

Department of Biostatistics

Department of Mental Health

140.658 Statistics For Psychosocial Research II: Measurement Models *Course Syllabus 2006*

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Learning Objectives

Upon successful completion of this course, students will be able to design path analysis models; to analyze latent variable panel data with linear structural equation models; to design latent class analysis models in the situation of categorical data; and to understand causal inference techniques.

Course Description

This course is the second in a two-quarter series on Statistics for Psychosocial Research, oriented towards latent variable models and related methods. We present quantitative approaches to theory construction in the context of multiple variables, with models for both continuous and categorical data. It is designed for doctoral students and is conducted jointly by the departments of Biostatistics and Mental Hygiene. Students will become familiar with the principles of path analysis through examples drawn from a variety of health-related applications. Linear structural equation analyses incorporating measurement models will be presented and exemplified with examples from the social sciences literature. Analysis of latent variable panel data with linear structural equation models will be presented. Latent class regression will be presented for the situation of categorical response data. The statistical basis for causal inference will be introduced and will provide context for the specific course topics just listed. Examples will be drawn from the health and social sciences, including stress and distress, social class and socioeconomic status, personality, functional impairment and disability.

Prerequisites

MH 330.657 or equivalent, or permission of the instructor. Auditing MH 330.657 is a sufficient entry criterion so long as the auditing student has completed the problem sets in that course. The course is designed to build upon what is learned in MH 330.657.

CoursePlus Web site

http://courseplus.jhsph.edu/index.cfm?event=showPublicCourseSyllabus&catalogID=7777 The course web site will contain current and previous lectures, problem sets, and datasets for the course. Students must create an e-learning account in order to receive course communications and to access materials. Please do this as soon as possible. The website will also include a bulletin board (BBS) on which students may post questions about the course and its contents. It is requested that students post their questions (unless there are privacy issues) on the BBS rather than e-mailing them directly to instructors or TAs.

Problem Sets & Computer Labs

The problem sets will require active manipulation of datasets provided by the instructors, using standard statistical packages such as Stata, Mplus, and AMOS. A paper copy of your homework must be handed in during class, or placed in Lilian Ghandour's mailbox by noon on the due date. Late homework will be accepted for another two days (until 5pm), but will be penalized half a letter grade. For example, late homework due on a Monday will be accepted (with a penalty) until 5pm on Wednesday. At that point, solutions will be posted, and we will no longer be able to accept homework. Late homeworks must be submitted through the CoursePlus dropbox.

Computer lab sessions will be held each Friday (other than September 1st) from 10-11 and 11-12 in Bloomberg W3017. Students will want to bring their lecture notes, a pencil, and a thumb drive (<u>http://en.wikipedia.org/wiki/Thumb_drive</u>) in order to save their computing output. It is recommended that students read through the homework assignment prior to each week's lab session.

Grading Policy

Grading will be determined by three problems sets and a final exam, each of which contributes 25% of the grade. The final exam lasts 90 minutes, and is open book/open note.

Textbooks

Bollen, K.A., Structural Equations with Latent Variables, New York: Wiley and Sons, 1989. or Maruyama, G. Basics of Structural Equation Modeling, SAGE, 1997. (Bollen is a better, but harder book)

Honor Code

The JHU Honor Code <u>http://www.jhsph.edu/schoolpolicies/policy_academic_ethics.html</u> should be followed throughout the course. You will be asked to write and sign the academic ethics statement, "*I have neither given nor received unauthorized aid on this assignment*" on your exam. Any infractions to the honor code will be referred to the Honor Committee.

Students with Disabilities

If you are a student with a documented or suspected disability who requires an academic accommodation, please contact Betty Addison in the Office of Career Services and Disability Support at 410-955-3034, Room E-1002, or via email at dss@jhsph.edu. For information about this office and its services go to: www.jhsph.edu/Student_Life/.

