Course syllabus for

Survival analysis with applications in medicine, 7.5 credits

Överlevnadsanalys med tillämpningar inom medicin, 7.5 hp
This course syllabus is valid from spring 2025.

Course code	5BD001
Course name	Survival analysis with applications in medicine
Credits	7.5 credits
Form of Education	Higher Education, study regulation 2007
Main field of study	Biostatistics and Data Science
Level	AV - Second cycle
Grading scale	Pass with distinction, Pass, Fail
Department	Department of Medical Epidemiology and Biostatistics
Decided by	Programme committee for study programmes in biomedicine
Decision date	2023-10-11
Revised by	Programme committee for study programmes in biomedicine
Last revision	2024-10-10
Course syllabus valid from	Spring 2025

Specific entry requirements

A Bachelor's degree or professional degree of at least 180 credits or the equivalent. The applicant must have completed a total of at least 60 credits in mathematics, statistics, and programming, of which univariate calculus, multivariate calculus, linear algebra, numerical methods, probability theory and statistics, and programming with a high-level language must be included. Proficiency in English equivalent to the Swedish upper secondary school course English 6/English B.

Objectives

The course aims to equip the student with an understanding of fundamental concepts in survival analysis (censoring, truncation, timescales, and the hazard and survival functions) and methods for modelling time-to-event (survival) data, including a rigorous statistical formulation of the likelihoods and partial likelihoods, along with the competence, skills, and judgement to appropriately apply such methods in biomedical research.

Upon completion of the course, the student should be able to:

Regarding knowledge and understanding

- Define key concepts in survival analysis, including censoring and truncation, and explain the relevance of these concepts for the analysis of time-to-event data in biomedical research.
- Understand the concept of timescales in statistical models for time-to-event data.

Regarding competence and skills

- Estimate and compare survival functions and state probabilities using parametric and non-parametric methods, including testing for and modelling time-varying effects.
- Propose a suitable statistical model for assessing a specific research hypothesis using data from a time-to-event study, fit the model using standard statistical software, evaluate the fit of the model, and interpret the results.
- Be able to control for different timescales using standard statistical software, and argue for an appropriate timescale for a given research hypothesis.
- Understand how to assess discrimination and calibration for predictions based on time-to-event models.

Regarding judgement and approach

- Critically evaluate the methodological aspects (design and analysis) of a scientific article in biomedicine reporting a time-to-event study.

Content

Both theoretical and practical (handson data analysis) components will be included. The following topics will be included:

- Concepts in survival analysis (censoring, truncation, timescales, and the hazard and survival functions)
- Non-parametric estimation and testing of survival functions
- Parametric models, including Poisson regression
- The Cox proportional hazards model
- Flexible parametric models
- Accelerated failure time models
- The proportional hazards assumption and how models can be extended to include time-varying coefficients (and time-varying covariates)
- Competing risks and an introduction to multi-state models
- Risk set sampling, including the case-cohort and nested case control study designs
- Discrimination and calibration
- Frailty
- Survival analysis with recurrent events
- Non-collapsibility and choice of causal effect measures

Teaching methods

The primary teaching methods will be lecture-based learning, technology-enhanced learning (primarily computer-based data analysis), individual learning, and group learning. The course focuses on active learning, i.e., putting knowledge into practice and critically reflecting upon the knowledge.

Examination

The examination consists of assignments (with written and/or oral presentation) and an individual written examination. The deliverable elements of the assignments (e.g., holding an oral presentation or submitting a written report) are to be completed before the end of the course according to the times specified in the schedule.

If there are special grounds, or a need for adaptation for a student with a disability, the examiner may decide to deviate from the syllabus' regulations on the examination form or the possibility of supplementation or exemptions from compulsory sections of the course. Content and learning outcomes as well is the level of expected skills, knowledge and abilities may not be changed, removed, or reduced.

Compulsory participation
It is compulsory to attend the introduction to the course and the sessions in which the assignments are presented/discussed. The examiner assesses if and, in that case, how absence from compulsory components can be compensated. Before the student has participated in all compulsory parts or compensated absence in accordance with the examiner's instructions, the student's results will not be registered in LADOK. Absence from a compulsory activity may result in that the student cannot compensate the absence until the next time the course is given.

Limit to the number of examinations
A student who does not pass the first examination is entitled to participate in five more examinations. If the student does not pass after four examinations, he/she is recommended to retake the course at the next regular course date, and may, after that, participate in two more examinations. If the student has failed six examinations, no additional examination or new admission is provided.

The number of times that the student has participated in one and the same examination is regarded as an examination session. Submission of a blank examination is regarded as an examination. An examination, for which the student registered but not participated in, is not counted as an examination.

Other directives

The course language is English.

Literature and other teaching aids

Collett, David

Modelling survival data in medical research

Fourth edition : Boca Raton : Chapman & Hall/CRC, 2023 - 540 pages
ISBN:9781032252858 LIBRIS-ID:1kdff39pzqb4ntd4
Library search

Additional study material and reference articles will also be provided during the course.