

COURSE SYLLABUS

Title: NUR 512: General Linear Approaches II
Term: Spring 2009 (Thursdays – 9:00am -11:50am)
Location: Helen Wood Hall 1W502 (except where noted)
Credit Hours: 3
Instructor: James McMahon, Ph.D.
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 james_mcmahon@urmc.rochester.edu
Office Hours: By Appointment
Pre-Requisites: NUR 510: General Linear Approaches I or permission of instructor

Course Description:

This course presents advanced techniques for the statistical analysis of multiple quantitative variables. These techniques are particularly applicable to the complex research designs characteristic of studies of nursing problems and other behavioral science questions. Building on General Linear Analysis I, topics include multiple regression, structural equations, logistic analyses and multivariate techniques. The emphasis is practical, with a focus on the analysis of actual data.

Course Objectives:

At the completion of the course the student will be able to:

- 1) Evaluate quantitative data for the appropriateness of the analysis via the general linear model.
- 2) Apply general linear analytic techniques that are appropriate to the study of questions, design and data level involved in the analysis of quantitative data.
- 3) Interpret the meaning of the general linear model findings in the context of study design.

Teaching Methods:

- 1) Lecture
- 2) Discussion
- 3) Lab work involving data analyses with real and fictitious data, with SPSS software
- 4) Preparation of a research article manuscript

Required Reading:

Textbooks

Tabachnick, B.G., & Fidell, L. S., (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn and Bacon.

George, D., & Mallery, P. (2009) *SPSS for Windows Step by Step: A Simple Study Guide and Reference*, 17.0 Update (10th Edition)

Articles

Cumming, G. & Finch, S. (2005). Inference by eye. Confidence intervals and how to read pictures of data. *American Psychologist*, **60**, 170-180.

Fairchild, A.J. & MacKinnon, D.P. (2009). A general model for testing mediation and moderation effects. *Prev Sci*, **10**, 187-99.

Ludbrook, J. (1998). Multiple comparison procedures updated. *Clin Exp Pharm Phys*, **25**, 1032-1037.

- Greenland, S. (2008). Invited commentary: variable selection versus shrinkage in the control of multiple confounders. *Am J Epi*, **167**, 523-529.
- Miller, G. A. & Chapman, J. P. (2001) Misunderstanding Analysis of Covariance. *Journal of Abnormal Psychology*, **110**, 40-48.
- Huberty, C.J., Morris, J.D. (1989). Multivariate versus multiple univariate analyses. *Psychological Bulletin*, **105**, 302-308.
- Atkins, D. C. & Gallop, R. J. (2007) Rethinking how family researchers model infrequent outcomes: a tutorial on count regression and zero-inflated models. *Journal of Family Psychology*, **21**, 726-735.
- Buhi, E. R., Goodson, P. & Neilands, T. B. (2007) Structural equation modeling: a primer for health behavior researchers, *American Journal of Health Behavior*, **31**, 74-85.
- Gueorguieva, R., & Krystal, J. H. (2004). Move over ANOVA: progress in analyzing repeated measures data and its reflection in papers published in Archives of General Psychiatry, *Archives of General Psychiatry*, **61**, 310-317.
- Krueger, C. & Tian, L. (2004) A comparison of the general linear mixed model and repeated measures ANOVA using a dataset with multiple missing data points. *Biological Research for Nursing*, **6**, 151-157.
- O'Connell, A. A. & McCoach, D. B. (2004) Applications of hierarchical linear models for evaluations of health interventions. Demystifying the methods and interpretations of multilevel models. *Evaluation & the Health Professions*, **27**, 119-151.
- Whitley, E. & Ball, J. (2002) Statistics review 4: sample size calculations. *Critical Care*, **6**, 335-341.
- Maxwell, S. E., Kelley, K. & Rausch, J. R. (2008) Sample size planning and statistical power and accuracy in parameter estimation. *Annual Review of Psychology*, **59**, 537-563.
- Erceg-Hurn, D. M. & Mirosevich, V. M. (2008) Modern robust statistical methods. An easy way to maximize the accuracy and power of your research. *American Psychologist*, **63**, 591-601.

Optional:

- Grice, J. W. & Iwasaki, M. (2007) A truly multivariate approach to MANOVA. *Applied Multivariate Research*, **12**, 199-226.

Required Software: SPSS (ver. 17)

Course Policies and Procedures:

Attendance: It is the responsibility of each student to attend classes, take all exams, and turn in all assignments on time. Exam content will be taken from all sources including lectures. Although lecture slides will be posted on BB, they might not reflect all content reviewed during the lectures.

