Hall.
- Ray Kurzweil (2012), How to Create a Mind: The Secret of Human Thought Revealed, ISBN-10 : 0670025291, Publisher : BRILLIANCE CORP
- Ian Goodfellow and Yoshua Bengio and Aaron Courville (2016), Deep Learning, MIT Press,
- Calum Chace, Surviving AI (2015): The promise and peril of artificial intelligence, ISBN-10 : 0993211623, Publisher : Three Cs
- Nishant Shukla (2018), Machine Learning with TensorFlow, Publisher : Manning Publications, ISBN-10 : 1617293873
- Jannach, D., Zanker, M., Felfernig, A., & Friedrich, G. (2010). Recommender Systems: An Introduction. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511763113
- http://aima.cs.berkeley.edu/
- http://www.deeplearningbook.org
- http://mitiq.mit.edu/publications.aspx
- http://www.recommenderbook.net/

# MDH-13 FWP-3: Digital Health Entrepreneurship (DHE)

| | |
|---|---|
| Module code | MDH-13 |
| Module coordination | Prof. Dr. Dominik Böhler |
| | Specialization Module 3 |
| Course number and name | MDH-13 FWP-3: Digital Health Entrepreneurship (DHE) |
| Lecturer | Prof. Dr. Dominik Böhler |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | compulsory elective course |
| Level | postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | Projekt |
| Weight | 5/90 |
| Language of Instruction | English |
| | Digital Health Entrepreneurship (DHE): Business, Markets and Innovation |

## Module Objective

This is one of the four elective specialization modules that aim to develop Digital Health competences in various subspecialist fields:

MDH-11 Digital Health Management (DHM) - Program and Project Management, Regulatory, Reimbursement

MDH-12 Digital Health Data Analytics and AI (DHI) - Data Science, Data Engineering

MDH-13 Digital Health Entrepreneurship (DHE) - Product Management, Business and Startup Development

MDH-14 Digital Health Programming (DHP) - Software Engineering, Software Development

Building Digital Health Products and Business Models requires detailed understanding of user needs, as well as a solid business development knowledge, skills and competences. Developing a personal vision and a product concept based within complex healthcare systems is challenging. Students in this course learn the basic tools for developing digital products and product teams. Herein they will lead an agile product development team developing a functional digital health application based on real customer and user needs.

This module aims at developing a practical and hands-on understanding of how to manage a Digital Health product and commerce, with a special focus on detailed understanding of the Digital Health startup management, Digital Health markets, business models and plans, investment opportunities, and successful scaleup and exit strategies. The training in this module is organized in the context of an innovation project conducted with a cross-functional team (students work in small groups).

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Knowledge of the steps of product development
- Knowledge of the principles of lean startup management
- Understanding Product Management as a role
- Knowledge of investment and funding mechanisms
- Understanding of the design thinking approach

**Methodological expertise:**

- Applying agile project work in a practical context
- Applying tools and methods from the business design toolbox
- Developing skills necessary to manage an agile team
- Designing and Testing Business Models

**Personal competence:**

- Experiencing leading and coaching a cross-functional team
- Managing across cultures and disciplinary boundaries

**Social competence:**

- Understanding how to solve conflict in diverse teams
- Presenting and pitching a personal product vision

## Applicability in this and other Programs

This is one of 4 specialization electives necessary for developing practical skills and competences in Digital Health domain; it is closely interrelated with the MDH-11 Digital Health Management.

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## Entrance Requirements

Completed modules on Digital Health Fundamentals, Global and International Health.

## Learning Content

1 Entrepreneurial Mindset
2 Methods and Tools for Business Design
  2.1 Lean Startup Methodology
  2.2 Design Thinking
  2.3 Business Model Generation
3 Sales Strategy and Process in Healthcare
4 Financial Modelling
5 Investment Strategy and Investor Relations for Startups
6 Building Exciting Organizations

## Teaching Methods

Team-based project work is the main teaching method, with lecturing, tutoring and guidance by the teachers. Students will join a cross-functional team developing a Digital Health product or program. They will work in the role of a product manager / business lead, who is designing and developing the product vision and leading a startup. This includes building and aligning a team across a specific product vision and managing the testing process with real users and customers in a hypothesis-driven framework. The teams will follow a 2-week sprint pattern in their agile development process. During the final presentation the project work will be graded.

