

**Tallinn University of Technology (TalTech)**  
**School of Information Technology**  
**IHB0020 Introduction to Medical Statistics**  
**Extended Syllabus**  
**Autumn 2025**

**Course objectives:**

The aim of the course is to introduce the concepts and methods used in medical statistics and to develop skills for their independent application.

**Learning outcomes:**

A student who has completed the course:

1. knows and can use measures related to the occurrence of disease;
2. knows the types of clinical studies and when they are used;
3. knows and can use effect estimation parameters;
4. knows possible sources of systematic error in the planning and conduct of clinical studies and how to avoid them;
5. understands what confounding is and how to control and avoid it;
6. knows, can choose, and can apply different statistical tests;
7. knows and can use regression analysis;
8. knows methods for survival data analysis and can apply them in practice;
9. understands what etiological and prognostic models are and when they are used;
10. knows how interaction effects are investigated and characterized;
11. knows and uses professional terminology and has improved domain-specific communication skills.

**Table of the Course's Constructive Alignment**

<b>Learning Outcome</b>	<b>Module / Topic</b>	<b>Learning Task(s)</b>	<b>Activity Assessing the Achievement of the Learning Outcome</b>
Knows and can use measures related to the occurrence of disease	Lecture: "Measuring Disease Occurrence"	Self-test Exercises Additional literature	Self-test Exercises Homework 1 Test 1
Knows the types of clinical studies and when they are used	Lecture: "Types of Epidemiological and Clinical Studies"	Self-test Additional literature	Self-test Test 1
Knows and can use effect estimation parameters	Lecture: "Measures of Association and Effect"	Self-test Additional literature	Self-test Homework 1 Test 1
Knows possible sources of systematic error in planning and conducting	Lecture: "Random and Systematic Errors in Study"	Self-test Additional literature	Self-test Test 1

clinical studies and how to avoid them	Design and Implementation”		
Understands what confounding is and how to control and avoid it	Lecture: “Confounding”	Self-test Additional literature	Self-test Test 1
Knows, can choose, and can apply different statistical tests	Lecture: “Choosing Statistical Tests”	Additional literature Practical Assignment 1 Self-test	Test 2 Practical Assignment 1 Self-test
Knows and can use regression analysis	Lecture: “Linear and Logistic Regression”	Additional literature Self-test Practical Assignment 1	Practical Assignment 1 Test 2 Self-test
Knows methods for survival data analysis and can apply them in practice	Lecture: “Kaplan–Meier Survival Analysis” Lecture: “Cox Regression. Proportional Hazards Regression Model”	Additional literature Self-test Homework 2 Practical Assignment 2	Homework 2 Practical Assignment 2 Test 2 Self-tests
Understands what etiological and prognostic models are and when they are used	Lecture: “Etiological and Prognostic Models”	Additional literature Self-test	Test 2 Self-test
Knows how interaction effects are investigated and characterized	Lecture: “Interactions and Study Design”	Additional literature Self-test	Test 2 Self-test
Knows and uses professional terminology and has improved domain-specific communication skills	All lectures	—	Homeworks, tests, practical assignments

### Brief Description of the Course Content (Topics)

The topics covered in the course include: measuring disease occurrence; types of clinical studies; effect estimation parameters; potential sources of systematic errors in the planning and implementation of studies; confounding; statistical tests; regression analysis; survival data analysis; etiological and prognostic models; investigation of interaction effects.

The course includes two independent home assignments containing exercises based on the material covered in the lectures. The solutions to the home assignments are discussed during the exercise session. As practical work, under the guidance of the instructor, two practical assignments are conducted, involving the creation and analysis of statistical models. For knowledge assessment, two tests are held during the semester.

**Language of the course:** Estonian/English

**Credits (ECTS):** 6 ECTS

**Students:** This is an elective course for students of Tallinn University of Technology.

**Special Needs:** Students with special needs are welcome to participate in the course. Please inform the instructor as early as possible of any special needs that may affect your participation in learning

or assessment activities.

**Registration:** Students wishing to take the course must register in ÖIS according to the deadlines specified in the academic calendar.

