



AALBORG UNIVERSITET

Department of Health Science and Technology

**Study board for Health and Technology**

**Study Regulations/Curriculum:**

<https://studieordninger.aau.dk/2024/48/5163>

**Semester framework theme:**

This is the 3rd semester out of four on the master's programme in Digital Health. It consists of two tracks, of which students must choose one. Each track comprises three modules, each worth 5 ECTS.

Track A

1. The Economics of Digital Health
2. Ethics, Health and Artificial Intelligence
3. User Studies and Information Behavior in Health

Track B

1. Machine Learning in the Welfare Sector
2. Decision Support for Clinical Practice
3. Standardization and Interoperability in Health Care

**Semester coordinator:**

Thomas Kronborg Larsen ([tkl@hst.aau.dk](mailto:tkl@hst.aau.dk))

**Secretariat assistance**

**Programme Administrator:**

Tinna Hjort ([tilu@hst.aau.dk](mailto:tilu@hst.aau.dk))

**Study Board Secretary:**

Berit Lund Sørensen ([blc@hst.aau.dk](mailto:blc@hst.aau.dk))

# SEMESTER DESCRIPTION

## Master of Digital Health

### AALBORG

## 3rd semester

### Autumn semester

### 2026

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## Semester organisation and time schedule

This semester consists of the following project and course modules:

<https://studieordninger.aau.dk/2024/48/5163>

| Module type                            | Title                                               | Module coordinator:                     | ECTS | Assessment            |
|----------------------------------------|-----------------------------------------------------|-----------------------------------------|------|-----------------------|
| <b>Track A - User perspective</b>      |                                                     |                                         |      |                       |
| Course module                          | The Economics of Digital Health                     | <a href="#">Jan Sørensen</a>            | 5    | Passed/Not Passed     |
| Course module                          | Ethics, Health and Artificial Intelligence          | <a href="#">Thomas Ploug</a>            | 5    | Passed/Not Passed     |
| Course module                          | User Studies and Information Behavior in Health     | <a href="#">Tanja Svarre</a>            | 5    | 7-point grading scale |
| <b>Track B - Developer perspective</b> |                                                     |                                         |      |                       |
| Course module                          | Machine Learning in the Welfare Sector              | <a href="#">Maciej Plocharski</a>       | 5    | Passed/Not Passed     |
| Course module                          | Decision Support for Clinical Practice              | <a href="#">Dan Stieper Karbing</a>     | 5    | Passed/Not Passed     |
| Course module                          | Standardization and Interoperability in Health Care | <a href="#">Ulrike Sabine Pielmeier</a> | 5    | 7-point grading scale |

## Semester outline

The main activities during the semester are outlined here:

| September | October                                                 | November | December                                                | January                                                 |
|-----------|---------------------------------------------------------|----------|---------------------------------------------------------|---------------------------------------------------------|
|           | <b>Semester group meeting</b><br><a href="#">(here)</a> |          | <b>Semester group meeting</b><br><a href="#">(here)</a> | <b>Exam</b> ( <a href="#">find the exam plan here</a> ) |

## Semester evaluation

The semester is evaluated in the following ways:

1. The students are invited to participate in two semester group meetings. The semester coordinator decides how the semester group meetings will be executed. The module coordinators are also invited.
2. The students will receive an electronic survey at the end of the semester to evaluate the semester and its activities. Time will be given to evaluate the previous semester at the beginning of the following semester.
3. Based on the above evaluations from the students, the semester coordinator will prepare a semester evaluation report which will be processed by the study board after the semester is completed.

## Part time study

The programme is a part-time study, and the students are expected to spend approximately 20 hours per week on their studies (incl. exams and exam preparations).

The average student is expected to work 30 hours per ECTS.

In this way, a course module of 5 ECTS requires 150 hours of work incl. exam and its preparation.

## Track A

### Course module description I

# THE ECONOMICS OF DIGITAL HEALTH

*ANVENDELSE AF SUNDHEDS- OG  
VELFÆRDSØKONOMISKE ANALYSER*

ECTS: 5

#### Course module coordinator:

*Jan Sørensen (jaso@dcm.aau.dk)  
Department of Clinical Medicine*

#### Exam plan

*Is located at Moodle:*

<https://www.moodle.aau.dk/course/view.php?id=59763>

#### Primary teaching language:

English

**Type of exam:** Oral exam

**Assessment:** Passed/Not Passed

**Duration of examination:** 20 minutes

#### Participants in an oral exam:

- ☐ Exam supervisor
- ☒ Lecturer
- ☒ Internal co-assessor

#### Description of the practical conduct of the exam:

**The exam is conducted:** ☒ individually ☐ group-based

**Exam language:** English

#### The exam starts with a presentation from the student(s):

☒ Yes ☐ No ☐ Not relevant

#### At an oral exam the student draws one or more question(s):

☐ Yes ☒ No ☐ Not relevant

#### Permitted aids in the exam:

- ☒ None
- ☐ Some – specify which
- ☐ Notes, literature, online books in offline mode, PC and calculator
- ☐ Other: Specify which
- ☐ All, including internet access (however not for communication or generative AI)