Exams: There will be one mid-term exam and one (non-cumulative) final exam consisting of multiple choice, short-answer questions, and analysis. Exam material will be taken from the textbook, work book, lectures, and distributed articles. Exams will not be administered in class but will be open exams taken on BB during a specified time period. Each exam is worth 20% of the final course grade. No make-up exams will be given. If an exam must be missed due to extremely extenuating circumstances, let the instructor know as soon as possible.

Lab work: Exercise sets will be assigned most weeks. These exercises will help consolidate the material in small portions of information, and will help demonstrate competence in various multivariate modeling techniques. Lab work assignments will be due on the subsequent Thursday after being assigned (at the beginning of class). Completion of the assignment will include turning in output. Lab work assignments will be worth a total of 25% toward the final grade.

Decision Tree and Statistical Inference Quizzes: Each week, starting in Week 3, there will be a decision tree and statistical inference quiz in which students will (a) determine an analytic strategy based on relevant descriptions of a research study (e.g., independent variables, dependent variables, design elements) and (b) render an interpretation of the results of a given analysis. Students should keep in mind that the decision tree will not be a comprehensive tool for definitively determining analytic approaches for all problems. Its intent, however, is to facilitate consideration of important measurement and design characteristics of studies when making modeling decisions. Quizzes are worth a total of 5%.

Manuscripts: Students will find a data set for use in the analysis and write-up of a Manuscript (research article prepared for submission to a peer-reviewed journal). There are many data sets available publicly, as well as from investigators in the School of Nursing and at the University broadly. Students are expected to find a data set for use on the final Manuscript project. The student will obtain approval for use of the given data set from the instructor. At least one multivariate analytic method described in this course will be used in the analysis of data for the Manuscript to demonstrate competence in the application of methods to real data and real problems.

Each student will identify a research question and formulate one or more hypotheses that can be tested empirically with the data. Based on the research question and topic area, each student will select an appropriate peer-reviewed journal, to which the manuscript could be submitted for publication. (Actual submission of the manuscript to a journal is not required and will not factor into the final grade, although students are encouraged to aim for this goal if they identify a worthy research question and appropriate data set) Thus, students will prepare and format manuscripts *in accordance with the instructions and format required by the journal they select* (which may or may not be APA format). In addition to the completed manuscript, students will also hand-in the following materials: (1) a paper copy of the “guide to authors” instructions from the selected peer-reviewed journal, and (2) all SPSS or other output from the data analyses performed. Very importantly, the manuscript will be graded, in part, on strict adherence to the selected journal requirements. The manuscript will account for a total of 30% of the final grade.

Grading:

Grade Composition

Decision Tree Quizzes	5%
Midterm Exam	20%
Final Exam	20%
Lab work	25%
Final Manuscript	30%
Total	100%

Grading Scale

A	93-100%
A-	90-92%
B+	87-89%
B	83-86%
B-	80-82%
C+	77-79%
C	73-76%
C-	70-72%
E	69% or less

Working Knowledge of SPSS: It is very important to emphasize that it will be assumed that students will have a working knowledge of SPSS and how to do such tasks as create, edit, and save data files, manage data, and conduct analyses taught in NUR 510. We will have only a very cursory review of SPSS basics in the first two labs. If students do not have this background or believe they are not versed in the basic use of SPSS, the workbook (George & Mallery, 2009), Chapters 1-14 will be helpful. It is however, the responsibility of the students to make sure they have a working knowledge of SPSS.

Class Cancellations: Occasionally, the instructor may be unable to attend a given lecture due to weather or other kinds of emergencies. In this event, if a substitute instructor can not be arranged to teach a given lecture, the members of the class will be emailed as soon as possible regarding the cancelled class. Please check your email on the evening before class. Additionally, in the case of ice or snow storms, please use your best judgment about whether or not to attend class. If you don't feel safe driving to class, please do not risk it.

Class Lecture Slides and Other Materials: PowerPoint slides will be used as visual aids for the lectures. The slides are not intended to be comprehensive; their content will be supplemented by other material supplied in lecture during discussions. Slides and supplemental materials will be posted on BB after each lecture.

Week 1: January 14

- A) Lecture/Discussion
 - 1) Introduction
 - 2) Review of Syllabus
 - 3) Overview of Statistical Decision Tree
 - 4) Overview of Statistical Inference
- B) Readings [43 pages]
 - Tabachnick & Fidell: Chapters 1 & 2 (Chapter 3 optional)
 - Cumming, G. & Finch, S. (2005). Inference by eye. Confidence intervals and how to read pictures of data. *American Psychologist*, 60, 170-180.
- C) Lab work
 - George & Mallery: Chapters 3 & 4 (due January 21)
- D) Manuscript Assignment
 - Begin seeking data set for final manuscript

Week 2: January 21

- A) Lecture
 - 1) Data Screening and Cleaning for Multivariate Analysis
- B) Reading [57 pages]
 - Tabachnick & Fidell: Chapter 4
- C) Lab work
 - George & Mallery: Chapters 5, 6 & 15 (due January 28)
 - Hand in printed data files and output G&M Chapters 3 & 4
- D) Manuscript Assignment
 - To be handed in on January 28: a list and brief description of potential data sets for use on Manuscript assignment.

