

Syllabus – Master Programme in Health Informatics

4HI10

Established by the Board of Higher Education, 6 November 2009

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**Karolinska
Institutet**

1. Basic programme information

1.1. Programme code	4HI10
1.2. Programme title	Masterprogrammet i hälsoinformatik <i>Master Programme in Health Informatics</i>
1.3. Number of credits	120 credits (120 ECTS credits)
1.4. Starting date	The syllabus applies to students who commence their studies in or after autumn 2010
1.5. Specific eligibility requirements	Bachelor's degree or professional qualification worth at least 180 credits in health-care, biomedicine, technology, computer and systems sciences or informatics. English language skills equivalent to English B at Swedish upper secondary school.
1.6. Qualification	Medicine masterexamen med huvudområdet hälsoinformatik <i>(Degree of Master of Medical Science (120 credits) with a Major in Health Informatics)</i> Student som uppfyller fordringarna för examen skall på begäran få examensbevis.

2. Objectives

2.1. Objectives of second level according to the Higher Education Act

Second level education shall essentially build on the knowledge that students acquire in first level education or corresponding knowledge.

Second level education shall involve a deepening of knowledge, skills and abilities relative to first level education and, in addition to what applies to first level education, shall,

- further develop the students' ability to independently integrate and use knowledge,
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable independence or for research and development work.

2.2. Objectives of the Degree of Master according to the Higher Education Ordinance

Knowledge and understanding

For a Degree of Master students must

- demonstrate knowledge and understanding in their main field of study, including both a broad command of the field and considerably deeper knowledge of certain parts of the field, together with insight into current research and development work; and
- demonstrate deeper methodological knowledge in their main field of study.

Skills and abilities

For a Degree of Master students must

- demonstrate an ability to integrate knowledge and to analyse, assess and deal with complex phenomena, issues and situations, even when limited information is available;
- demonstrate an ability to critically, independently and creatively identify and formulate issues and to plan and, using appropriate methods, carry out advanced tasks within specified time limits, thus contributing towards the development of knowledge, and to evaluate this work;
- demonstrate an ability in both national and international contexts to clearly present and discuss their conclusions and the knowledge and arguments behind them, in dialogue with different groups, orally and in writing; and
- demonstrate the skill required to participate in research and development work or to work independently in other advanced contexts.

Judgment and approach

For a Degree of Master students must

- demonstrate an ability to make assessments in their main field of study, taking into account relevant scientific, social and ethical aspects, and demonstrate an awareness of ethical aspects of research and development work;
- demonstrate insight into the potential and limitations of science, its role in society and people's responsibility for how it is used; and
- demonstrate an ability to identify their need of further knowledge and to take responsibility for developing their knowledge.

2.3. Objectives of the Master Programme in Health Informatics at Karolinska Institutet

In addition to the national objectives, the following objectives apply for the Master Programme in Health Informatics at Karolinska Institutet.

Knowledge and understanding

Students must

- have in-depth knowledge and understanding of healthcare, such as organisation, its control and its objectives
- have basic knowledge and understanding of human anatomy, physiology and common diseases and their treatment
- have in-depth knowledge and understanding of basic computer systems science, databases and web-based applications
- have in-depth knowledge and understanding of how IT can be used to achieve operational improvements within healthcare

Skills and abilities

Students must demonstrate skills and abilities in terms of

- analysing and assessing the need for – and methods for developing and disseminating information and improved knowledge within – healthcare
- analysing, characterising, evaluating and improving care-related work processes
- developing, introducing, improving and evaluating methods that provide clinical decision-making support
- participating in procuring, ordering, adapting, developing, introducing, maintaining, evaluating and improving clinical health information systems
- having a good insight into the health informatics research process and a good ability to independently formulate relevant hypotheses within the field of health informatics, and – on the basis of this – to plan and carry out projects including suitable methodological efforts
- modelling, developing and introducing systems for analysis, simulation and visualisation within health informatics

Judgment and approach

Students must

- demonstrate a good insight into research ethics and respect for patients' integrity and safety, and
- be able to evaluate information and relate this to established knowledge within the field of health informatics

Students with advanced studies within *health informatics with a clinical specialisation* must

- have knowledge and skills of significance for leading the development, adaptation and implementation of clinical information systems

Students gaining further depth within *health informatics with a technical specialisation* must

- have knowledge and skills of significance for the implementation of all phases within the development of health information systems
- be able to apply mathematical methods for extracting new knowledge from medical data, for use in medical research or as components of clinical decision-making support systems.

3. Description of the main field of study

Health informatics is an interdisciplinary field based on clinical medicine, mathematics, computer systems science and social sciences. Health informatics has been developed on the basis of this to become a separate scientific field with its own scientific issues and methods. Health informatics is of fundamental importance for effective information management within health and medical care, and for improving the quality of care and patient safety.

Studies within health informatics develop knowledge about healthcare needs and the needs of patients/citizens for effective, appropriate information and knowledge management, and how its methods can be used to promote safe, knowledge-based, cost-effective, patient-centred and equal healthcare and prevention.

Knowledge within the field is applied primarily through research, teaching and development work in direct contact with care practitioners and

employers, and with system suppliers and researchers within various medical and systems science fields. All application must be based on a professional attitude and in accordance with accepted ethical principles.

4. Content and structure

4.1. The course's main content and structure

The programme lasts for four terms, with various themes based on a progression from previous terms: bridging (term 1), basic (term 2) and further health informatics methodological knowledge with applications (term 3), and finally research within health informatics (term 4).

