The University of North Carolina at Chapel Hill
School of Social Work

SOWO 917  Longitudinal and Multilevel Analysis
Spring Semester, 2010

INSTRUCTOR

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CLASS MEETING TIMES & OFFICE HOURS

Class meets on Wednesdays 9:00-11:50 am
Office hours are Tuesdays 10:30 – 12:30 (Room 524j TTK)

COURSE DESCRIPTION

This course introduces statistical frameworks, analytical tools, and social behavioral applications of three types of models: event history analysis, hierarchical linear modeling (HLM), and growth curve analysis.

COURSE OBJECTIVES

At the completion of the course, students will have a solid understanding of the challenges and problems in longitudinal and multilevel analysis. They will know how to choose appropriate statistical analyses that best suit the type of data and research questions for a given study. They are expected to be able to run, interpret, and communicate results clearly and effectively in writing based on the following models: life tables, Kaplan-Meier’s estimate of survivor function, discrete time model, Cox proportional hazard model, marginal models handling multilevel event data, two-level and three-level hierarchical linear models, growth curve analysis, and analysis of a categorical dependent variable using HGLM.

PRE-REQUIREMENT

Students are assumed to be familiar with descriptive and inferential statistics as well as multiple regression analysis. They should have statistical and statistical software background at least equivalent to that provided by SOCI209, PSYC282, EDUC284 (linear regression), or SOCI211 (categorical data analysis). Students without such prerequisites should contact the instructor to determine their eligibility to take this course.
**STATISTICAL SOFTWARE PACKAGES**

Students may choose to use Stata, SAS, or SPSS as the primary statistical software package for the course, though the classroom lectures and materials will be based on Stata. Specialized software package HLM will also be demonstrated.

**TEXTBOOKS**


**RECOMMENDED TEXTBOOKS**


**ASSIGNMENTS**

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<tr>
<th>Assignment</th>
<th>Grade Percentage</th>
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<td>Assignment 1</td>
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<td>Assignment 2</td>
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<td>Assignment 5</td>
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<td>Midterm Exam (take home)</td>
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<td>Final Exam (take home)</td>
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**GRADING SYSTEM**

The standard School of Social Work interpretation of grades and numerical scores will be used.

- \( H = 94-100 \)
- \( P = 80-93 \)
- \( L = 70-79 \)
- \( F = 69 \) and below
**Policy on Class Attendance**

Class attendance is an important element of class evaluation, and you are expected to attend all scheduled sessions. Each class session will cover a great deal of materials, and you will fall behind the course when you miss even one class session. It’s student’s responsibility to inform the instructor via email in advance for missing a class session. You are expected not to miss more than two sessions for the whole semester. Starting from the second missing, your course grade will be reduced by 10% for each session missed.

**Policy on Incomplete and Late Assignments**

Assignments are to be turned in to the professor by 5pm of the due date noted in the course outline. Extensions may be granted by the professor given advance notice of at least 24 hours. Late assignments (not turned in by 5pm on the due date) will be reduced 10 percent for each day late (including weekend days). A grade of incomplete will only be given under extenuating circumstances and in accordance with University policy.

**Policy on Academic Dishonesty**

Students are expected to follow the UNC Honor Code. Please include the honor code statement along with your signature on all assignments: “I have neither given nor received unauthorized aid on this assignment.”

Please refer to the APA Style Guide, the SSW Manual, and the SSW Writing Guide for information on attribution of quotes, plagiarism and appropriate use of assistance in preparing assignments.

If reason exists to believe that academic dishonesty has occurred, a referral will be made to the Office of the Student Attorney General for investigation and further action as required.

**Policy on Accommodations for Students with Disabilities**

Students with disabilities which affect their participation in the course may notify the instructor if they wish to have special accommodations in instructional format, examination format, etc., considered.

**Course Outline (Topics, Readings, and Assignments)**

1/13/10 1. Introduction and course overview

- Review of longitudinal design: multi-wave panel, cohort, staggered multiple cohorts, cohort-sequential, experimental, survey, and designs using administrative data.
- Review of conventional approaches to longitudinal analysis: transition probability of Markov chain model, paired t test, within-subject ANOVA, repeated measure MANOVA.
- Review of statistical concepts: statistical assumptions embedded in OLS, problems of autocorrelation, and maximum likelihood estimator.