Week 3: January 28 [Room 3W134]

- A) Lecture
 1) Linear Regression review
 2) Multiple Regression I
- B) Reading [78 pages]
 Tabachnick & Fidell: Chapter 5 (section 5.4.2 optional)
- C) Lab work
 George & Mallery: Chapter 16 (due February 4)
Hand in printed data files and output G&M Chapters 5, 6 & 15
- D) Manuscript Assignment
Hand in list and brief description of potential data sets for use on Manuscript assignment.
To be handed in on February 11: Develop a written description of the data set for final manuscript (including sample size, description of sample, recruitment methods, and the aims of the original study for which the data was collected). Provide one or two hypotheses to be addressed using the data set. Provide a list of variables of interest contained in the data set that will be included in the analysis to address the stated hypotheses.

Week 4: February 4 [Room 3W134]

- A) Lecture
 1) Multiple Regression II
- B) Readings [26 pages]
 Tabachnick & Fidell: Chapter 5 (review)
 Fairchild, A.J. & MacKinnon, D.P. (2009). A general model for testing mediation and moderation effects. *Prev Sci*, 10, 187-99.
 Ludbrook, J. (1998). Multiple comparison procedures updated. *Clin Exp Pharm Phys*, 25, 1032-1037.
 Greenland, S. (2008). Invited commentary: variable selection versus shrinkage in the control of multiple confounders. *Am J Epi*, 167, 523-529.
- C) Lab work
 TBA (due February 11)
Hand in printed data files and output G&M Chapters 16

Week 5: February 11

- A) Lecture
 1) Analysis of Covariance (ANCOVA)
 2) Elements of an Introduction Section for a research article
- B) Readings [57 pages]
 Tabachnick & Fidell: Chapter 6 (section 6.4.1 optional)
 Miller, G. A. & Chapman, J. P. (2001) Misunderstanding Analysis of Covariance. *Journal of Abnormal Psychology*, 110, 40-48.
- C) Lab work
 George & Mallery: Chapter 14 (due February 18)
Hand in printed data files and output from Week 4 lab work
- D) Manuscript Assignment
Hand in description of data set, hypotheses, and variable list assignment from Week 3.
To be handed in on February 25: Select a peer-reviewed journal for possible submission of Manuscript. Print out “guide to authors” instructions from the journal’s web site. Write introduction (draft—2-3 pages) for Manuscript in format required by the selected journal.

Week 6: February 18

- A) Lecture
1) Multivariate Analysis of Variance (MANOVA) and Covariance (MANCOVA)
- B) Readings [75 pages]
Tabachnick & Fidell: Chapter 7 (sections 7.4.1 and 7.4.3 optional)
Huberty, C.J., Morris, J.D. (1989). Multivariate versus multiple univariate analyses. *Psychological Bulletin*, 105, 302-308.
Optional:
Grice, J. W. & Iwasaki, M. (2007) A truly multivariate approach to MANOVA. *Applied Multivariate Research*, 12, 199-226.
- C) Lab work
George & Mallery: Chapter 23, Exercises 1, 2, 4 & 5 (due February 25th):
Hand in printed data files and output output G&M Chapters 14

Week 7: February 25

- A) Lecture
1) Review for Mid-Term Exam
2) Elements of a Methods Section for a research article
- B) Reading
Review of previously assigned chapters and articles
- C) Lab work
Open lab
Hand in printed data files and output from G&M Chapter 23, Ex. 1, 2, 4 & 5
- D) Final Manuscript Assignment
Hand in guide to authors from selected journal, and draft introduction section.
To be handed in March 18: Write methods section (draft—2-3 pages) for Manuscript in format required by the selected journal.

MID-TERM EXAM. OPEN ON BB FEB 25 5PM TO MAR 3 11PM

Week 8: March 4 [Room 3W134]

- A) Lecture
1) Logistic Regression
2) Poisson, Negative Binomial, Other Regression Types
- B) Readings [79 pages]
Tabachnick & Fidell: Chapter 10 (section 10.4.4 optional)
Atkins, D. C. & Gallop, R. J. (2007) Rethinking how family researchers model infrequent outcomes: a tutorial on count regression and zero-inflated models. *Journal of Family Psychology*, 21, 726-735.
- C) Lab work
George & Mallery: Chapter 25 (due March 18)

SPRING BREAK. NO CLASS ON MARCH 11.

