

STA 6177 / PHC 6937: Applied Survival Analysis

Fall, 2017

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When: Tuesday 9th period (4:05 – 4:55 pm) in HPNP G301
Thursday 8th and 9th periods (3:00 – 4:55 pm) in HPNP G101
Office hours by appointment

Objectives:

Survival analysis is about the analysis of time-to-event data. It is one of the most widely applied branches of statistics. In public health and medicine, it is the theoretical foundation for the design and analysis of cohort and case-control studies. The goal of this course is to help you understand the fundamental concepts of survival analysis and their applications in epidemiology. Basic concepts from probability and calculus will be reviewed as needed.

Calendar:

- Aug. 22 Introduction, review syllabus
Lecture 1: Probability, random variables, distributions, and expectation & variance
24 Continue Lecture 1
29 Exercises 1
31 Lecture 2: Estimation of probabilities: Prevalence and incidence, LLN and CLT, calculus, and the delta method
- Sept. 5 Exercises 2
7 Lecture 3: Fundamental concepts of survival analysis: Censoring, survival and hazard functions, failure-time distributions, and maximum likelihood estimation
12 Exercises 3
14 Lecture 4: Empirical CDF and the Kaplan-Meier and Nelson-Aalen estimators
19 Exercises 4
21 Lecture 5: Cohort studies, measures of association, and accelerated failure time models
26 Exercises 5, Exam 1 review
28 **Exam 1**
- Oct. 3 Review Exam 1 solutions
5 Lecture 6: Log-rank test
10 Exercises 6

- 12 Lecture 7: Semiparametric relative-risk regression: the Cox model
17 Exercises 7
19 Lecture 8: Cox model: baseline hazard estimation and correction for ties
24 Exercises 8
26 Lecture 9: Building and interpreting regression models
31 Exercises 9
- Nov 2 Lecture 10: Residuals and goodness-of-fit for regression models
7 Exercises 10, Exam 2 review
9 **Exam 2**
14 Review Exam 2 solutions
16 Lecture 11: Confounding and stratification: Mantel-Haenszel, the stratified log-rank test and Cox regression.
21 Lecture 12: Case-control studies and conditional logistic regression
23 **Thanksgiving (No class)**
28 Exercises 11 and 12
30 Lecture 13: Cox model extensions: Competing risks, recurrent events, and time-dependent covariates
- Dec. 5 Exercises 13, Final exam review, Final exam distributed
7 **No class**
12 **Final exam due**

Class format and website:

Thursday will be two hours of lecture divided into four segments. Each segment will be approximately 20 minutes with 5 minutes for questions. There will be a fifteen-minute break between periods. You are encouraged to bring a hard copy of the lecture notes to class, and laptops are allowed.

Tuesday will be a problem-solving session where we work on the problem sets. This will be crucial for reviewing concepts, learning to apply them, and preparing for the exams. Laptops are allowed.

Class website:

There will be a class website on Canvas. You will need to sign in with your Gatorlink ID and password. Lecture notes, announcements, and other files will be posted here. Technical issues can be resolved at the UF Helpdesk (<http://helpdesk.ufl.edu>) or E-learning Support (<https://lss.at.ufl.edu/help.shtml>)

Problem sets:

Problem sets will be given each week unless there is an exam. You are encouraged to work together, but you should write up your own results. They will not be graded, but they will be important for learning the material and preparing for the exams.

Exams:

There will be two midterm exams and one final exam. The midterm exams will be in class with open notes. Calculators are allowed, but laptops and cell phones are not. The final exam will be a take-home exam. The exams will use problems adapted from the problem sets.

Readings:

There is no required textbook for the course. The primary readings will be lecture notes.

Good textbooks for epidemiology are *Epidemiology: An Introduction* by Kenneth J. Rothman (Oxford University Press, 2012) and *Statistical Models in Epidemiology* by David Clayton and Michael Hills (Oxford University Press, 1993). Good basic textbooks on survival analysis are: *Applied Survival Analysis, 2nd edition* by David W. Hosmer, Stanley Lemeshow, and Susanne May (Wiley-Interscience, 2008) or *Survival Analysis Using SAS: A Practical Guide, 2nd edition* by Paul D. Allison (SAS Press, 2012). More advanced textbooks that cover the class material are: *The Statistical Analysis of Failure Time Data (2nd Edition)* by John D. Kalbfleisch and Ross L. Prentice (Wiley Series in Probability and Statistics, 2002), *Survival and Event History Analysis: A Process Point of View* by Odd Aalen, Ørnulf Borgan, and Håkon Gjessing (Springer-Verlag, 2008), and *Modeling Survival Data: Extending the Cox Model* by Terry M. Therneau and Patricia M. Grambsch (Springer-Verlag, 2000).

Software:

All statistical computing in the class will be done in R (<https://cran.r-project.org/>). An introduction to R is available online (<https://cran.r-project.org/doc/manuals/R-intro.pdf>). Many of the functions we use will be in the `survival` package (<https://cran.r-project.org/web/packages/survival/survival.pdf>). From within R, this can be installed using the command: `install.packages("survival")`.

Grading:

The assessment will include class participation, assignments, and two exams. Class participation will include weekly attendance and participation in discussions. Students are responsible for all course material, including reading required materials prior to each class. Failure to complete assignments will result in a failing grade.

- 15% Class participation
- 25% Exam 1 (in class September 28)
- 25% Exam 2 (in class November 9)
- 35% Final Exam (due December 12)

The grading scale for this course consists of the standard scale, including minus grades, below. The conversion factors for grade point values that are assigned to each grade are also included (in parentheses):

- 93% - 100% = A (4.00)
- 90% - 92% = A- (3.67)
- 87% - 89% = B+ (3.33)
- 83% - 86% = B (3.00)
- 80% - 82% = B- (2.67)
- 77% - 79% = C+ (2.33)
- 73% - 76% = C (2.00)
- 70% - 72% = C- (1.67)
- 67% - 69% = D+ (1.33)
- 63% - 66% = D (1.00)
- 60% - 62% = D- (0.67)
- Below 60% = E (0.00)

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at: <http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Academic Integrity:

Cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior. Students are expected to act in accordance with the University of Florida policy on academic integrity. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>
<http://gradschool.ufl.edu/students/introduction.html>

Policy Related to Class Attendance and Late or Missing Assignments:

Attendance of all class sessions is required. Please see the instructors as early as possible regarding possible absences. All assignments need to be handed in on time. Grading will penalize late assignments. Missed assignments will receive a zero score. Personal issues with respect to class attendance or fulfillment of course requirements (assignments, final presentation, class discussion) will be handled on an individual basis. All faculty are bound by the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Accommodations:

Students with disabilities requesting accommodations should first register with the Disability Resources Center (352-392-8565; www.dso.ufl.edu/drc/). Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Please register as early as possible in the semester.

Online feedback:

Students are expected to provide feedback on the quality of instruction in this course by completing the online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

University of Florida Honor Code

UF students are bound by the Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.” On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code specifies a number of behaviours that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to the appropriate personnel. The full student conduct and honor code is at <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

U Matter, We Care

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to many other helping resources including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.