## SCOPE AND EXPECTED WORK EFFORT

| Activity                 | Number of hours spent on study activities in the module |
|--------------------------|---------------------------------------------------------|
| Lectures                 | 16                                                      |
| Workshop/group exercises | 16                                                      |
| Exam                     | 0.5                                                     |
| Exam preparation         | 34.5                                                    |
| Literature study         | 35                                                      |
| Individual homework      | 48                                                      |

## MODULE ACTIVITIES

| Title                                                                                                                         | Lecturer and place of employment                                      | Learning objectives from the programme curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 1 (hybrid)</b><br>Introduction to Economics of Digital Health<br><br>Lecture + workshop/exercises                      | Jan Sørenen, Danish<br>Centre for Health<br>Services Research,<br>AAU | <ul style="list-style-type: none"> <li>• Differentiate and categorize different types of health applications</li> <li>• Understand elements of national strategies for digital health</li> <li>• Understand how digital health create societal value</li> <li>• Engage in meaningful conversations about the health and economic impact of digital health on patient care</li> <li>• Undertake simple cost-effectiveness analyses of digital health</li> </ul>                                                                |
| <b>Day 2 (online)</b><br>Introduction to cost analysis of digital health interventions<br><br>Lecture + workshop/exercises    | Jan Sørenen, Danish<br>Centre for Health<br>Services Research,<br>AAU | <ul style="list-style-type: none"> <li>• Understand how digital health create societal value</li> <li>• Engage in meaningful conversations about the health and economic impact of digital health on patient care</li> <li>• Discuss the challenges of using health economic evaluations to digital health</li> <li>• Identify relevant methods assessing the valuing health outcomes and costs of implementing digital health solutions</li> <li>• Undertake simple cost-effectiveness analyses of digital health</li> </ul> |
| <b>Day 3 (online)</b><br>Introduction to outcome analysis of digital health interventions<br><br>Lecture + workshop/exercises | Jan Sørenen, Danish<br>Centre for Health<br>Services Research,<br>AAU | <ul style="list-style-type: none"> <li>• Understand how digital health create societal value</li> <li>• Engage in meaningful conversations about the health and economic impact of digital health on patient care</li> <li>• Discuss the challenges of using health economics evaluation to digital health</li> <li>• Identify relevant methods assessing the valuing health outcomes and costs of implementing digital health solutions</li> <li>• Undertake simple cost-effectiveness analyses of digital health</li> </ul> |

|                                                                                                               |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 4 (hybrid)</b><br><br>Influencing policy through economic analysis<br><br>Lecture + workshop/exercises | Jan Sørensen, Danish<br><br>Centre for Health<br><br>Services Research,<br><br>AAU | <ul style="list-style-type: none"> <li>• Understand how digital health create societal value</li> <li>• Engage in meaningful conversations about the health and economic impact of digital health on patient care</li> <li>• Discuss the challenges of using health economics evaluation to digital health</li> <li>• Identify relevant methods assessing the valuing health outcomes and costs of implementing digital health solutions</li> <li>• Ability to critically interpret and evaluate economic evaluations of digital health solutions</li> <li>• Undertake simple cost-effectiveness analyses of digital health</li> </ul> |
|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Literature

Literature list is found in Moodle - <https://www.moodle.aau.dk/course/view.php?id=59763>

## Course module description I I

# ETHICS, HEALTH AND ARTIFICIAL INTELLIGENCE

*ETIK, SUNDHED OG KUNSTIG INTELLIGENS*

ECTS: 5

### Course module coordinator:

*Thomas Ploug (ploug@ikk.aau.dk)  
Department of Culture and Communication*

### Exam plan

*Is located at Moodle:*

<https://www.moodle.aau.dk/course/view.php?id=59763>

### Primary teaching language:

English

**Type of exam:** Oral exam

**Assessment:** Passed/Not Passed

**Duration of examination:** 20 minutes

### Participants in an oral exam:

- ☐ Exam supervisor
- ☒ Lecturer
- ☒ Internal co-assessor

### Description of the practical conduct of the exam:

**The exam is conducted:** ☒ individually ☐ group-based

**Exam language:** English

### The exam starts with a presentation from the student(s):

☒ Yes ☐ No ☐ Not relevant

### At an oral exam the student draws one or more question(s):

☒ Yes ☐ No ☐ Not relevant

### Permitted aids in the exam:

- ☒ None
- ☐ Some – specify which
- ☐ Notes, literature, online books in offline mode, PC and calculator
- ☐ Other: Specify which
- ☐ All, including internet access (however not for communication or generative AI)

