

**GEORGE MASON UNIVERSITY
COLLEGE OF HEALTH AND HUMAN SERVICES**

Fall 2009

GCH/NURS 804 Advanced Quantitative Data Analysis for Healthcare Research I

Instructor: Heibatollah Baghi, Ph.D. Office Hours: Wed. & Thurs. 10 A.M. – 12 Noon
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Credit Hours: 3

Time & Place: Thursdays 4:30 – 7:10 P.M. Robinson Hall B 470

Prerequisite: A graduate-level course in statistics

Course Description: This course examines factorial ANOVA, factorial ANCOVA, repeated measures ANOVA, ANOVA and ANCOVA via regression approach, and mutiway frequency analysis. Students apply mathematical calculations and interpret SPSS outputs using healthcare research data.

Textbooks:

B. H. Munro (2005). Statistical Methods for Health Care Research. (5th ed). Lippincott-Raven Publishers: Philadelphia, PA. (Required)

D. F. Polit (1996). Data Analysis & Statistics for Nursing Research. Upper Saddle River, NJ: Prentice-Hall, Inc. (Required)

D. George & P. Mallery (2009). SPSS for Windows Step By Step: A Simple Guide and Reference (Ninth Edition). Boston, MA: Pearson Education, Inc., MA. (Optional)

Selected readings from the following books on reserve in the library at Johnson Center:

J. Cohen (1988). Statistical Power Analysis for the Behavioral Sciences. Lawrence Erlbaum Associates, Publishers: Hillsdale, NJ.

R. G. Lomax (2001). Statistical Concepts: A Second Course for Education and Behavioral Sciences. (Second Edition). Lawrence Erlbaum Associates: New Jersey.

COURSE OBJECTIVES:

By the end of this course, the students will be able to:

1. Determine when factorial analysis of variance (ANOVA) and covariance (ANCOVA) are the appropriate procedures for testing hypotheses in healthcare research.
2. Develop a source table for one-way and factorial analysis of variance and covariance.
3. Explain the advantages of testing for statistical interaction in ANOVA.
4. Select the appropriate multiple-comparison procedures among means for factorial ANOVA and ANCOVA.
5. Examine situations in which repeated measures and randomized block analysis of variance should be used.
6. Interpret SPSS computer output for selected statistical techniques.
7. Perform analyses of variance and covariance via the regression approach.
8. Interpret Multiway Frequency Analysis.
9. Determine the minimum sample size using statistical power analysis for hypothesis testing.

GRADING SCALE:

For the purpose of grading, the assignments and the research paper will account for 95 points (63.3 %), Quizzes will account for 30 points (20.0%) and the final exam will account for 25 points (16.7%).

Scores	Percentage	Grade
141 – 150	94 –100	A
135 - 140	90 -- 93	A-
130 - 134	87 – 89	B+
125 - 129	83 – 86	B
120 - 124	80 – 82	B-
111 - 119	74 – 79	C

OUTLINE AND SCHEDULE:

<u>Week</u>	<u>Topic #</u>	<u>Topic (Reading)</u>
Sept. 3	1	Course introduction; explain assignments and project; discuss computer-based data analysis. (Munro, Ch. 1); Pre-test