## Remarks

Guest lectures by successful Digital Health startups (optional).

## Recommended Literature

- Lewrick, Michael, et al. Das Design Thinking Playbook : Mit traditionellen, aktuellen und zukünftigen Erfolgsfaktoren, Versus, 2017. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=4852944.
- Bland, David, and Alexander Osterwalder. Testing Business Ideas, John Wiley & Sons, Incorporated, 2019. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=5974984.
- Osterwalder, Alexander, et al. Value Proposition Design : How to Create Products and Services Customers Want, John Wiley & Sons, Incorporated, 2014. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=1887760.
- Aulet, Bill. Disciplined Entrepreneurship Workbook, John Wiley & Sons, Incorporated, 2017. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/th-deggendorf/detail.action?docID=4826750.

# MDH-14 FWP-4: Digital Health Programming (DHP)

| | |
|---|---|
| Module code | MDH-14 |
| Module coordination | Prof. Dr. Mouzhi Ge |
| | Specialization Module 4 |
| Course number and name | MDH-14 FWP-4: Digital Health Programming (DHP) |
| Lecturers | Prof. Dr. Mouzhi Ge<br>Christian Roth |
| Semester | 2 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | compulsory elective course |
| Level | Postgraduate |
| Semester periods per week (SWS) | 4 |
| ECTS | 5 |
| Workload | Time of attendance: 60 hours<br>self-study: 90 hours<br>Total: 150 hours |
| Type of Examination | Projekt |
| Weight | 5/90 |
| Language of Instruction | German |
| | Digital Health Programming (DHP): Advanced Software Engineering |

## Module Objective

This is one of the four elective specialization modules that aim to develop Digital Health competences in various subspecialist fields:

MDH-11 Digital Health Management (DHM) -Program and Project Management, Regulatory, Reimbursement

MDH-12 Digital Health Data Analytics and AI (DHI) - Data Science, Data Engineering

MDH-13 Digital Health Entrepreneurship (DHE) - Product Management, Business and Startup Development

MDH-14 Digital Health Programming (DHP) - Software Engineering, Software Development

Digital Health Programming can be framed from two fundamental views, one view is to consider the healthcare as a key business logic and programming as the technical enabler, the other view is to consider programming as key technologies and the technologies are applied in the healthcare domain. Either view can be derived from health or IT domain experts. However, both views intend to merge the healthcare domain knowledge and IT programming. As such, the integration between health and IT becomes the essential value to enable Digital Health. The merger of Digital Health and Advanced Software Engineering leverages healthcare information systems, digital diagnostics, computer aided healthcare decision support, EHR management systems.

This module aims at developing a practical and hands-on understanding of the main processes of advanced software engineering in Digital Health: how medical software can be designed, developed, improved and deployed in a real-world DevOps setting.

After completing the module, the students will have achieved the following learning objectives:

**Professional competence:**

- Knowledge of the main principles of advanced software engineering in healthcare;
- Knowledge of the data flow and main components in healthcare DevOps;
- Understanding being a full-stack developer in Digital Health;
- Understanding of the front-end and back-end design;
- Understanding of the whole loop to integrate front-end design and back-end design to support healthcare applications;
- Understanding of the real-world Digital Health contexts.

**Methodological expertise:**

- The students can evaluate full-stack system design for healthcare information systems;
- Application of advanced software engineering: abstract function, objects or module in various digital health contexts;
- The students can build functioning healthcare information systems in various application domains such as a complete web (or Android app) or a software application for healthcare domain.

**Personal competence:**

- Ability to critically discuss the advantages and disadvantages of technology selection and programing design for Digital Health;
- Ability to reflect on reusability, testing and user experience of healthcare information systems;

- Ability to analyse and discuss the ethical and data privacy issues in advanced software engineering.

**Social competence:**

- Teamwork on building healthcare information systems by assigning different building blocks to team members.