## SCOPE AND EXPECTED WORK EFFORT

| Activity                 | Number of hours spent on study activities in the module |
|--------------------------|---------------------------------------------------------|
| Lec                      | 16                                                      |
| Workshop/group exercises | 16                                                      |
| Exam                     | 0,5                                                     |
| Exam preparation         | 30,5                                                    |
| Literature study         | 50                                                      |
| Individual homework      | 37                                                      |

## MODULE ACTIVITIES

| Title                                                                                                                                                        | Lecturer and place of employment             | Learning objectives from the programme curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 1 (hybrid)</b><br><br><b>Introduction to Ethics and Applied Ethics</b><br><br>Foundations of moral reasoning<br><br>Lecture + workshop/exercises      | Thomas Ploug<br><br>Aalborg University (AAU) | <ul style="list-style-type: none"> <li>Knowledge of AI ethics in healthcare and how it differs from other fields.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Day 2 (hybrid)</b><br><br><b>Data Ethics of AI Use</b><br><br>Privacy, data minimisation, purpose and data governance<br><br>Lecture + workshop/exercises | Thomas Ploug<br><br>Aalborg University (AAU) | <ul style="list-style-type: none"> <li>Knowledge of a range of existing and emerging AI-powered digital health tools in use and the relevant ethical considerations.</li> <li>Understanding of ethical considerations of AI and digital health tools and applications, such as data privacy (ownership of health records, patient history, and consent) and fairness across the individual, organizational, and societal levels.</li> <li>Identify ethical concerns at both the design and deployment levels.</li> <li>Assess the trade-offs, risks, and benefits of AI in digital health applications.</li> <li>Identify potential areas for ethical concern and risks, including safety and transparency, algorithmic fairness and bias, data privacy.</li> <li>Evaluate/assess privacy measures including informed consent and data privacy at the deployment level.</li> <li>Apply ethical frameworks to AI-backed digital health tools to mitigate risks and ensure health equity and fairness at the deployment level.</li> </ul> |
| <b>Day 3 (hybrid)</b><br><br><b>AI Ethical Issues</b>                                                                                                        | Thomas Ploug<br><br>Aalborg University       | <ul style="list-style-type: none"> <li>Knowledge of a range of existing and emerging AI-powered digital health tools in use and the relevant ethical considerations.</li> <li>Understanding of ethical considerations of AI and digital health tools and applications, such as data privacy (ownership of health records, patient history, and consent) and fairness across</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                                                                                                                                                                |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Accuracy, bias, accountability and sustainability</b><br><br>Lecture + workshop/exercises                                                                                   | (AAU)                                               | the individual, organizational, and societal levels. <ul style="list-style-type: none"> <li>• Identify ethical concerns at both the design and deployment levels.</li> <li>• Assess the trade-offs, risks, and benefits of AI in digital health applications.</li> <li>• Identify potential areas for ethical concern and risks, including safety and transparency, algorithmic fairness and bias, data privacy.</li> <li>• Evaluate/assess privacy measures including informed consent and data privacy at the deployment level.</li> <li>• Apply ethical frameworks to AI-backed digital health tools to mitigate risks and ensure health equity and fairness at the deployment level.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Day 4 (hybrid)</b><br><br><b>Societal Effects and Governance of AI</b><br><br><b>Trust, misinformation and the right to explanation</b><br><br>Lecture + workshop/exercises | Thomas Ploug<br><br>Aalborg University<br><br>(AAU) | <ul style="list-style-type: none"> <li>• Knowledge of a range of existing and emerging AI-powered digital health tools in use and the relevant ethical considerations.</li> <li>• Understanding of ethical considerations of AI and digital health tools and applications, such as data privacy (ownership of health records, patient history, and consent) and fairness across the individual, organizational, and societal levels.</li> <li>• Identify ethical concerns at both the design and deployment levels.</li> <li>• Assess the trade-offs, risks, and benefits of AI in digital health applications.</li> <li>• Identify potential areas for ethical concern and risks, including safety and transparency, algorithmic fairness and bias, data privacy.</li> <li>• Communicate the benefits and risks of AI in digital health applications.</li> <li>• Apply ethical frameworks to AI-backed digital health tools to mitigate risks and ensure health equity and fairness at the deployment level.</li> <li>• Synthesize and develop ethically informed strategies for deploying digital health tools with regard for their impact at the individual, organizational, and societal levels.</li> </ul> |