**Prerequisites and/or Required Prior Knowledge:** None

**Required Resources:** MS Office programs. For free installation as a student, refer to the instructions here: [Microsoft Office kodukasutus / Microsoft Office private usage - IT info - Confluence](#).

For practical assignments, the software **MedCalc** is used. A computer with the Windows operating system is required. A free 15-day trial version of the program must be downloaded and installed on your device before the start of the practical session: <https://www.medcalc.org/download/>.

#### **Lecturers:**

- Jana Holmar, PhD – [jana.holmar@taltech.ee](mailto:jana.holmar@taltech.ee)
- Moonika Viigimäe, MD, PhD – [moonika.viigimae@taltech.ee](mailto:moonika.viigimae@taltech.ee)

**Contacting the lecturer:** The preferred method of contact is email.

**Contact Learning Schedule:** Available in the course Moodle.

#### **Description of the Learning Process**

- Active participation in lectures and practical sessions in both contact and session-based formats (in the weeks without a contact session, the weekly materials in Moodle must be reviewed independently).
- Work with course literature.
- Self-tests.
- Feedback.
- Completing home assignments.

#### **E-learning Support**

All course materials are available in the Moodle e-learning environment under the course name **IHB0020 Introduction to Medical Statistics**.

[Course: IHB0020 Introduction to Medical Statistics \(2025 autumn\) | Moodle](#)

#### **Course Literature**

- Lecture materials (Moodle)
- Bland M. *An Introduction to Medical Statistics*. Oxford University Press, 2015.
- Bonita R, Beaglehole R, Kjellström T & World Health Organization. (2006). *Basic Epidemiology* (2nd ed.). World Health Organization.
- Kirkwood BR, Sterne JAC. *Essential Medical Statistics* (2nd ed.). Blackwell Science, Oxford, 2003.
- Barton B, Peat J. *Medical Statistics: A Guide to SPSS, Data Analysis and Critical Appraisal* (2nd ed.). John Wiley & Sons, 2014.
- Petrie A, Sabin C. *Medical Statistics at a Glance*. Wiley-Blackwell, 2009.

#### **Continuous Assessment**

- **Two written homework assignments:**  
Independent solving of tasks based on topics covered in lectures.

- **Two practical assignments:**  
Creation and analysis of statistical models.  
**Requirements:** MS Office programs. For free installation as a student, see the instructions in *Microsoft Office private usage - IT info - Confluence*.  
The practical assignments use the **MedCalc** software. A Windows OS computer is required. A free 15-day trial version must be downloaded before the start of the practical session:  
<https://www.medcalc.org/download/>.
- **Two written tests**

## Assessment Criteria for Continuous Assessment

### Written homework assignments

- **"5"**: The solution process is thoroughly described; the chosen approach fits the given data; reasoning is provided; the task is solved, and conclusions are included; concepts are well understood.
- **"4"**: The solution process is described in full; the chosen approach fits the data; the task is solved, and conclusions are included; concepts are well understood.
- **"3"**: The solution process is partially described; the approach fits the data; the task is solved, but conclusions are missing; concepts are understood.
- **"2"**: The solution process is minimally described; the approach fits only partially; the task is partially solved without reaching the intended solution or conclusions; concepts are only partially understood.
- **"1"**: The solution process is poorly described; the approach does not fit the data; the task is unsolved; conclusions are missing; concepts are not understood.

Homework assignments must be submitted by the deadlines (**Homework 1:** 30.10.25, **Homework 2:** 26.11.25). Each assignment can yield up to **10 points**. A penalty of **2 points per day** is applied for late submission. Work submitted **more than 4 days late** will receive a score of **0 points**. Only assignments submitted **on time** can be returned once for revision. Revisions must be resubmitted within **4 days**; otherwise, the original score stands. Empty or partial submissions are evaluated as is and are **not** eligible for revision.

### Practical assignments

- **"5"**: The process is thoroughly described; the approach fits the data; reasoning is provided; the task is solved with conclusions; concepts are well understood.
- **"4"**: The process is described in full; the approach fits the data; the task is solved with conclusions; concepts are well understood.
- **"3"**: The process is partially described; the approach fits the data; the task is solved, but conclusions are missing; concepts are understood.
- **"2"**: The process is minimally described; the approach fits partially; the task is partially solved; concepts are only partially understood.
- **"1"**: The process is poorly described; the approach does not fit; the task is unsolved; concepts are not understood.