## Applicability in this and other Programs

This is one of 4 specialization electives necessary for developing practical skills and competences in Digital Health domain; it is closely interrelated with the MDH-12 Digital Health Data Analytics & Artificial Intelligence.

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## Entrance Requirements

Knowledge of database is a prerequisite; essential knowledge of web or software programming such as PHP or Python or Java

## Learning Content

1 Healthcare domain requirements: importance of major components of medical data processing; importance of data privacy in healthcare, privacy-preserving system objectives, data processing in healthcare, business logic in healthcare domain.

2 System design for healthcare information systems: overview, rationale, need, benefits and challenges of health care information systems; process modelling for healthcare system; user interaction modelling for healthcare system; ER modelling for healthcare data in relational database; UML modelling for objects in healthcare systems; workflow design for healthcare information systems.

3 Implementation of healthcare information systems: the importance of software development process; selection of the right programming technologies for healthcare information systems, full command of certain IDE such as Eclipse, PHPstorm, PyCharm etc. independent implementation and get used to the de-bugging in your program; practice of pair programming, hands on experience for full-stack development, including both front-end and back-end development.

4 Testing for healthcare information systems: the importance of Test-Driven Development (TDD); Unit testing; White-box testing such as Control flow testing, Data flow testing, Path testing etc.; Black-box testing such as All-

pairs testing, Error guessing, Use case testing etc.; Bug documentation; Issue tracking systems.

5 Deployment and maintenance for healthcare applications: introduction to web server; installation software; path management; package dependency; deployment options; real-world deployment; maintenance of a live healthcare system; general security issues such as injection; case study of HER management systems; healthcare DevOps.

6 User experience in advanced software engineering for digital health: User experience principles, evaluation metrics of healthcare information systems; domain-specific evaluation for healthcare system; user studies for evaluating healthcare information system; global technology development for digital healthcare; challenges in Public Health; intelligent health systems; future trends.

## Teaching Methods

Team-based project work is the main teaching method, with lecturing, tutoring and guidance by the teachers. Students will join a cross-functional team developing a Digital Health product or program. They will work in the role of a software developer / software engineer. The teams will follow a 2-week sprint pattern in their agile development process. During the final presentation the project work will be graded.

## Remarks

- Build a functioning healthcare information system, which can be simple but working and totally deployable, e.g. on the web server or cloud or with installable software;
- Guest lectures by experts in the field (optional);
- Building hands-on experience in advanced software engineering.

## Recommended Literature

- Gerald L. Glandon, Donna J. Slovensky, Detlev H. Smaltz, Information Technology for Healthcare Managers, Publisher : AUPHA/HAP Book; 9th edition (August 1, 2020), ISBN-10 : 1640551913.
- Chris Northwood: The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Publisher: Apress; 1st ed. edition (November 20, 2018).
- Gerald Glandon: Information Systems for Healthcare Management, Publisher : Health Administration Press; 8th edition (August 1, 2013), ISBN-10: 1567935990

- Martin Fowler: Patterns of Enterprise Application Architecture, Publisher : Addison-Wesley Professional; 1st edition (November 5, 2002), ISBN-10: 0321127420
- Robert Martin: Agile Software Development, Principles, Patterns, and Practices, Publisher : Pearson; 1st edition (October 15, 2002), ISBN-10: 0135974445
- Karen A. Wager, Frances W. Lee, John P. Glaser: Health Care Information Systems: A Practical Approach for Health Care Management, Publisher : Jossey-Bass; 4th edition (March 27, 2017), ISBN-10: 1119337186
- Robert C. Martin: Clean Code: A Handbook of Agile Software Craftsmanship, Herausgeber: Prentice Hall; 1. Edition (1. August 2008) ISBN-10 : 9780132350884.

# MDH-15 Intercultural and Scientific Communication & Management

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| Module code | MDH-15 |
| Module coordination | Prof. Dr. Michelle Cummings-Koether |
| Course number and name | MDH-14 Intercultural and Interdisciplinary Communication and Leadership |
| Lecturer | Prof. Dr. Michelle Cummings-Koether |
| Semester | 3 |
| Duration of the module | 1 semester |
| Module frequency | annually |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 6 |
| ECTS | 6 |
| Workload | Time of attendance: 70 hours<br>self-study: 110 hours<br>Total: 180 hours |
| Type of Examination | Projekt |
| Weight | 6/90 |
| Language of Instruction | English |
| | |

## Module Objective

Intercultural differences can have a great influence on management decisions and outcomes. In addition, the use of basic soft skills adds another dimension of communication to the management environment. For future managers, intercultural competence, combined with soft skills and emotional intelligence, will be one of the most important requirements for working successfully in a global environment.

