PUBHBIO 8235
Regression Modeling of Time-to-Event Data
Spring 2016

Instructor: Michael Pennell, Ph.D.
246 Cunz Hall
Phone: 614-247-7936
Email: pennell.28@osu.edu

Office Hours: Tuesdays and Thursdays 2:00-3:00 pm or by appointment

Lectures: Wednesdays and Fridays 12:45-2:05 pm, Lazenby 0018

Teaching Assistant: Mark Burch, burch.126@osu.edu, Office Hours: Wednesdays and Fridays, 11 am – 12 pm in Cunz 400B

Course Webpage: Carmen: http://carmen.osu.edu
Login with your OSU internet username (name.#) and password then go to PUBH-BIO 8235.

Course Description: This course is a follow-up to PUBH-BIO 7235 covering topics in more depth as well as introducing additional topics in survival analysis. Statistical models and methods useful for analyzing both univariate and multivariate failure time data are discussed. Topics beyond applied survival analysis include martingale and asymptotic theory, recurrent event processes, and Bayesian methods. Emphasis will be on nonparametric and semiparametric approaches for modeling, estimation and inference although parametric methods will also be shown.

Primary Text: *Survival and Event History Analysis*, by Aalen, Borgan, and Gjessing
Available free* at: http://link.springer.com/book/10.1007/978-0-387-68560-1

Secondary Texts: *Survival Analysis: Techniques for Censored and Truncated Data*, 2nd edition, by Klein & Moeschberger.
Available free*
at: http://web.a.ebscohost.com/ehost/detail/detail?sid=03573274-452a-4fe0-8f87-f8b34f3b285e%40sessionmgr4002&vid=0&hid=4204&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=108043&db=nlebk

Bayesian Survival Analysis by Ibrahim, Chen, and Sinha.
(Readings will be posted on Carmen).

***You must be using a University computer or signed in to the OSU library website.

Required Software:
STATA will be used for all data analysis examples in class, except for the Bayesian analyses in which case SAS will be used. To ensure that you obtain the best computing support from myself and the TA, **you are required to use the software package demonstrated in class for all homework.** STATA is

available at a reduced rate for students at http://www.stata.com/order/new/edu/gradplans/student-pricing/. If you do order STATA, please choose STATA/IC. You may also access STATA and SAS in the Cunz Hall computer labs.

Grading: Final class grade will be determined as follows:

Homework	20%
Exam 1	25%
Exam 2	25%
Final Project	30%

Grading Scale:* 100-94 A
93-90 A-
89-87 B+
86-84 B
83-80 B-
79-77 C+
76-74 C
73-70 C-
69-60 D
59 or lower E
*The instructor reserves the right to adjust the grading scale if it appears necessary due to class performance. These adjustments will only raise a student's grade not lower it.

Exams: There will be two in-class exams (February 26 and April 8). The exams will be closed book with THREE letter-size sheet of notes (both sides) allowed as reference. **There is no final exam.**

Homework: There will be six homework assignments. Homeworks 1-5 will consist of four sets of problems (A-D), with one set released per lecture. Homework 6 will consist of two sets of problems (A&B). The following weighting scheme will be used to determine your homework grade:

Best 4 scores on HW 1-5:	20% each
Lowest score on HW 1-5:	10%
HW 6:	10%

Please refer to the course schedule below for the release dates of problem sets and homework due dates. All assignments are due on lecture days and must be turned in by the start of class (12:45 pm). Late homework will not be accepted without advance notice. **You are permitted (and encouraged!) to work together on homework, but submitted assignments must be written independently.** Homework should be submitted in hard copy with email only used in an emergency.

Project: Each student will individually give an in-class presentation (15 minutes) at the end of the semester. Additionally, a short report (8-10 pages) on the topic of the presentation is required as part of the project. Topic ideas and further project guidance will be provided early in the semester.

