

**PHS 651**  
**ADVANCED REGRESSION METHODS FOR POPULATION HEALTH II**  
**Fall 2011**

**Goals:** The course is designed to extend knowledge of regression analysis of observational data to situations with unequal variance, unequal sampling and propensity weights, clusters and longitudinal observations. Data sets from ongoing research in Population Health will be used as class examples and for exercises. The course also aims to generate deeper understanding of some of the principles underlying statistical estimation, and related mathematical and theoretical subject matter will be introduced when relevant.

**Background required:** A prior course in ordinary and logistic regression analysis is an absolute pre-requisite. Knowledge of calculus, matrix manipulations, general linear models, statistical theory and the SAS package are all helpful.

**Assignments and exams:** Each section of the course will be accompanied by a homework exercise, to be completed in 1 or 2 weeks. There will be in-class quizzes on October 10, November 2 and December 5. A take-home exam (=final project) will be posted at the middle of November and is due December 21. Grade is based on 25% homework, 35% in class quizzes, 40% take-home exam. Homework will receive full credit by being handed in and any comments responded to.

**Readings:** *Quantitative Methods in Population Health: Extensions of Ordinary Regression*, John Wiley and Sons, 2003. Data sets used in the book can be downloaded from Mari Palta's biosketch on the pophealth web page.

Errata, additional notes and practice quizzes can be found at Learn@UW.

Class meets MW 1:10-2:25

Tutorial F11:00-12:00 starts October 7, Q&A by demand and as noted on syllabus.

**INSTRUCTOR: Mari Palta, Ph.D.**

[mpalta@wisc.edu](mailto:mpalta@wisc.edu)

WARF 689; Phone 263-4029

Office hours: by appointment, or meet at tutorial.

- Week 1:  
Sept 7
- Introduction to data sets. Review of linear regression and its assumptions.  
Highlighting of data features that require further methods.
- Reading: Introduction, Chapter 1  
Homework: Regression analysis of sleepiness (due September 14)  
Tutorial: No
- Week 2:  
Sept 12, 14
- Maximum likelihood estimation in simple regression. Introduction to PROC MIXED in SAS.
- Reading: Chapter 2  
Homework: More regression analysis (due Oct 3).  
Tutorial: No
- Week 3:  
Sept 19, 21
- Matrix algebra
- Reading: Appendix, Chapter 3  
Tutorial: No
- Week 4:  
Sept 26, 28
- No class
- Week 5:  
Oct 3, 5
- Least squares estimation in matrix notation.  
Variance matrices and linear transformations
- Reading: Chapter 4, 5.2, 5.3  
Homework: Writing out matrices for ordinary regression . (due October 10).  
Tutorial: Review for quiz
- Week 6:  
Oct 10, 12
- Quiz 1, October 10***  
Standard errors of regression coefficients.  
Homework: Obtaining the standard error of regression coefficients with interaction (due October 19).  
Tutorial: Go over quiz 1
- Week 7:  
Oct 17, 19
- Robust standard errors with PROC MIXED and PROC SURVEYREG.  
Weighted regression for unequal variance.
- Reading: Chapter 6  
Tutorial: Q&A
- Week 8:  
Oct 24, 26
- Weighted regression to account for unequal probability sampling.  
Sensitivity analysis for non-response by weighted regression.
- Reading: Chapter 7  
Homework: Analysis of survey data and sensitivity analyses for non-response (due Nov 2)  
Tutorial: Review for Quiz 2 (has to be rescheduled- due to PopH retreat)

- Week 9: ***Quiz 2 November 2***  
Oct 31, Nov 2 Implications of correlated data. Fitting different covariance matrices with PROC MIXED  
Reading: Chapter 8  
Homework: Analyze correlated data with PROC MIXED (due Nov 16)  
Tutorial: Go over Quiz 2
- Week 10: More on PROC MIXED  
Nov 7, 9 Random effects  
Reading: Sections 10.1-10.2  
Tutorial: Q&A
- Week 11: Random effects.  
Nov 14, 16 Reading: Chapter 10  
Homework: Fit and interpret random effects (due Nov 30)  
Tutorial: Q&A and intro to ***take home exam***
- Week 12: Generalized linear models  
Nov 21, 23 Reading: Chapter 11, 12  
Tutorial: No- Thanksgiving recess
- Week 13: Regression analysis with binary and Poisson outcome.  
Nov 28, 30 Reading: Chapters 13 and 14  
Homework: Regression analysis with binary and count data (due December 12).  
Tutorial: Review for Quiz 3
- Week 14: ***Quiz 3 December 5***  
Dec 5, 7 Poisson outcome, Generalized estimating equations.  
Reading: Chapters 14 and 15  
Tutorial: ***Discussion of progress and feedback on take home exam.***
- Week 15: Generalized estimating equations.  
Dec 12, 14 Reading: Chapter 15  
Tutorial: Q&A

***Take home, due December 21***