Intercultural differences can also affect the ability to constructively work together in scientific and academic environments. Often those differences are not recognized until

after misunderstandings have already begun. Many conflicts in international teams can be led back to cultural differences, and the ability to recognize the causes of these conflicts, as well as the ability to rationalize different possibilities to solve these conflicts, is an essential part of being culturally competent.

When one adds the layer of scientific communication, especially when presenting to international audiences, then the necessity for these skills becomes invaluable. This ability to recognize and respond appropriately to cultural differences can help lead to more successful working relationships as well as better scientific and academic work. Therefore, this class will primarly focus on the rhetorik of scientific communication.

Intercultural competence is the ability to recognized one´s own cultural patterns, and the ability to respond to other's cultural patterns in the best way possible for both sides, and to find way to reduce misunderstandings and conflicts for future cultural interactions.

In addition, effective leadership requires good communication skills. Effective rhetoric, argumentation skills, and presentations skills are part of a basic set of skills, that are required for todays global management environment. In addition, the need to be able to present scientific results, especially in international environments, is closely related. The ability to be able to present scientific infomation to various audiences, and through differing mediums, is essential in the medical environment.

Beyond that, interdisciplinary communication requires the skill to combine different set of knowledge from various background fields, and the acquirement and proper use soft skills, in order to build the trust and relationships that modern international management, especially in the medical field, requires. The combination of all of the above communication, cultural and soft skills help to achieve the goal to be able to communicate globally.

After completing the course, the students are expected to have the following competences and skills.

- Develop knowledge and understanding of key theories, concepts and models in intercultural communication.
- Familiar with different cultural standardization models, and how to apply these to various cultures.
- The ability to work with other cultures on a common level of understanding, based on an analysis of commonalities and differences.
- To better understand and solve cultural and communication problems, and to recognize how these affect international working environments.
- The ability to combine different approaches to management, leadership and soft skills, and to analyze the best approach to utilizing these in order to lead more effectively.
- Have improved communication, rhetoric and presentation skills, and to apply these especially to intercultural and scientific communication.

- To be more effective in international environments, by recognizing their own emotional intelligence and leadership skills.
- The students are able to understand how communication and leadership differs in various cultures, and how communication styles need to be adjusted to various combinations of culture.
- They are able to analyze the effectiveness of working with others on various levels, that go beyond skill sets, and look for cultural and communication patterns that work well with their own patterns.
- They can rationalize which communication approaches will be best suited for various situation.
- The ability to differentiate between the different types of cultures.
- They will be able to combine soft skills and communication skills, to better be able to communicate on a scietific level in differing fields, especially in international environments.

The module examines case studies and readings that focus on general concepts of culture as well as in particular on issues of intercultural competence, cultural identity and cultural diversity from a strategic, organizational and management perspective, combined with communication skills on various levels, and applies this to communication theory, with a focus on leadeship within the medical field.

- They can look at certain behavior in a certain culture, and are able to recognize what cultural standards and communication expectations are driving this behavior, thus being able to adapt their own behavior to be able to react appropriately.
- They will be able to combine approaches from interdisciplinary fields, in order to communicate more effectively and individually.
- The ability to understand one's own cultural patterns and attitude
- The possibility to increase one's own tolerance for cultural differences
- Increased cultural and emotional intelligence
- Students should develop written and verbal presentational skills.
- They can demonstrate group-work, questioning and listening skills.

## Applicability in this and other Programs

Intercultural and managements problems and challenges in different international environments can identified by the students and can be solved by students after the course in an effective manner. The added communication skills will benefit the students in other fields And the scientific communication skills will be a good addition to most other courses.

