BIOS 780: Advanced Survival Analysis

Fall, 2016

Instructor: Jason Fine

Prerequisite: BIOS 760, 761, 763, and previous exposure to survival analysis. It is expected that only PhD and DrPH students in Biostatistics having passed the qualifying exams will formally register for this class. Permission may be granted for other students.

Lectures

• Regularly scheduled class times are Tuesday/Thursday, 11:00 until 12:15 pm, in McG 2305.

• Lecture notes will emailed to students. Handouts from texts will be distributed in class.

• I will have occassional short term travel commitments which may prevent me from lecturing at the regularly scheduled time. Make-up classes will generally be scheduled on Friday, from 11 until 12:15 pm with the location to be determined, and will be announced in class.

Office Hours: Tuesday, Thursday after class, and by appointment.

Texts :

1. Counting Processes and Survival Analysis, by TR Fleming and DP Harrington, Publisher: Wiley. (primary)

2. Statistical Models Based on Counting Processes, by PK Andersen, O Borgan, RD Gill, N Keiding, Publisher: Springer (secondary)

Overview: This class will develop the theoretical underpinnings for standard nonparametric and semiparametric analyses employed with censored survival data in biomedical applications, including Kaplan-Meier estimator, logrank test, and proportional hazards model. Additional topics will include competing risks, model diagnostics for PH model, alternatives to PH model, and multivariate survival. The focus here will be on presenting key methodologic developments for the analysis of survival data and how a rigorous understanding of this methodology can be obtained using counting processes and martingale theory. Heavy emphasis will be placed technical details, with some real data examples.

Grading: Homeworks, including theoretical exercises and data analysis, exams, either take home or in class, and potentially projects, with the number and timing not yet decided. Percentages assigned to graded work will be determined at a later time and communicated to students taking the class.

Material to (Potentially) be Covered in Lectures

Introduction and review

One sample estimators: Kaplan-Meier and Nelson-Aalen

Competing risks

One sample estimators using counting processes

Counting processes and martingales

Martingale theory: key results

Application of martingale theory to one sample estimators

Nonparametric hypothesis testing: weighted logrank tests

Proportional hazards regression: model specification, estimation, theoretical issues

Proportional hazards regression special topics: stratification, model diagnostics, time-dependent covariates

Additive hazards model

Multivariate survival