GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2024-2025

## Survival Analysis (C002950)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 5.0** **Study time 150 h**

**Course offerings and teaching methods in academic year 2024-2025**

| | | | |
|---|---|---|---|
| A (semester 2) | English | Gent | seminar |
| | | | lecture |
| | | | independent work |

**Lecturers in academic year 2024-2025**

| | | |
|---|---|---|
| Goetghebeur, Els | WE02 | lecturer-in-charge |

| Offered in the following programmes in 2024-2025 | crdts | offering |
|---|---|---|
| Master of Science in Teaching in Science and Technology(main subject Mathematics) | 5 | A |
| Master of Science in Mathematics | 5 | A |
| Master of Science in Statistical Data Analysis | 5 | A |
| Exchange Programme in Mathematics (master's level) | 5 | A |

**Teaching languages**

English

**Keywords**

Competing risks, Hazards, Kaplan-Meier curve, Martingale residuals, Proportional hazards model, Non-informative censoring, SAS, Survival analysis, Theory of risks, Time-varying covariates

**Position of the course**

The course builds on methods and skills acquired in the courses of`Principles of statistical data analysis',`Analysis of Continuous Data' and`Categorical Data Analysis'.
Students will understand the key concept of non-informative censoring and its implications for survival analysis. Students will learn how to design and analyze studies of times until the occurrence of an event, such as death or the next cause-specific failure of a system, based on non-informatively right-censored data.

**Contents**

- Informative and non-informative censoring.
- Parametric models and maximum likelihood theory for estimating survival functions and hazards based on non-informatively censored data.
- The Kaplan-Meier estimator of the survival function as a non-parametric maximum likelihood estimator.
- The (weighted) logrank test for non-parametric comparisons of hazards between groups.
- Designing a two groups comparison with logrank test.
- Proportional hazards models for the combined effect of several prognostic factors on hazards over time.
- Maximum partial likelihood as a heuristic estimation method.
- Martingale and Schoenfeld residuals as a diagnostic tool
- The extended proportional hazards model with time-varying covariates
- Accelerated failure time models
- Cause-specific hazards
- Marginal models for repeated events
- Data-analysis by means of the software packages SAS or R.

**Initial competences**

Students have successfully completed`Principles of statistical data analysis',`Analysis of

Continuous Data' and 'Categorical Data Analysis' or acquired the competences reached there in some other way.

**Final competences**

1 The student knows the definition and practical importance of non-informative censuring and can evaluate its plausibility in a specific context.
2 He/she can draw Kaplan-Meier curves and perform (weighted) logrank tests to compare survival curves between groups in a powerful manner.
3 The student can design a comparative study of survival times and calculate the required sample size.
4 He/she will interpret the proportional (PH) hazards model correctly, can fit it to a given data set, can build a model and draw justified conclusions, both in the formal and the practical sense.
5 He/she can construct a prognostic score and make predictions with known error margins, based on the PH model.
6 The student can check the fit of the model and propose necessary extensions or alternatives if needed.
7 He she has been introduced to the analysis of repeated events and has acquired a basis from which he/she can further explore the rich literature on this topic.
8 He she can appropriately report on the results of a survival analysis.

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Seminar, Lecture, Independent work

**Study material**

Type: Slides

Name: survival analysis
Indicative price: € 10
Optional: no
Language : English
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Additional information: The slides are free of charge, the indicated cost is for printing the slides (if so desired)

**References**

D. Collett. 'Modeling Survival Data in Medical Research', 4th Edition, Chapman & Hall/CRC, 2023.
J. D. Kalbfleisch R. L. Prentice. The Statistical Analysis of Failure Time Data', Wiley-Interscience; 2nd edition, 2002.
T. M. Therneau P. Grambsch. 'Modeling Survival Data: Extending the Cox Model' (Statistics for Biology and Health), Springer Verlag, 2000.
P. D. Allison. 'Survival Analysis Using the SAS System: A Practical Guide', 2nd edition, SAS Publishing, 2010.
D. Kleinbaum, G. David, M. Klein. 'Survival Analysis. A Self-Learning Text', Third Edition, Springer, 2012.

**Course content-related study coaching**

Students are coached during PC labs. Through the electronic learning environment they can exchange questions and answers outside lecture hours. A project will provide the students with practical experience in data analysis, with feedback provided.

**Assessment moments**

end-of-term and continuous assessment

**Examination methods in case of periodic assessment during the first examination period**

Written assessment with open-ended questions

**Examination methods in case of periodic assessment during the second examination period**

Written assessment with open-ended questions

**Examination methods in case of permanent assessment**

Oral assessment, Assignment

**Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible

**Extra information on the examination methods**

The knowledge and problem solving skills of the students are tested.
Periodic evaluation: open book exam.
Permanent evaluation takes the form of a more involved data analysis project, which is also presented orally.
Failed students can retake the exam in a second session. This will then also involve a project with oral defense in addition to the written exam.Partial results for which the student scored at least half of the points, can be transferred to the next examination period within the same academic year.
Partial results will never be rounded.

**Calculation of the examination mark**

Periodic evaluation (50%) and permanent evaluation (50%).
Students must pass both parts to pass the course.
Failed students can retake the exam in a second session.