Readings:

Readings are offered to help students master the material. Readings from the two short monographs below are "required" or "highly recommended." "Alternative and additional" readings may be ignored, skimmed, or read in full if the student is interested. "Alternative and additional readings" will enrich the student's knowledge of the material, but are not required for mastery. The texts are available in the bookstore. Alternative and additional readings are available on e-reserve http://eres.welch.jhmi.edu/eres/coursepage.aspx?cid=250. The password is 140658sph.

Date	Day	Topic	Instructor	Homeworks
10/30	М	Introduction to Structural Regression	Liz	
11/1	W	Introduction to Path Analysis	Jeannie	
11/3	F	NO LAB		
11/6	М	Examples in Path Analysis	Jeannie	
11/8	W	Causality I	Liz	receive HW 1
11/10	F	LAB 1		
11/13	М	Causality II	Liz	
11/15	W	Regression for Items	Liz	
11/17	F	LAB 2		
11/20	М	Intro to Structural Equations with Latent	Jeannie	HW 1 due,
11/22	W	Structural Equations with Latent Variables: SEM	Jeannie	Teccive 11 w 2
$\frac{11/24}{11/27}$	M	Advanced SEM	Liz	
11/29	W	Item Response Theory	Jeannie	
12/1	F	LAB 3		
12/4	М	Intro to Latent Class Regression	Liz	
12/6	W	Latent Class Regression	Liz	HW 2 due, receive HW 3
12/8	F	LAB 4	TT	
12/11	IVI	Growth Curve Modeling	Hanno	
12/13	W	SEMs for Genetic Analysis	Jeannie	
12/15	F	LAB 5	-	
12/18	М	Review	Liz and Jeannie	HW 3 due
12/20	W	FINAL EXAM		

STATISTICS FOR PSYCHOSOCIAL RESEARCH II: Structural Models (140.658); **SHORT FORM**

NOTE: There are only FIVE labs this term due to scheduling and Thanksgiving. So, for problem set 2 you will only be in the lab for ONE session! Please use your time wisely!

Lecture Schedule:

Monday, October 30: Introduction to structural regression (Liz)

Readings:

Bollen, Chapter 1, "Introduction" and Chapter 2, "Model Notation, Covariances, and Path Analysis", pp. 10-31 Maruyama, Chapter 1, "What Does It Mean to Model Hypothesized Causal Processes With Nonexperimental Data?" and Chapter 2, "History and Logic of Structural Equation Modeling."

Additional readings:

Easy: Loehlin, JC., A Path Models in Factor, Path, and Structural Analysis, @ in his Latent Variable Models: An Introduction to Factor, Path, and Structural Analysis, Third edition, Hillsdale, NJ: Laurence Erlbaum Associates, 1998.

Wednesday, November 1: Introduction to path analysis (Jeannie)

Readings:

Bollen, Chapter 2 "Model Notation, Covariances, and Path Analysis," pp. 32-39.

Maruyama, Chapter 5, "Effects of Random and Nonrandom Error on Path Models" Moderate:

Loehlin, Chapter 2 "Fitting path models"

Monday, November 6: Examples in path analysis (Jeannie)

Reading:

Maruyama, Chapter 6, "Recursive and Longitudinal Models: Where Causality Goes in More Than One Direction and Where Data Are Collected Over Time", pg. 99-108

Optional Reading:

Sewell, William H., Robert M. Hauser, and Wendy C. Wolf. 1980. "Sex, Schooling, and Occupational Status", *American Journal of Sociology* 86:551-583.

Wheaton, Blair. 1978. "The Sociogenesis of Psychological Disorder: Reexamining the Causal Issues with Longitudinal Data", *American Sociological Review* 43:383-403.

Wednesday, November 8: Causality I (Liz)

Readings:

Bollen, Chapter 3, "Causality and Causal Models" Maruyama, Chapter 3, "The Basics: Path Analysis and Partitioning of Variance"

Additional readings:

Easy:

Rothman, K.J., "Causal Inference in Epidemiology", in his *Modern Epidemiology*, Boston: Little, Brown & Company, 1986. Note, articles references include good extra readings.