## Literature

Literature list is found in Moodle - <https://www.moodle.aau.dk/course/view.php?id=59763>

## Course module description I I I

# USER STUDIES AND INFORMATION BEHAVIOR IN HEALTH

*BRUGERSTUDIER- OG  
INFORMATIONSAADFÆRD INDENFOR  
SUNDHEDSOMRÅDET*

ECTS: 5

### Course module coordinator:

*Tanja Svarre (tanjasj@ikk.aau.dk)  
Department of Culture and Communication*

### Exam plan

*Is located at Moodle:*

<https://www.moodle.aau.dk/course/view.php?id=59763>

### Primary teaching language:

English

**Type of exam:** Oral exam

**Assessment:** 7-point grading scale

**Duration of examination:** 20 minutes including voting

### Participants in an oral exam:

- ☒ Exam supervisor
- ☐ Lecturer
- ☒ Internal co-assessor

### Description of the practical conduct of the exam:

**The exam is conducted:** ☒ individually ☐ group-based

**Exam language:** English

### The exam starts with a presentation from the student(s):

☒ Yes ☐ No ☐ Not relevant

### At an oral exam the student draws one or more question(s):

☐ Yes ☒ No ☐ Not relevant

### Permitted aids in the exam:

- ☐ None
- ☐ Some – specify which
- ☐ Notes, literature, online books in offline mode, PC and calculator
- ☐ Other: Specify which
- ☒ All, including internet access (however not for communication or generative AI)

## SCOPE AND EXPECTED WORK EFFORT

| Activity                 | Number of hours spent on study activities in the module |
|--------------------------|---------------------------------------------------------|
| Lectures                 | 14                                                      |
| Workshop/group exercises | 18                                                      |
| Exam                     | 0,5                                                     |
| Exam preparation         | 20,5                                                    |
| Literature study         | 45                                                      |
| Individual homework      | 52                                                      |

## MODULE ACTIVITIES

| Title                                                                                                                                                                                                           | Lecturer and place of employment         | Learning objectives from the programme curriculum                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 1 morning (hybrid)</b><br><br>Introduction to Information behaviour and user studies<br><br>Information behaviour models<br><br>Lecture + workshop/exercises                                             | Mette Skov and<br><br>Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>• Information behavior and digital practice in health</li> <li>• Communicate and discuss information behavior and digital practices in health implementation and adoption with professionals and non-professionals</li> </ul> |
| <b>Day 1 afternoon (hybrid)</b><br><br>Information practice of health professionals and patients' information behaviour (1)<br><br>Lecture + workshop/exercises                                                 | Mette Skov and<br><br>Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>• Information behavior and digital practice in health</li> </ul>                                                                                                                                                              |
| <b>Day 2 morning (online)</b><br><br>Information practice of health professionals and patients' information behaviour (2)<br><br>Methods for studying Information behaviour<br><br>Lecture + workshop/exercises | Mette Skov and<br><br>Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>• Methods for mapping and analyzing information behavior and digital practice in health</li> <li>• Information behavior and digital practice in health</li> </ul>                                                             |

|                                                                                                                                                                         |                                   |                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 2 afternoon (online)</b><br><br>Developing empirical designs of information behaviour studies<br><br>Lecture + workshop/exercises                                | Mette Skov and Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>Independently plan and conduct studies of user practices and behavior</li> <li>Methods for mapping and analyzing information behavior and digital practice in health</li> <li>Collect and analyse data regarding information behavior and digital practices in healthcare</li> <li>Information behavior and digital practice in health</li> </ul> |
| <b>Day 3 morning (online)</b><br><br>Analysis of empirical health Information behaviour data<br><br>Lecture + Workshop/exercises                                        | Mette Skov and Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>Collect and analyse data regarding information behavior and digital practices in healthcare</li> <li>Independently plan and conduct studies of user practices and behavior</li> <li>Information behavior and digital practice in health</li> <li>Methods for mapping and analyzing information behavior and digital practice in health</li> </ul> |
| <b>Day 3 afternoon (online)</b><br><br>Information practice of health professionals and patients' information behaviour (3)<br><br>Lecture + workshop/exercises         | Mette Skov and Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>Collect and analyse data regarding information behavior and digital practices in healthcare</li> <li>Independently plan and conduct studies of user practices and behavior</li> <li>Information behavior and digital practice in health</li> <li>Methods for mapping and analyzing information behavior and digital practice in health</li> </ul> |
| <b>Day 4 morning (hybrid)</b><br><br>Information practice of health professionals and patients' information behaviour (4)<br><br>Student presentations of pilot studies | Mette Skov and Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>Participate in an interdisciplinary collaboration to solve problems related to user practice</li> <li>Communicate and discuss information behavior and digital practices in health implementation and adoption with professionals and non-professionals</li> <li>Information behavior and digital practice in health</li> </ul>                   |
| <b>Day 4 afternoon (hybrid)</b><br><br>Validity of empirical studies<br><br>Lecture + workshop/exercises                                                                | Mette Skov and Tanja Svarre (IKK) | <ul style="list-style-type: none"> <li>Information behavior and digital practice in health</li> <li>Participate in an interdisciplinary collaboration to solve problems related to user practice</li> </ul>                                                                                                                                                                              |

