GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2019-2020

## Survival Analysis (C002950)

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

| | | | |
|---|---|---|---|
| Credits | 5.0 | Study time | 150 h |
| Contact hrs | 62.5 h | | |

Course offerings and teaching methods in academic year 2020-2021

| | | | |
|---|---|---|---|
| A (semester 2) | English | seminar: practical PC room classes | 7.5 h |
| | | self-reliant study activities | 22.5 h |
| | | seminar: coached exercises | 7.5 h |
| | | lecture | 22.5 h |

Lecturers in academic year 2020-2021

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

| Offered in the following programmes in 2020-2021 | crdts | offering |
|---|---|---|
| Master of Science in Statistical Data Analysis | 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

Lecture, self-reliant study activities, seminar: coached exercises, seminar: practical PC room classes

Learning materials and price

A syllabus is available.
Cost: 10 EUR

References

D. Collett. `Modeling Survival Data in Medical Research', 3rd Edition, Chapman & Hall/CRC, 2015.
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 series of projects will provide the students with practical experience in data analysis, with feedback provided.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, open book examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Oral examination, assignment

Possibilities of retake in case of permanent evaluation

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 two take home problem sets for independent work and 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.

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.