Practical assignment reports must be submitted by **15.12.25**. A penalty of **2 points per day** applies to late submissions. Reports submitted **more than 4 days late** will receive **0 points**. Only reports submitted on time can be revised once. Revisions must be submitted within **4 days** of receiving feedback; otherwise, the original score stands. Empty or partial submissions are evaluated as is and are **not** eligible for revision.

### Written tests

- "5": Excellent command of terminology; can describe and explain statistical methods and parameters without error; logical reasoning.
- "4": Good command of terminology; minor errors; logical reasoning.
- "3": Adequate command of terminology; some errors and inaccuracies in reasoning.
- "2": Limited command of terminology; frequent errors; possible logical flaws.
- "1": Poor command of terminology; numerous errors; serious logical flaws.

Tests are taken on scheduled days. Each test can be **retaken or improved once**.

- **Test 1:** 30.10.25; retake 08.01.26
- **Test 2:** 11.12.25; retake 08.01.26

### Final Grade

The final grade is calculated as a **weighted average**:

- Written homework: **20%**
- Practical assignments: **20%**
- Written tests: **60%**

To pass the course, all assignments must be submitted, and both tests must achieve at least **51%**.

Task	Max Points	Min Points	Deadline/Date
Homework 1	10	5.1	30.10.25
Homework 2	10	5.1	26.11.25
Practical 1	10	5.1	15.12.25
Practical 2	10	5.1	15.12.25
Test 1	30	15.3	30.10.25
Test 2	30	15.3	11.12.25
<b>Total:</b>	<b>100</b>	<b>51</b>	

### Conversion of points to final grade:

- "5" (**Excellent**): 91–100 points
- "4" (**Very Good**): 81–90 points
- "3" (**Good**): 71–80 points
- "2" (**Satisfactory**): 61–70 points
- "1" (**Poor**): 51–60 points
- "0" (**Fail**): less than 51 points

### Academic Practices:

As a student of the TalTech School of Information Technologies, you are required to follow the university's academic practices in your studies. It is expected that any work you submit under your name is your own. Plagiarism, cheating and unallowed AI usage are not acceptable. If it is confirmed that you have engaged in such activities, the specific assignment will be graded as "0", and a report will be submitted to the School's *Committee for Handling Academic Practices and Misconduct*.

Depending on the committee's recommendation, this may result in a formal reprimand from the Dean or, in the case of serious violations, expulsion from the university.

#### **AI Usage Rules:**

The use of AI is **not permitted** in graded tasks — meaning homework assignments, practical tasks, and tests must be completed independently without any external, including AI, assistance.

AI is also **not allowed** in activities that hinder the acquisition of knowledge and skills, such as:

- entering the full text of an assignment provided by the instructor to obtain a mathematical solution, result values, or interpretation;
- using AI to find answers to self-test questions.

AI **may be used** for:

- exploring additional information on interesting or advanced topics;
- as a calculator, where the numerator and denominator values of a formula are provided by the student in the process of solving word problems.

#### **Detailed Course Schedule and Topics**

The semester plan is preliminary and may change due to meeting cancellations, material updates, or other adjustments. Any changes will be announced through the course Moodle page.

##### **Week 1 (04.09.25, 17:00–18:30) – Viigimäe and Holmar**

*Contact learning*

- During the class: Introduction to the syllabus and assessment criteria. Lecture: "Introduction to Medical Statistics."
- Topics covered: Evidence-based medicine; concepts of medical statistics and biostatistics; historical development of medical statistics; medical statistics databases.
- After the class: Read the material in Moodle. Provide feedback.

##### **Week 2 (11.09.25) – Viigimäe**

*Distance learning* – Lecture: "Measuring the Occurrence of Diseases."

- Topics covered: Measures of disease frequency; prevalence; incidence; temporal profiles of disease occurrence; epidemic curve; cartogram; mortality; lethality; survival.
- Additionally:
  - Read supporting materials in Moodle.
  - Noordzij M, et al. (2010). *Measures of Disease Frequency: Prevalence and Incidence*. *Nephron Clin Pract*, 115:c17–c20.
  - Complete the self-test.
  - Provide feedback.