## **Literature**

Literature list is found in Moodle - <https://www.moodle.aau.dk/course/view.php?id=59763>

## Course module description I

# MACHINE LEARNING IN THE WELFARE SECTOR

*MACHINE LEARNING INDEN FOR  
SUNDHEDSOMRÅDET*

ECTS: 5

### Course module coordinator:

Maciej Plocharski ([mpl@hst.aau.dk](mailto:mpl@hst.aau.dk))  
Department of Health Science and Technology

### Exam plan

Is located at Moodle:

<https://www.moodle.aau.dk/course/view.php?id=59763>

### Primary teaching language:

English

**Type of exam:** Oral exam

**Assessment:** Passed/Not Passed

**Duration of examination:** 20 minutes

### Participants in an oral exam:

- ☒ Exam supervisor
- ☐ Lecturer
- ☒ Internal co-assessor

### Description of the practical conduct of the exam: The

**exam is conducted:** ☒ individually ☐ group-based **Exam**

**language:** English

### The exam starts with a presentation from the student(s):

☒ Yes ☐ No ☐ Not relevant

### At an oral exam, the student draws one or more question(s):

☒ Yes ☐ No ☐ Not relevant

### Permitted aids in the exam:

- ☐ None
- ☐ Some – specify which
- ☒ Notes, literature, online books in offline mode, PC, and calculator
- ☐ Other: Specify which
- ☐ All, including internet access (however not for communication or generative AI)

## SCOPE AND EXPECTED WORK EFFORT

| Activity                 | Number of hours spent on study activities in the module |
|--------------------------|---------------------------------------------------------|
| Lectures                 | 16                                                      |
| Workshop/group exercises | 16                                                      |
| Exam                     | 0.3                                                     |
| Exam preparation         | 35                                                      |
| Literature study         | 35                                                      |
| Individual homework      | 48                                                      |

## MODULE ACTIVITIES

| Title                                                                                                                                | Lecturer and place of employment                     | Learning objectives from the programme curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 1 morning (hybrid)</b><br>Introduction to Machine Learning<br>Lecture + workshop/exercises                                    | Maciej Plocharski<br>and Danny<br>Anthonimuthu (HST) | <ul style="list-style-type: none"> <li>• Basic elements and structure of a machine learning system.</li> <li>• How patterns can be described using features.</li> <li>• Various health-related contexts and scenarios in which machine learning is involved.</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> <li>• Can translate knowledge of features and basic AI models into the design, development, and evaluation of a simple AI system.</li> </ul> |
| <b>Day 1 afternoon (hybrid)</b><br>Model training and evaluation<br>Lecture + workshop/exercises                                     | Maciej Plocharski and<br>Danny<br>Anthonimuthu (HST) | <ul style="list-style-type: none"> <li>• Can analyze, visualize, and select features.</li> <li>• Can prepare data for training, validation, and testing of machine learning models.</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> </ul>                                                                                                                                                                                                                 |
| <b>Day 2 morning (online)</b><br>Classification part I (logistic regression, support vector machine)<br>Lecture + workshop/exercises | Maciej Plocharski and<br>Danny<br>Anthonimuthu (HST) | <ul style="list-style-type: none"> <li>• Can apply and evaluate basic supervised and unsupervised machine learning models</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> <li>• Can prepare data for training, validation, and testing of machine learning models</li> </ul>                                                                                                                                                                              |
| <b>Day 2 afternoon (online)</b><br>Classification part II (Decision trees, random forests)<br>Lecture + workshop/exercises           | Maciej Plocharski and<br>Danny Anthonimuthu<br>(HST) | <ul style="list-style-type: none"> <li>• Can apply and evaluate basic supervised and unsupervised machine learning models</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> <li>• Can prepare data for training, validation, and testing of machine learning models</li> </ul>                                                                                                                                                                              |