The aim of the first term is to bridge the knowledge gap between students with care education backgrounds and those with technical education backgrounds. The first course that students encounter provides a joint understanding of the main field of study as an academic and practical discipline, as well as an understanding of which main challenges within care relate to managing information and knowledge. Bridging courses worth a total of 15 higher education credits provide basic knowledge of computer systems science for students with a health and medical care background. Correspondingly, students with a technical background gain an understanding of the basics of medical science and the organisation of health and medical care. The concluding course of the term is connected to the first course of the term, in which the challenges within care were addressed. Here, the solutions are dealt with in the form of IT system within care.

Prior to the second term, students choose one of two options: a clinical specialisation or a technical specialisation. Those who choose a clinical specialisation will obtain knowledge about managing change management within healthcare operations through the implementation of information systems, while those who choose health informatics with a technical specialisation will carry out more in-depth studies towards advanced methodological knowledge. Students' educational background has no significance in terms of the choice of specialisation. Most courses are joint courses for all students, but some are specific to the chosen specialisation. This specialisation also determines students' perspectives in certain joint courses.

Term 2 includes courses providing fundamental knowledge and skills for students following both specialisations: methods for carrying out operational analyses and modelling user requirements, methods for evaluating various aspects of health information systems post-implementation, and methods within the field of clinical decision-making support.

During term 2, students who choose a clinical specialisation also follow a course on project management and IT implementation. Term 3 then provides more in-depth knowledge of methods for change management. Those who instead choose a technical specialisation will follow a more in-depth, technical course in health information systems during term 2. During the third term, this group then follows an advanced course in machine learning methods for extracting medical knowledge from large quantities of data, which can then be used e.g. for clinical decision-making support.

Alongside the courses in health informatics methodology, case study courses are followed during the second and third terms. Here, scenarios are

presented from actual health informatics projects, as a starting point for cases where students get the opportunity to apply their methodological knowledge. In this way, students gain an insight into a large number of complex but relevant projects. Both terms conclude with project courses in which students can apply their methodological knowledge. The chosen specialisation determines students' role or perspective in these courses.

All students follow a course in health informatics modelling and simulation and research methodology as preparation for term 4, consisting of scientific project work that runs throughout the entire term.

4.2. Teaching language

The teaching language is English.

5. Transitional provisions

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6. Other guidelines

6.1. Grading scale

An objective-related seven-point scale is used for grading on courses. The pass grades are A, B, C, D and E. The fail grades are Fx and F. Alternative grading scales may apply to modules within courses, elective courses or cross-programme courses. The grading scale is detailed in the course syllabus.

6.2. Requirements for admission to higher studies term

For entrance to:

- term 3, all courses from term 1 and at least 10 credits from courses in term 2 must be passed.

In addition, there may be course-specific entry requirements (see the relevant course syllabus).

7. Study plan with constituent courses

7.1. Joint courses

Term	Name of the course	Credits	Cycle	Depth of the course
1	Health informatics – needs, objectives and limitations <i>Hälsoinformatik – behov, mål och begränsningar</i>	5	First	G2
1	<i>Bridging courses:</i> <ul style="list-style-type: none"> • Supplementary course in computer systems science (Kompletteringskurs i data- och systemvetenskap), 15 credits or • Basic medical science (Grundläggande medicinsk vetenskap) 7.5 credits, and • Health care organization and management (<i>Vården och omsorgens organisation och styrning</i>) 7.5 credits 	15	First	-
1	Computer applications in health care and biomedicine <i>Informationssystem i hälso- och sjukvården</i>	10	Second	AV
2	User needs and requirements engineering / <i>Verksamhetsanalys och användarkravhantering</i>	7.5	Second	AV
2	Evaluation methods for health informatics / <i>Utvärdering</i>	2.5	Second	AV
2	Clinical Decision Support / <i>Kliniskt beslutstöd</i>	5	Second	AV
2	Case studies in health informatics 1/ <i>Fallstudier inom hälsoinformatik 1</i>	5	Second	AV
2	Projects in health informatics 1 – from idea to specification <i>Projekt inom hälsoinformatik 1 – från idé till specifikation</i>	5	Second	AV
3	Modelling, simulation and visualisation in health informatics <i>Modellering, simulering och visualisering inom hälsoinformatik</i>	5	Second	AV
3	Case studies in health informatics 2 <i>Fallstudier inom hälsoinformatik 2</i>	5	Second	AV
3	Projects in health informatics 2 – from specification to product <i>Projekt inom hälsoinformatik 2 – från specifikation till produkt</i>	5	Second	AV
3	Scientific research methods <i>Vetenskaplig forskningsmetodik</i>	7.5	Second	AV
4	Degree project in health informatics <i>Examensarbete i hälsoinformatik</i>	30	Second	AV

7.2. Courses for students choosing health informatics with a clinical specialisation

Term	Name of the course	Credits	Cycle	Depth of the course
2	Project management and IT introduction in healthcare / <i>Projektledning och IT-införande i vården</i>	5	Second	AV
3	Management, leadership and change work in health informatics / <i>Management, ledarskap och förändringsarbete inom hälsoinformatik</i>	7.5	Second	AV

7.3. Courses for students choosing health informatics with a technical specialisation

Term	Name of the course	Credits	Cycle	Depth of the course
2	Health information systems – design, architecture and interoperability / <i>Hälsoinformationssystem – design, arkitektur, interoperabilitet</i>	5	Second	AV
3	Machine learning for extraction of medical knowledge / <i>Maskinlärning för extraktion av medicinsk kunskap</i>	7.5	Second	AV