##### **Week 3 (18.09.25, 17:00–18:30) – Viigimäe**

*Contact learning*

- Before the class: Review formulas covered in Week 2.
- During the class: Exercise session.
- After the class: Read the material in Moodle.

#### **Week 4 (25.09.25) – Viigimäe**

*Distance learning* – Lecture: “Types of Epidemiological and Clinical Studies.”

- **Topics covered:** Causality; disease determinants and risk factors; epidemiological studies – classification.
- **Additionally:**
  - Read supporting materials in Moodle.
  - Roever L. (2016). *Endpoints in Clinical Trials: Advantages and Limitations*. Evidence Based Medicine and Practice, 1:2.
  - Complete the self-test.
  - Provide feedback.

#### **Week 5 (02.10.25) – Viigimäe**

*Distance learning* – Lecture: “Parameters for Estimating Association and Effect.”

- **Topics covered:** Association and effect; analysis of results – epidemiological studies and estimable parameters.
- **Additionally:**
  - Read supporting materials in Moodle.
  - Bonita R, Beaglehole R, Kjellström T & WHO (2006). *Basic Epidemiology*, 2nd ed. WHO. Chapters 2 (pp. 33–36) and 5 (pp. 83–96).
  - Rensing M, Blettner M, Klug SJ. (2010). *Data Analysis of Epidemiological Studies*. Dtsch Arztebl Int, 107(11):187–192.
  - Tripepi G, et al. (2007). *Measures of Effect: Relative Risks, Odds Ratios, Risk Difference, and ‘Number Needed to Treat’*. Kidney International, 72:789–791.
  - Complete the self-test.
  - Provide feedback.

#### **Week 6 (09.10.25) – Viigimäe**

*Distance learning* – Lecture: “Random and Systematic Errors in Study Design and Implementation.”

- **Topics covered:** Statistical significance; errors in studies; random error; systematic error; bias in epidemiological studies; controlling for bias.
- **Additionally:**
  - Bonita R, Beaglehole R, Kjellström T & WHO (2006). *Basic Epidemiology*, 2nd ed. WHO. Chapter 3 (pp. 51–55).
  - Tripepi G, et al. (2008). *Bias in Clinical Research*. Kidney International, 73:148–153.
  - Complete the self-test.
  - Provide feedback.
  - **First homework deadline: 30.10.25**

#### **Week 7 (16.10.25, 16:00–17:30) – Holmar**

*Contact learning* – Lecture: “Choosing Statistical Tests.”

- Before the class: Read Moodle articles:
  - Kwiecien R, et al. (2011). *Concordance Analysis*. Dtsch Arztebl Int, 108(30):515–521.
  - du Prel J-B, et al. (2010). *Choosing Statistical Tests*. Dtsch Arztebl Int, 107(19):343–348.
  - Vicor A, et al. (2010). *Judging a Plethora of p-Values*. Dtsch Arztebl Int, 107(4):50–56.

- Prescott RJ. (2019). *Avoid being tripped up by statistics*. *Gait & Posture*, 72:240–249.
- During the class: Preparation for statistical testing; null hypothesis; confidence intervals and p-value; data assessment and categorization; most common statistical tests – descriptions and examples; algorithm for selecting appropriate tests; correlation.
- After the class: Complete the self-test and provide feedback.

### **Week 8 (23.10.25) – Viigimäe**

*Distance learning* – Lecture: “Confounding of Factor Effects.”

- **Topics covered:** Causality of factors; confounding; interaction of factors.
- **Additionally:**
  - Bonita R, Beaglehole R, Kjellström T & WHO (2006). *Basic Epidemiology*, Chapter 3 (pp. 55–60).
  - Jager KJ, et al. (2008). *Confounding: What it is and how to deal with it*. *Kidney International*, 73:256–260.
  - Skelly AC, et al. (2012). *Assessing bias: the importance of considering confounding*. *Evidence-Based Spine-Care Journal*, 3(1):9–12.
  - Complete the self-test.
  - Provide feedback.
  - **First homework deadline: 30.10.25**

### **Week 9 (30.10.25, 17:00–18:30) – Viigimäe**

*Contact learning*

- Submit the first homework (deadline: 30.10.25).
- Written Test I (Topics from Weeks 1–6 and 8).
- Remake possibility for Test I and II on 08.01.26.