Week 9: March 18

- A) Lecture
- 1) Principal Components and Factor Analysis
 - 2) Elements of a Results Section for a research article
- B) Reading [69 pages]
Tabachnick and Fidell: Chapter 13 (sections 13.4.1 thru 13.4.5 optional)
- C) Lab work
George & Mallery: Chapter 20 first, then Chapter 18 (due March 25th)
Hand in printed data files and output from G&M Chapter 25
- D) Manuscript Assignment
Hand in draft methods section.
To be handed in April 1: Write results section (draft) including all tables and graphs for Manuscript in format required by the selected journal.

Week 10: March 25

- A) Lecture
- 1) Path Analysis
 - 2) Structural Equation Modeling I
- B) Reading [104 pages]
Tabachnick & Fidell: Chapter 14 (sections 14.4.1 thru 14.4.5 optional)
- C) Lab work
TBA (due April 1)
Hand in printed data files and output from G&M Chapters 20 & 18

Week 11: April 1

- A) Lecture
- 1) Structural Equation Modeling II
 - 2) Elements of a Discussion Section for a research article
- B) Reading [12 pages]
Buhi, E. R., Goodson, P. & Neilands, T. B. (2007) Structural equation modeling: a primer for health behavior researchers. *American Journal of Health Behavior*, 31, 74-85.
- C) Lab work
TBA (due April 8)
Hand in printed data files and output from Week 10 lab assignment.
- D) Final Manuscript Assignment
Hand in draft results section.
To be handed in April 15: Write discussion/conclusion section(s) (draft) for Manuscript in format required by the selected journal. Combine all sections (Introduction, Methods, Results, Discussion/Conclusion, and References Cited) into complete manuscript.

Week 12: April 8

- A) Lecture
- 1) Multilevel Modeling
 - 3) Final elements of writing a research article
- B) Reading [77 pages]
Tabachnick & Fidell: Chapter 15
- C) Lab work
TBA (due April 15)
Hand in printed data files and output from Week 11 lab assignment.

Week 13: April 15

A) Lecture

1) Repeated Measures Analysis

B) Readings [48 pages]

Gueorguieva, R., & Krystal, J. H. (2004). Move over ANOVA: progress in analyzing repeated measures data and its reflection in papers published in Archives of General Psychiatry, *Archives of General Psychiatry*, 61, 310-317.

Krueger, C. & Tian, L. (2004) A comparison of the general linear mixed model and repeated measures ANOVA using a dataset with multiple missing data points. *Biological Research for Nursing*, 6, 151-157.

O'Connell, A. A. & McCoach, D. B. (2004) Applications of hierarchical linear models for evaluations of health interventions. Demystifying the methods and interpretations of multilevel models. *Evaluation & the Health Professions*, 27, 119-151.

C) Lab work

TBA (due April 22)

Hand in printed data files and output from Week 12 lab assignment.

D) Final Manuscript Assignment

Hand in draft of complete Manuscript for comments.To be handed in May 3: Final version of complete manuscript.**Week 14: April 22**

A) Lecture

1) Sample Size Determination and Power Analysis

2) Controversies in Statistics: Where Do We Go From Here?

B) Readings [44 pages]

Whitley, E. & Ball, J. (2002) Statistics review 4: sample size calculations. *Critical Care*, 6, 335-341.

Maxwell, S. E., Kelley, K. & Rausch, J. R. (2008) Sample size planning and statistical power and accuracy in parameter estimation. *Annual Review of Psychology*, 59, 537-563.

Erceg-Hurn, D. M. & Mirosevich, V. M. (2008) Modern robust statistical methods. An easy way to maximize the accuracy and power of your research. *American Psychologist*, 63, 591-601.

FINAL EXAM. OPEN ON BB APR 22 5PM TO APR 27 11PM

Americans with Disabilities Act (ADA) Statement:

The University of Rochester is committed to providing equal educational and employment opportunities for individuals with disabilities, in accordance with state and federal laws and regulations, including the Americans with Disabilities Act (ADA) of 1991 and Section 504 of the Rehabilitation Act of 1973. To ensure equality of access for students with disabilities, the University provides reasonable accommodations, including auxiliary aids and modifications to courses, programs, services, activities or facilities. Exceptions will be made in those situations where the accommodation would fundamentally alter the nature of the program, cause undue hardship on the school, or jeopardize the health or safety of others. Accommodations must specifically address the functional limitations of the disability.

The process of receiving accommodations begins with self-identification. When a student chooses to self-identify a disability, documentation should be forwarded to Debbie Boyd, School

of Nursing Disability Coordinator, University of Rochester, School of Nursing, Box SON,
Rochester, NY 14642, (585) 275-2717.

Professional and Academic Honesty:

Each student is responsible for her or his own work. Students are expected to have read and to practice the principles of academic honesty, as discussed in the School of Nursing Student Handbook.