Oregon State University

ST625 Survival Analysis

Winter 2025

Instructor info

Instructor:	Rob Trangucci rob.trangucci@oregonstate.edu	Office hours: W 3p-4:30p
Teaching assistant:	Patrick Carroll carropat@oregonstate.edu	Office hours: NA

Class meetings

Lecture: MWF 2p-2:50p **Room**: Weniger Hall 285

All class meetings will be in-class lectures.

Textbook

Modelling Survival Data in Medical Research, 4th Edition, Collett

Optional textbooks

- *Survival and Event History Analysis*, Aalen, Borgan, and Gjessing
- *Counting Processes and Survival Analysis*, Fleming and Harrington

Course organization

I will use the course website https://rtrangucci.github.io/st_625_w_25.html for organizing the material, while I will use Gradescope for assignment submission and grading.

Prerequisites

A minimum grade of C is required in ST 553 and ST 563.

Course objectives

To highlight the unique challenges posed by the analysis of failure/survival data. To allow you to analyze survival data using parametric and nonparametric techniques in the face of these challenges. To apply these techniques to real data using R code and R packages for survival analysis. To understand the theory and methodology through math, practice and code.

Course schedule

Week	Topic	LO	HW
1	Intro to survival analysis Hazard and survival function	1,2	
2	Censoring and truncation Nelson-Aalen and Kaplan-Meier estimators	1, 2	1
3	Log-rank test Asymptotics	1, 2 1, 2, 4	2
4	Asymptotics Parametric regression models	2,3,4	3
5	Parametric regression models	2,3,6	Test
6	Influence functions Cox PH model	2,3,6	4
7	Cox PH model	3,6	5
8	Frailty and model misspecification in Cox PH Counting processes	2, 3, 5	6
9	Martingales in survival analysis	1-5	7
10	Presentations	1-5	

Learning outcomes

1. Derive the relationship between the hazard function, the survival function and mean lifetime.
2. Compute the observed data likelihood from censored survival data under parametric and nonparametric models.
3. Apply model checking tools to a fitted Cox model to determine whether proportional hazards assumptions are reasonable.
4. Define the key differences between a score test, a Wald test, and a likelihood ratio test.
5. Derive a score test and a Wald test for survival models.
6. Derive the expression for the Cox partial likelihood from the joint likelihood for the baseline hazard and the proportional hazards.

Concepts to be discussed include: hazard function (failure rate function); nonparametric likelihood; counting processes; empirical distribution function; censoring and truncation; Kaplan-Meier

estimator; Bias of the KM estimator; Cox proportional hazards model; Accelerated Failure Time Model; Partial Likelihood; log-rank test; martingales. R will be the programming language used in the course.

Course activities and grading

1. Weekly homework assignments: 50% of grade
2. In-class exam: 30% of grade
3. Final project: 20% of grade

Course Statements

Academic Calendar

All students are subject to the registration and refund deadlines as stated in the Academic Calendar: https://registrar.oregonstate.edu/osu-academic-calendar

Statement Regarding Students with Disabilities

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations."

Student Conduct Expectations

link: https://beav.es/codeofconduct

Student Bill of Rights

OSU has twelve established student rights. They include due process in all university disciplinary processes, an equal opportunity to learn, and grading in accordance with the course syllabus: https://asosu.oregonstate.edu/advocacy/rights

Reach Out for Success

University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it's important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at https://oregonstate.edu/ReachOut. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255)

Student Evaluation of Courses

During Fall, Winter, and Spring term the online Student Learning Experience surveys open to students the Wednesday of week 9 and close the Sunday before Finals Week. Students will receive notification, instructions and the link through their ONID email. They may also log into the system via MyOregonState or directly at beaves.es/Student-Learning-Survey. Survey results are extremely important and are used to help improve courses and the learning experience of future students. Responses are anonymous (unless a student chooses to "sign" their comments, agreeing to relinquish anonymity of written comments) and are not available to instructors until after grades have been posted. The results of scaled questions and signed comments go to both the instructor and their unit head/supervisor. Anonymous (unsigned) comments go to the instructor only.