## Entrance Requirements

Good English skills

International and intercultural experiences (recommended)

## Learning Content

- Definition of soft skills
- How soft skills shape international management
- Leadership and emotional/cultural intelligence
- Organizational culture in an international environment
- How intercultural leadership and scientific communication affects the medical field
- Cultural Theories
- Rhetoric in the business and scientific environment
- Presentation skills
- Argumentation skills
- Intercultural leadership and communication across various cultures
- Cultural sensitivity

More topics can be added depending of progress of the discussion, or to include current events.

## Teaching Methods

Group discussions, interactive teaching, presentations, project and case studies, self-study and certain parts in a flipped classroom environment.

## Recommended Literature

Recommended reading (if possible in the most current edition):

- Deresky, H. (2017). International Management: Managing across Borders and Cultures. New Jersey:Pearson.
- Hofstede, G. (2010). Cultures and Organizations: Software of the Mind. New York: Mcgraw-Hill.
- Kawamura, K.M. (2015). Cross Cultural Competence. A Field Guide for Developing Global Leaders and Managers. Bingley: Emerald Group Publishing.
- Lamri, J. et. al. (2019). The 21st Century Skills: How soft skills can make the difference in the digital era. Independantly published.
- Meyer, E. (2016). The Culture Map. New York: Public Affairs.

- Molinsky, A. (2013). Global Dexterity: How to Adapt Your Behavior Across Cultures without Losing Yourself in the Process. Boston, MA: Harvard Business Review.
- Riggio, R.E. & Tan, S.J. (2013). Leader Interpersonal and Influence Skills: The Soft Skills of Leadership. New York: Routledge.
- Steers, R.M., et. al. (2016). Management across Cultures: Developing Global Competencies. Cambridge, UK: Cambridge University Press.
- Trompenaars, F. & Hampden-Turner, C. (2011). Riding the Waves of Culture: Understanding Diversity in Global Business. Boston, MA: Nicholas Brealey International.

# MDH-16 Master Thesis

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| Module code | MDH-16 |
| Module coordination | Prof. Dr. Georgi Chaltikyan |
| | Master Thesis |
| Course number and name | MDH-16 Master Thesis |
| Semester | 3 |
| Duration of the module | 1 semester |
| Module frequency | |
| Course type | required course |
| Level | postgraduate |
| Semester periods per week (SWS) | 0 |
| ECTS | 24 |
| Workload | Time of attendance: 0 hours<br>self-study: 720 hours<br>Total: 720 hours |
| Type of Examination | presentation 20 min., master thesis |
| Weight | 24/90 |
| Language of Instruction | English |
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## Module Objective

By producing a Master's Thesis the students should demonstrate their ability to apply the knowledge and skills acquired during the study course, in an independently written scientific work on complex tasks.

They thus demonstrate that they have successfully completed their Master's levels studies and acquired the capacity for independent scientific work.

## Entrance Requirements

According to the paragraph 7 of the Study and Examination Regulations, those students who have collected at least 40 ECTS credits may register for the Master's Thesis.

## Learning Content

The Master's Thesis is a written report in a form of a scientific paper. It describes the scientific findings, as well as the way leading to these findings. It contains justifications for decisions regarding chosen methods for the thesis and discarded alternatives. The student?s own substantial contribution to the achieved results has to be evident. In addition, the student presents his work in a colloquium, in which the scientific quality and the scientific independence of his achievements are evaluated.

The work on the Master?s Thesis is supervised by any of the instructors within the study course (professors or lecturers). The Master?s Thesis can be written on any subject or topic related to the content of any of the modules of the study course. The students can suggest the topics for their Master?s Theses according to their research or practice preferences.

The preparation time of a Master?s Thesis according to the regulations is 6 (six) months. However, an extension up to a maximum of 8 months from the subscription date is possible (§11 APO). As a general rule, the size of the thesis (the main textual part) should be in the range of 80 pages (a 10% variation is allowed).

## Teaching Methods

Students perform an independent supervised scientific research work.

## Recommended Literature

- Jacobsen K. (2020): Introduction to Health Research Methods: A Practical Guide. 3rd edition. JBL, Burlington, MA.
- Recommendations and instructions on writing a master's thesis (available through iLearn).