|                                                                                                       |                                                      |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 3 morning (online)</b><br>Regression analysis part 1<br><br>Lecture + workshop/exercises       | Maciej Plochanski and<br>Danny<br>Anthonimuthu (HST) | <ul style="list-style-type: none"> <li>• Can apply and evaluate basic supervised and unsupervised machine learning models</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> </ul>                                            |
| <b>Day 3 afternoon (online)</b><br>Regression analysis part 2<br><br>Lecture+<br>workshop/exercises   | Maciej Plochanski and<br>Danny Anthonimuthu<br>(HST) | <ul style="list-style-type: none"> <li>• Can apply and evaluate basic supervised and unsupervised machine learning models</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> </ul>                                            |
| <b>Day 4 morning (hybrid)</b><br>Unsupervised learning methods<br><br>Lecture + workshop/exercises    | Danny Anthonimuthu<br>(HST)                          | <ul style="list-style-type: none"> <li>• Can apply and evaluate basic supervised and unsupervised machine learning models</li> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> </ul>                                            |
| <b>Day 4 afternoon (hybrid)</b><br>Deep learning in health sector<br><br>Lecture + workshop/exercises | Danny Anthonimuthu<br>(HST)                          | <ul style="list-style-type: none"> <li>• Can assess the applicability of prediction and classification approaches in health care contexts.</li> <li>• Can translate knowledge of features and basic AI models into the design, development, and evaluation of a simple AI system.</li> </ul> |

## Literature

Literature list is found in Moodle - <https://www.moodle.aau.dk/course/view.php?id=59763>

## Course module description I I

# DECISION SUPPORT FOR CLINICAL PRACTICE

*BESLUTNINGSSTØTTE TIL KLINISK  
PRAKSIS*

ECTS: 5

### Course module coordinator:

*Dan Stieper Karbing (dank@hst.aau.dk)  
Department of Health Science and Technology*

### Exam plan

*Is located at Moodle:*

<https://www.moodle.aau.dk/course/view.php?id=59763>

### Primary teaching language:

English

**Type of exam:** Oral exam

**Assessment:** Passed/Not Passed

**Duration of examination:** 20 minutes

### Participants in an oral exam:

- ☒ Exam supervisor
- ☒ Lecturer
- ☒ Internal co-assessor

**Description of the practical conduct of the exam:** The

**exam is conducted:** ☒ individually ☐ group-based **Exam**

**language:** English

**The exam starts with a presentation from the student(s):**

- ☒ Yes ☐ No ☐ Not relevant

**At an oral exam the student draws one or more question(s):**

- ☒ Yes ☐ No ☐ Not relevant

### Permitted aids in the exam:

- ☐ None
- ☒ Some – portfolio
- ☐ Notes, literature, online books in offline mode, PC and calculator
- ☐ Other: Specify which
- ☐ All, including internet access (however not for communication or generative AI)

## SCOPE AND EXPECTED WORK EFFORT

| Activity                 | Number of hours spent on study activities in the module |
|--------------------------|---------------------------------------------------------|
| Lectures                 | 15                                                      |
| Workshop/group exercises | 18                                                      |
| Exam                     | 0.5                                                     |
| Exam preparation         | 39.5                                                    |
| Literature study         | 35                                                      |
| Individual homework      | 42 (can be done in groups)                              |

## MODULE ACTIVITIES

| Title                                                                                                                                                                 | Lecturer and place of employment | Learning objectives from the programme curriculum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 1 morning (hybrid)</b><br>Introduction to course. Rationale for decision support systems in clinical practice.<br>2 x lectures + workshop/exercises            | Dan Stieper Karbing, HST         | <ul style="list-style-type: none"> <li>• Can account for basic elements and structure of a decision support system.</li> <li>• Can account with examples for the role of decision support systems in clinical practice.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Day 1 afternoon (hybrid)</b><br>Probabilistic medical reasoning. Decision analysis. Representation of criteria for decisions.<br>2 x lectures + workshop/exercises | Dan Stieper Karbing, HST         | <ul style="list-style-type: none"> <li>• Can account with examples for the role of decision support systems in clinical practice.</li> <li>• Can apply selected methods for visualizing a clinical decision problem</li> <li>• Can apply selected methods for identifying appropriate attributes and decision maker's preferences for a decision problem.</li> <li>• Can apply selected methods for decision support system inference engine including forward/backward chaining, fuzzy inference, basic numerical optimization, and probabilistic inference.</li> </ul>                                                                                                                                                                                                  |
| <b>Day 2 morning (online)</b><br>Structure of decision support systems and rule-based systems.<br>2 x lectures + workshop/exercises                                   | Dan Stieper Karbing, HST         | <ul style="list-style-type: none"> <li>• Can account for basic elements and structure of a decision support system.</li> <li>• Can account for and relate different methods for decision support system knowledge base.</li> <li>• Can apply selected knowledge-based methods for decision support including rule-based methods, decision theory-based methods and model-based methods and Bayesian networks.</li> <li>• Can identify appropriate combination of methods for knowledge base and inference engine for a decision support system in relation to a clinical decision support problem.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul> |