Tentative Schedule: *Subject to change*

Week	Date	Lecture*	Topics	Reading†	Problem Set	HW Due
1	1/13	1	Introduction to Survival Analysis and Counting Processes	ABG Ch 1	1A	
	1/15	2	Discrete Time Stochastic Processes	ABG Ch 2.1	1B	
2	1/20	3	Processes in Continuous Time	ABG Ch 2.2-2.3	1C	
	1/22	4	Processes in Continuous Time	ABG Ch 2.2-2.3	1D	
3	1/27	5	Nelson-Aalen Estimator	ABG Ch 3.1	2A	**HW 1**
	1/29	6	Nelson-Aalen, Kaplan-Meier Estimator	ABG Ch 3.1, 3.2	2B	
4	2/3	7	Kaplan-Meier, Nonparametric Tests	ABG Ch 3.2, 3.3	2C	
	2/5	8	Nonparametric Tests	ABG Ch 3.3	2D	
5	2/10	9	Competing Risks & Cumulative Incidence Function	ABG Ch 3.4	3A	**HW 2**
	2/12	10	Proportional Hazards (PH) Models: Partial Likelihood, Estimation	ABG Ch 4.1.1, 4.1.2	3B	
6	2/17	11	PH Models: Large Sample Theory	ABG Ch 4.1.5, 4.1.6	3C	
	2/19	12	PH Models: Goodness of Fit	ABG Ch 4.1.3 KM Ch 11.2, 11.3, 11.5	3D	
7	2/24	13	Review for Exam 1			**HW 3**
	2/26	14	**Exam 1**			
8	3/2	15	PH Models: Checking PH	KM 11.4	4A	
	3/4	16	PH Models: Checking PH, Accounting for Non-PH	ABG Ch 4.1.4 KM 9.2, 9.3	4B	
9	3/9	17	PH regression modeling in collaborative research	None	4C	
	3/11	18	Additive Hazards Models	ABG Ch 4.2	4D	
SPRING BREAK 3/14-3/18						
10	3/23	19	Parametric Accelerated Failure Time (AFT) Models	ABG Ch 5 KM Ch 12	5A	**HW 4**
	3/25	20	Introduction to Frailty Models	ABG Ch 6	5B	
11	3/30	21	Shared Frailty Models & Random Effects AFT Models	ABG Ch 7.1-7.3, 7.6	5C	
	4/1	22	Nelson-Aalen Estimator & Regression Models for Clustered Survival Data	ABG Ch 8.2-8.3	5D	
12	4/6	23	Exam 2 Review			**HW 5**
	4/8	24	Exam 2			
13	4/13	25	Bayesian Parametric Models	ICS Ch 1.5-1.8; 2	6A	
	4/15	26	Bayesian Semiparametric Models	ICS Ch 3.1-3.4	6B	
14	4/20	27	Student Presentations			**HW 6**
	4/22	28	Student Presentations			

*** Likely to change depending on course flow.**

†ABG = Aalen, Borgan, Gjessing; KM= Klein, Moeschberger; ICS = Ibrahim, Chen, Sinha

Learning Objectives:

Upon successful completion of the course, students will have the knowledge, comprehension and/or skills to be able to use and apply commonly used statistical methods for analyzing univariate and multivariate failure time data. In particular, students will be able to:

1. Construct appropriate models for time to event data using parametric, non-parametric or semi-parametric models and both interpret results and verify model assumptions;
2. Explain basic features of counting processes and apply them to obtain asymptotic results for failure time models;
3. Formulate expressions to estimate parameters using likelihood theory for failure time models;
4. Construct models and expressions for parameter estimation for more advanced time-to-event data situations to include bivariate/multivariate survival and recurrent event data;
5. Research and present results, both orally and in writing, for an advanced topic in the field of survival analysis not covered in the course.

Core Competencies Covered:

- **Core MPH Competencies:**

1. Apply appropriate descriptive and inferential statistical techniques to public health data and interpret results of statistical analyses in the context of public health research and evaluation.

- **Core MPH in Biostatistics Competencies:**

1. Critique scientific research articles and assess the appropriateness of statistical applications involved.
2. Describe preferred methodological alternatives to commonly used statistical methods when assumptions are not met.
3. Apply appropriate statistical techniques for analyzing public health-related data with specific characteristics.
4. Use standard statistical software for both data management and data analysis.

- **Core MS Competencies:**

1. Read the scientific literature in the student's field and critique the methods and results.
2. Conduct literature reviews to evaluate the state of the science regarding specific topics.

- **Core Interdisciplinary Biostatistics PhD Competencies for the Public Health Specilization:**

1. Understand the theoretical foundations of statistical methods.
2. Critique general scientific research articles and assess the appropriateness of the statistical applications and methodology involved.
3. Effectively communicate the results of statistical analyses to statistical and non-statistical audiences.
4. Conduct thorough literature reviews to summarize, evaluate and critique the state of the science regarding new topics in the student's general area of specialization.

Office for Disability Services:

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities.

Academic integrity:

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University, the School of Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the University's *Code of Student Conduct* and the School's *Student Handbook*, and that all students will complete all academic and scholarly assignments with fairness and honesty. The *Code of Student Conduct* and other information on academic integrity and academic misconduct can be found at the COAM web pages (http://oaa.osu.edu/coam/home.html). Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct*, the *Student Handbook*, and in the syllabi for their courses may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Please note that the use of material from the Internet without appropriate acknowledgement and complete citation is plagiarism just as it would be if the source were printed material. Further examples are found in the *Student Handbook*. Ignorance of the *Code of Student Conduct* and the *Student Handbook* is never considered an "excuse" for academic misconduct.

If I suspect a student of academic misconduct in a course, I am obligated by University Rules to report these suspicions to the University's Committee on Academic Misconduct. If COAM determines that the student has violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.