### **Week 10 (06.11.25) – Holmar**

*Distance learning* – Lecture: “Linear and Logistic Regression.”

- Topics covered: Regression and correlation; multiple linear regression; stepwise regression; logistic and multiple logistic regression; ROC curve and area under the curve.
- Additionally:
  - Read Moodle articles:
    - Tripepi G, et al. (2008). *Linear and Logistic Regression Analysis*. *Kidney Int*, 73(7):806–810.
    - Schneider A, et al. (2010). *Linear Regression Analysis*. *Dtsch Arztebl Int*, 107(44):776–782.
    - Kuss O. (2016). *Propensity Score: An Alternative Method of Analyzing Treatment Effects*. *Dtsch Arztebl Int*, 113(35-36):597–603.
  - Complete the self-test.
  - Provide feedback.

### **Week 11 (13.11.25) – Holmar**

*Distance learning* – Lecture: “Kaplan-Meier Survival Analysis.”

- Topics covered: Mortality analysis; events and censoring; Kaplan-Meier estimate; survival curve; group comparisons; adjustment; log-rank test.
- Additionally:

- Jager KJ, et al. (2008). *The Analysis of Survival Data: the Kaplan-Meier Method*. *Kidney Int*, 74(5):560–565.
- Zwiener I, et al. (2011). *Survival Analysis*. *Dtsch Arztebl Int*, 108(10):163–169.
- Complete the self-test.
- Provide feedback.
- Second homework deadline: 26.11.25

### **Week 12 (20.11.25) – Holmar**

*Distance learning* – Lecture: “Cox Regression. Proportional Hazards Regression Model.”

- Topics covered: Cox proportional hazards model; survival curve; adjustment; time-dependent effects; time-varying risk factors.
- Additionally:
  - van Dijk PC, et al. (2008). *Cox Regression in Nephrology*. *Kidney Int*, 74(6):705–709.
  - Dekker FW, et al. (2008). *Survival Analysis: Time-Dependent Effects and Time-Varying Risk Factors*. *Kidney Int*, 74(8):994–997.
  - Complete the self-test.
  - Provide feedback.
  - Second homework deadline: 26.11.25

### **Week 13 (27.11.25, 16:00–17:30) – Holmar**

*Contact learning* – Practical Assignments I and II using **MedCalc** software.

- Before the class:
  - Install the MedCalc 15-day trial (Windows OS required)  
<https://www.medcalc.org/download/>.
  - Download practice data files and instructions from Moodle.
- After the class:
  - Review the practical work, save necessary data, and prepare reports.
  - Deadline for practical assignment reports: 15.12.25
  - Provide feedback.

### **Week 14 (04.12.25) – Holmar**

*Distance learning* – Two lectures:

- “Etiological and Prognostic Models.”
- “Interactions and Study Design.”
- Topics covered: Etiological models; prognostic models; step-by-step validation; factors; interaction; medical study design.
- Additionally:
  - Tripepi G, et al. (2008). *Etiological and Prognostic Models*. *Kidney Int*, 74(12):1512–1515.
  - Altman DG, et al. (2000). *Validating a Prognostic Model*. *Stat Med*, 19(4):453–473.
  - de Mutsert R, et al. (2009). *The Effect of Joint Exposures: Examining Interaction*. *Kidney Int*, 75(7):677–681.
  - Röhrig B, et al. (2009). *Study Design in Medical Research*. *Dtsch Arztebl Int*, 106(11):184–189.

- Complete the self-tests.
- Provide feedback.
- Deadline for practical assignment reports: 15.12.25

**Week 15 (11.12.25) – Holmar**

*Contact learning* – Written test II

- Before the class: Prepare for the second test and finalize practical assignments reports.
- During the class: Written Test II (Topics from Weeks 9–14).
- After the class: Review Moodle materials as needed.
- Provide feedback

**Week 16 (18.12.25)**

*Distance learning*

- Finalize submission of practical assignment reports (Deadline: 15.12.25).
- Remake possibility for Test I and II on 08.01.26.
- Provide feedback.