|                                                                                                                                                              |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 2 afternoon (online)</b><br>Bayesian networks and decision support.<br>2 x lectures +<br>workshop/exercises                                           | Dan Stieper Karbing,<br>HST | <ul style="list-style-type: none"> <li>• Can account for and relate different methods for decision support system knowledge base.</li> <li>• Can apply selected methods for visualizing a clinical decision problem.</li> <li>• Can apply selected knowledge-based methods for decision support including rule-based methods, decision theory-based methods and model-based methods and Bayesian networks.</li> <li>• Can apply selected methods for decision support system inference engine including forward/backward chaining, fuzzy inference, basic numerical optimization, and probabilistic inference.</li> <li>• Can identify appropriate combination of methods for knowledge base and inference engine for a decision support system in relation to a clinical decision support problem.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul>                                                                                                                                       |
| <b>Day 3 morning (online)</b><br>Modeling the system and decision maker preferences.<br>2 x lectures +<br>workshop/exercises                                 | Dan Stieper Karbing,<br>HST | <ul style="list-style-type: none"> <li>• Can account for and relate different methods for decision support system knowledge base.</li> <li>• Can apply selected methods for visualizing a clinical decision problem.</li> <li>• Can apply selected methods for identifying appropriate attributes and decision maker's preferences for a decision problem.</li> <li>• Can apply selected knowledge-based methods for decision support including rule-based methods, decision theory-based methods and model-based methods and Bayesian networks.</li> <li>• Can apply selected methods for decision support system inference engine including forward/backward chaining, fuzzy inference, basic numerical optimization, and probabilistic inference.</li> <li>• Can identify appropriate combination of methods for knowledge base and inference engine for a decision support system in relation to a clinical decision support problem.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul> |
| <b>Day 3 afternoon (online)</b><br>Development and implementation of decision support systems for clinical practice.<br>2 x lectures +<br>workshop/exercises | Dan Stieper Karbing,<br>HST | <ul style="list-style-type: none"> <li>• Can account with examples for the role of decision support systems in clinical practice.</li> <li>• Can identify appropriate combination of methods for knowledge base and inference engine for a decision support system in relation to a clinical decision support problem.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                                                                                               |                             |                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 4 morning (hybrid)</b><br>Evaluation of decision support systems.<br>2 x lectures + workshop/exercises | Dan Stieper Karbing,<br>HST | <ul style="list-style-type: none"> <li>• Can account with examples for the role of decision support systems in clinical practice.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul>                                                                                  |
| <b>Day 4 afternoon (hybrid)</b><br>Support on group exercise solution<br>2 hours ad hoc                       | Dan Stieper Karbing,<br>HST | <ul style="list-style-type: none"> <li>• Can identify appropriate combination of methods for knowledge base and inference engine for a decision support system in relation to a clinical decision support problem.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul> |
| Summing up, exam preparation and evaluation.<br>1 x lecture + student presentations                           | Dan Stieper Karbing,<br>HST | <ul style="list-style-type: none"> <li>• Can identify appropriate combination of methods for knowledge base and inference engine for a decision support system in relation to a clinical decision support problem.</li> <li>• Can combine understanding of methods for knowledge base and inference engine to design, implement and evaluate a simple decision support system.</li> </ul> |

## Literature

Literature list is found in Moodle - <https://www.moodle.aau.dk/course/view.php?id=59763>

## Course module description I I I

# STANDARDIZATION AND INTEROPERABILITY IN HEALTH CARE

*STANDARDISERING OG  
INTEROPERABILITET I  
SUNDHEDSSEKTOREN*

ECTS: 5

### Course module coordinator:

*Ulrike Sabine Pielmeier (upiel@hst.aau.dk)  
Department of Health Science and Technology*

### Exam plan

*Is located at Moodle:*

<https://www.moodle.aau.dk/course/view.php?id=59763>

### Primary teaching language:

English

**Type of exam:** Written exam

**Assessment:** 7-point grading scale

**Duration of examination:** 3 hours

### Participants in an oral exam:

- ☐ Exam supervisor
- ☐ Lecturer
- ☐ Internal co-assessor

**Description of the practical conduct of the exam:** The

**exam is conducted:** ☒ individually ☐ group-based **Exam**

**language:** English

**The exam starts with a presentation from the student(s):**

☐ Yes ☒ No ☐ Not relevant

**At an oral exam the student draws one or more question(s):**

☐ Yes ☐ No ☐ Not relevant

### Permitted aids in the exam:

- ☐ None
- ☐ Some – specify which
- ☐ Notes, literature, online books in offline mode, PC and calculator
- ☐ Other: Specify which
- ☒ All, including internet access (however not for communication or generative AI)

## SCOPE AND EXPECTED WORK EFFORT

Standardization and Interoperability in Health Care is a course aimed at students who want to improve their skills and profile themselves in standardization, data use and exchange of information across health care sectors. This course addresses the principles, methods, standards, and challenges of defining and achieving interoperability between health care information systems. The focus is on how health data can be exchanged, interpreted, and reused safely and meaningfully to support clinical workflows, decision-making, research, and secondary use, within regulatory and organizational constraints.