Sept. 10	2	Review of variables, levels of measurement; univariate descriptive statistics; various ways of running SPSS for Windows. (Munro, Chs. 1 and 2)
Sept. 17	3	Review of univariate and bivariate statistics; sample size considerations and Power analysis. (Munro, Chs. 3 and 5; Cohen, Ch. 2)
Sept. 24	4	Experimental designs; one-way analysis of variance (ANOVA); sample size considerations and power analysis. (Munro, Ch. 6; Polit, pp. 155-166; Cohen, Ch. 8; George & Mallery, Ch. 12) <u>Quiz 1</u>
Oct. 1	5	Factorial ANOVA; statistical interaction; external validity. (Munro Ch.7, pp. 173-181, 191-194; Polit, pp. 165-169; 173-182; 185-191); George & Mallery, Ch. 13) <u>Quiz 2</u>
Oct. 8	6	One-way analysis of covariance (ANCOVA); Purposes of ANCOVA. (Munro, Ch. 8; Polit, pp. 306-317) <u>Quiz 3</u>
Oct. 15	7	Factorial analysis of covariance; statistical control; statistical interaction. (Munro, Ch. 8; Polit, pp. 306-317) <u>Quiz 4</u>
Oct. 22	8	Repeated measures analysis of variance. <u>Quiz 5</u> (Munro, Ch. 9; Polit, pp. 169-173, 183-185)
Oct. 29	9	Randomized block analysis of variance. (Lomax, Ch. 8, pp. 259-264)
Nov. 5	10	Correlational techniques; partial and semipartial correlations; regression and prediction; sample size considerations and power analysis in correlation. (Munro, Ch. 10; Polit, Ch. 9; Cohen, Ch. 3)
Nov. 12	11	ANOVA and regression; similarities and contrast; dummy coding and effect coding; sample size considerations and power analysis in regression. (Munro, Ch. 11; Polit, 258-280; Cohen, Ch. 9) <u>Quiz 6</u>
Nov. 19	12	Nonparametric techniques; associations among categorical variables. (Munro, Ch. 4)
Nov. 26		No Classes
Dec. 3		Presentation
Dec. 10		Review
Dec. 17		Final Exam

SPECIFIC COURSE OBJECTIVES:

These specific objectives should be used to guide your reading of the material and preparation for exams.

<u>Topic #</u>	<u>Objectives</u>
2	Demonstrate the various ways of running SPSS for Windows: use the menus and syntax command and indicate when each method is most appropriate.
2	Illustrate how SPSS can select and transform data in the Data Editor to facilitate data analysis.
2	Demonstrate how to open an existing data file, to read ASCII data files, and to enter them into SPSS for Windows.
2	Carry out a wide range of statistical tests on health science databases, using SPSS for Windows.
1	Define measurements scales and discuss the properties of each scale; explain the appropriateness of each scale to statistical testing methods.
1	Explain the term <i>variable</i> in quantitative research.
1	Describe the classification of variables from the measurement perspective.
3	Describe the classification of variables from the research design perspective.
3	Discuss the relations among type I error, power, effect size, and sample size.
3	Obtain the minimum required sample size in hypothesis testing.
3	Define univariate and bivariate statistical tests in terms of their purpose and the types of variables used in a study.
4	Develop and interpret the source table in ANOVA (one-way and two-way).
5	Discuss the advantages of the factorial ANOVA over one-way ANOVA.
4	Distinguish between factors and levels in a factorial design.
5	List the null and alternative hypotheses in a factorial ANOVA.
5	Interpret and graph the interaction from a two-way ANOVA.

<u>Topic #</u>	<u>Objectives</u>
5	Explain the purpose of breaking down a significant interaction.
4	Compute selected multiple comparison procedure in ANOVA.
4	Indicate the reason for performing a post hoc analysis.
6	Describe situations when ANCOVA would be preferred over ANOVA.
6	List the assumptions that need to be tested to perform an ANCOVA.
7	Discuss the advantages of the factorial ANCOVA over one-way ANCOVA.
7	Indicate the hypotheses that can be tested with a factorial ANCOVA.
8	Develop and interpret the source table for repeated measures ANOVA.
8	Identify situations in which repeated measures designs would be used.
8	Describe the two major ways in which repeated measures ANOVA is used.
9	Identify situations in which randomized block ANOVA models would be used.
9	Develop and interpret the source table for randomized block ANOVA.
10	Identify the elements in the multiple regression equation models.
10	Perform test of significance of the regression coefficients (β s).
10	Interpret and discuss the results of regression using SPSS for Windows.
11	Apply regression analysis to designs with categorical independent variables using dummy coding.
11	Apply regression analysis to designs with categorical independent variables using effect coding.
12	Identify research situations in which the use of nonparametric techniques is appropriate.
12	List the assumptions necessary to perform hypotheses tests by nonparametric tests.
12	Discuss the research situations in which the associations among categorical variables are studied.

HOMEWORK ASSIGNMENTS:

The purpose of homework assignments is to provide actual experience with different methods of data analysis techniques using SPSS for Windows. Late assignments will not be accepted without prior approval of the instructor. The due dates and the number of points for each assignment are listed below.