Moderate:

Holland, P.W., "Statistics and Causal Inference", *Journal of the American Statistical Association*, 81:945-60, 1986.

Monday, November 13: Causality II (Liz)

Optional Reading: Difficult:

Pearl, J. "Graphs, Causality, and Structural Equation Models. UCLA, Technical Report ftp://ftp.cs.ucla.edu/pub/stat_ser/R253.pdf

Wednesday, November 15: Regression for items (Liz)

Harder:

Diggle, P.J., Liang, K.-Y., and Zeger, S.L., "Generalized Linear Models for Longitudinal Data" in their *Analysis of Longitudinal Data*, London: Oxford, 1994.

Monday, November 20: Introduction to SEM with latent variables (CFA) (Jeannie)

Reading:

Bollen, Chapter 7, "Confirmatory factor analysis" may also wish to scan Chapter 5. Maruyama, Chapter 7, "Introducing the Logic of Factor Analysis and Multiple Indicators to Path Modeling"

Wednesday, November 22: SEM with latent variables : Examples (Jeannie)

Reading:

Bollen, Chapter 8, "The General Model, Part I: Latent Variable and Measurement Models Combined", and page 331

Maruyama, Chapter 8, "Putting It All Together: Latent Variable Structural Equation Modeling" and Chapter 9, "Using Latent Variable Structural Equation Modeling to Examine Plausibility of Models"

Optional Reading:

Shanahan, Michael J., Glen H. Elder, Jr., and Richard A. Miech. 1997. "History and Agency in Men's Lives: Pathways to Achievement in Cohort Perspective." *Sociology of Education* 70: 54-67.

Monday, November 27: Advanced structural equations models (Liz)

Additional readings:

Moderate:

Aneshensel, C.S., and Frerichs, R.R., "Stress, Support, and Depression: A Longitudinal Causal Model", Journal of Community Psychology, 10:363-76, 1982.

Muthén, B.O., "Analysis of Longitudinal Data using Latent Variable Models with Varying Parameters," in: *Best Methods for Analyzing Change*.

Wednesday, November 29: Item Response Theory (Jeannie)

Reading:

pp. 313-320 in Nunnally, 1978. Psychometric Theory New York: MacGraw-Hill.

Stroud MW, McKnight PW, Jensen MP. Assessment of self-reported physical activity in patients with chronic pain: development of an abbreviated Roland-Morris disability scale. (2004) *J Pain* 5(5)257-63 *** Please try to read before class.

Monday, December 4: Introduction to latent class regression (Liz)

Additional readings: Moderate: Bandeen-Roche, K., Huang, G.-H., Munoz, B., and Rubin, G.S., "On Determining Risk Factor Associations with Questionnaire Outcomes: A Methods Case Study", *American Journal of Epidemiology* (in press), 1999.

Wednesday, December 6: Latent class regression (Liz)

Additional Readings:

Moderate:

Garrett, E.S., Miech, R., Owens, P., Eaton, W.W., Zeger, S.L. "Checking Assumptions in Latent Class Regression Models via a Markov Chain Monte Carlo Estimation Approach: An Application to Depression and Socio-Economic Status". Johns Hopkins University, Department of Biostatistics, Technical Report. <u>http://www.bepress.com/jhubiostat/paper17</u>

Harder:

Bandeen-Roche, K., Miglioretti, D.J., Zeger, S.L., and Rathouz, P.J. "Latent Variable Regression for Multiple Discrete Outcomes", *Journal of the American Statistical Association*, 92:1375-1386, 1997.

Dayton, C.M. & Macready, G.B. "Concomitant-Variable Latent-Class Models", *Journal of the American Statistical Association*, 83: 173-178, 1988.

Monday, December 11: Growth Curve Modeling (Guest Lecturer: Hanno Petras)

Wednesday, December 14: SEMs for Genetic Analyses (Jeannie)

Additional:

Rijsdijk FV, Sham PC (2002) Analytic approaches to twin data using structural equation models. *Briefings in Bioinformatics.* 3(2)119:133.