The course covers technical, semantic, organizational, and legal dimensions of interoperability, emphasizing real-world healthcare systems and infrastructures.

The average student is expected to work 30 hours per ECTS.

In this way, a course module of 5 ECTS requires 150 hours of work incl. exam and its preparation.

| Activity                 | Number of hours spent on study activities in the module |
|--------------------------|---------------------------------------------------------|
| Lectures                 | 15                                                      |
| Workshop/group exercises | 17                                                      |
| Exam                     | 3                                                       |
| Exam preparation         | 30                                                      |
| Literature study         | 40                                                      |
| Individual homework      | 45                                                      |

## MODULE ACTIVITIES

| Title                                                                                                                                                                         | Lecturer and place of employment | Learning objectives from the programme curriculum                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 1 morning (hybrid)</b><br>Concepts and Levels of Interoperability<br>2 x lectures + workshop/exercises                                                                 | Ulrike Pielmeier<br>HST          | <ul style="list-style-type: none"> <li>• Have knowledge of standards on information and communication models in health care.</li> <li>• Have knowledge of different research approaches related to terminology and models in clinical information systems.</li> </ul> |
| <b>Day 1 afternoon (hybrid)</b><br>Requirements analysis for health data exchange<br>2 x lectures + workshop/exercises                                                        | Ulrike Pielmeier<br>HST          | <ul style="list-style-type: none"> <li>• Can analyze the need for terminology and classifications in a given clinical information system.</li> </ul>                                                                                                                  |
| <b>Day 2 morning (online)</b><br>From Standards to Interoperability: Practical Selection and Application in Clinical Information Systems<br>2 x lectures + workshop/exercises | Ulrike Pielmeier<br>HST          | <ul style="list-style-type: none"> <li>• Can choose and apply appropriate standards for a given clinical information system to create interoperability.</li> </ul>                                                                                                    |
| <b>Day 2 afternoon (online)</b><br>Choosing the Right Level of Interoperability for Digital Health Problems<br>2 x lectures + workshop/exercises                              | Ulrike Pielmeier<br>HST          | <ul style="list-style-type: none"> <li>• Can assess needs for the level of interoperability to solve different kind of problems in digital health.</li> </ul>                                                                                                         |

|                                                                                                                                                                |                                                           |                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Day 3 morning (online)</b><br><br>Design of user interface, practical use of SNOMED CT, and post-coordination<br><br>2 x lectures + workshop/exercises      | Katja Møller Jensen<br><br>HST                            | <ul style="list-style-type: none"> <li>• Can apply appropriate methods for Information System development and research.</li> </ul>                                                                                                                                                          |
| <b>Day 3 afternoon (online)</b><br><br>Interoperability Architectures and API-based interoperability using HL7 FHIR.<br><br>2 x lectures + workshop/exercises  | Simon C. Dahl<br><br>Center for Clinical Data Science     | <ul style="list-style-type: none"> <li>• Have knowledge of terminology and semantics in clinical information systems from interface to database level.</li> <li>• Can choose and apply appropriate standards for a given clinical information system to create interoperability.</li> </ul> |
| <b>Day 4 morning (hybrid)</b><br><br>Use Cases for Interoperability - Live Epidemiology, Personalized Medicine and AI<br><br>2 x lectures + workshop/exercises | Charles Vestegham<br><br>Center for Clinical Data Science | <ul style="list-style-type: none"> <li>• Understand use of clinical information for primary and secondary purposes.</li> <li>• Can discuss issues associated with primary and secondary use of clinical information.</li> </ul>                                                             |
| <b>Day 4 afternoon (hybrid)</b><br><br>Evaluation of terminology and models<br><br>1 x lecture + workshop / student presentation                               | Ulrike Pielmeier<br><br>HST                               | <ul style="list-style-type: none"> <li>• Are able to evaluate terminology and models in clinical information systems in regard to digital health.</li> </ul>                                                                                                                                |

## Literature

Literature list is found in Moodle - <https://www.moodle.aau.dk/course/view.php?id=59763>