Assignment 1. Using the data set provided by the instructor, perform **STUDENT'S T- TEST**.
9/24; 5 points

Assignment 2. Using the data set provided by the instructor, a) perform a **ONE-WAY ANOVA**;
b) Given $\alpha = .05$, degrees of freedom for the numerator of F-ratio of 3 ($u = 3$), and a moderate effect size (.30), what is the minimum sample size you need for a power of .90? Use Table 8.3.13 in Cohen (1988). 10/01; 10 points

Assignment 3. Using the data set provided by the instructor, perform a **FACTORIAL ANOVA**
10/08; 10 points

Assignment 4. Using the data set provided by the instructor, perform a **ONE-WAY ANCOVA**.
10/15; 10 points

Assignment 5. Using the data set provided by the instructor, perform a **FACTORIAL ANCOVA**.
10/22; 10 points

Assignment 6. Review the section **SUBJECTS EXPOSED TO ALL TREATMENT LEVELS** on pages 210 and 211 and perform **REPEATED MEASURES ANOVA** on data reported in Figure 9-3. 10/29; 10 points

Assignment 7. a) Answer the research question on page 258 by running a **CORRELATION**; b) for a two-tailed test with $\alpha = .05$ and a moderate effect size (0.30), how many subjects do you need for a power of .80? Use Table 3.3.5 in Cohen (1988).
11/12; 10 points

Assignment 8. Answer the research questions on page 284 by running a **HIERARCHICAL REGRESSION**. 11/19; 10 points

Course Project. Refer to the attached page. 20 points. Due date to submit the proposal: 10/23

Your reports for the assignments 1 – 8 should include the following sections: a) Introduction including research questions, with hypotheses listed in words and symbols; b) Method, including population, sample, research design, and statistical method used for data analysis; c) Results, including descriptive statistics, inferential statistical analysis using a summary table; (SPSS outputs should be attached to the assignments); and d) Discussion, including summary and interpretation of the findings reported in the previous sections relative to the research questions you posed.

Course Project:

The purpose of this project is to determine which statistical methods are appropriate for selected research designs and to understand conceptual aspects and proper application of statistical method (s) discussed throughout the course. The project must be typewritten, double spaced and very limited in length. You may choose any data set from healthcare research *--for example, data from (1) your research area, (2) your possible MS thesis, or 3) existing health science data set on the data disk that came with your textbook. Your report should include the following sections:

1. **Abstract.** The abstract should state the nature of the research and its conclusions.
2. **Introduction.** This contains a statement of the problem, the specific hypotheses to be tested, definitions, and a discussion of the importance of the proposed study.
3. **Method.** This section should include: (a) Subjects -- a paragraph that describes the population of interest and the sample size used; (b) Materials -- everything that will be used to establish the research conditions and the definition of the variables that will be used in the study; c) Procedures -- definition of the variables, data collection, design, and statistical methods used in analysis of the data, e.g., ANOVA, ANCOVA, and regression.
4. **Results.** Each hypothesis tested should be listed in the order as stated in an earlier section. The results section contains no interpretation of the findings. Present descriptive statistics first. Then present the results of the inferential statistical analysis using a summary table. Remember that all tables are to be referred to in the text and that each table should be self-contained. You should run your calculations using SPSS.
5. **Discussion.** Summarize the findings reported in the previous sections relative to the (hypothetical) research questions posed. This section, in which the results are discussed and conclusions are stated, is where you should place interpretations, generalizations, and inferences regarding the stated hypotheses. However, you must be careful not to generalize beyond the data obtained in the study.

Evaluative criteria for the research project are:

1. Clarity and focus	4	3	2	1
2. Relatedness to course objectives	4	3	2	1
3. Level of analysis (i.e. intensive summary)	4	3	2	1
4. Accuracy of interpretations	4	3	2	1
5. Validation of assumptions	4	3	2	1

4 = Adequate, 1 = Inadequate

* You may refer to the following CDC Website:

<http://www.cdc.gov/datastatistics/>

If you check on the “surveys” tab toward the bottom of the page, you will have access to a variety of datasets. (The full list is in the menu of the right of the survey box.) Each dataset can be downloaded entirely or, for the larger surveys, by geographic region. (For example, NHANE data are available by state.)