Readings:
Singer & Willett, Chapter 1.
2. **Life table and Kaplan-Meier methods**
Overview of event history analysis
Censoring
Cohort life tables
Kaplan-Meier’s estimate of survivor functions

Readings:
Guo, Chapters 1 & 2.
Singer & Willett, Chapter 9.

Assignment 1 (**DUE: 2/3/10**): (1) hand calculation of a life table; (2) use provided data set to construct life tables by stratum, perform a Kaplan-Meier test on group differences, and interpret findings; and (3) describe a longitudinal study that requires event history analysis.

3. **Discrete time models**
Review of binary and multinomial logistic regression
The logit model for discrete time
Time-varying covariates

Readings:
Guo, Chapter 3.
Singer & Willett, Chapters 10-11.

4. **Parametric models**
The exponential model
The Weibull model
Overview of other parametric models

Readings:
Guo, Chapter 5.
Singer & Willett, Chapters 12-13.

(Hand out Assignment 2)
Assignment 2 (Due: 2/17/10): (1) solve problems on discrete-time and parametric models; and (2) use provided data to estimate a discrete-time model, and interpret findings.

2/10/10 5. Cox proportional hazards model (I)
Overview
Partial likelihood estimator
Cox regression with time-varying covariates

Readings:
Guo, Chapter 4.
Singer & Willett, Chapter 14.

2/17/10 6. Cox proportional hazards model (II)
Competing risks
Accelerated failure time models
Model-predicted survivor curves
Power analysis for survival models

Readings:
Singer & Willett, Chapter 15.

(Hand out Midterm)
Midterm Exam (Due: 3/17/09): Use data sets provided by the course or data set you choose to run a Cox regression model. Write a paper (no more than 14 pages, double spaced) to present findings. The paper should include: (1) data and specification of Cox regression; (2) testing interaction terms; (3) present predicted survivor curves based on estimated model; and (4) interpret findings.

2/24/10 7. Cox proportional hazards model (III)
Introduction to multilevel event time data (multivariate failure time data)

Readings:
Guo, Chapter 6.

3/3/10 8. Cox proportional hazards model (IV)
Overview of approaches to multilevel event time data
Marginal approaches to multilevel event times
Unobserved heterogeneity

Readings:


3/10/10 **Happy Fall Break! No class.**

3/17/10 **9. Overview of HLM and contextual analysis**

Multi-level hypotheses in social sciences

Intra-class correlation

Random effects

Two-level model

Readings:


Singer & Willett, Chapter 2.

3/24/10 **10. Contextual analysis**

Three-level model

Goodness-of-fit indices

Application to contextual and multilevel analysis

Readings:

Singer & Willett, Chapters 3-4


(Hand out Assignment 3)

**Assignment 3 (Due: 4/7/10):** (1) describe a multilevel or longitudinal study that requires hierarchical linear modeling, (2) solve problems on HLM; (3) use provided data to estimate intra-class correlation, and (4) run a two-level HLM, interpret findings.

3/31/10 **11. Principles of estimation, hypothesis testing, and GEE method**

Hypothesis testing

Multiparameter testing

HLM assumptions about data

Overview of estimation via ML and empirical Bayesian

Generalized-estimating-equation (GEE) method

Readings:

Singer & Willett, Chapters 5-6
12. Computer Lab:
Using HLM software

Readings:
Singer & Willett, Chapter 7

(Hand out Assignment 4)
Assignment 4 (Due: 4/21/10): Read the Sampson, Raudenbush, & Earls’ (1997) article. Group discussion and classroom presentation. This Science-published study has made significant contributions to the field, both conceptually and methodologically. On the due date, students will present findings from their group discussions on the paper. Students will be divided into smaller groups in advance.


13. Growth curve analysis and testing mediating effects
Graphic presentation of individual trajectories
Three-level models in growth curve analysis
Predicted values of outcome variable using SAS Proc Mixed
Testing mediating effects in HLM

Readings:
Singer & Willett, Chapter 8

14. Classroom discussion & other topics in HLM
Part A (9:00-10:00):
Student presentation and classroom discussion on Sampson, Raudenbush, & Earls (1997).

Part B (10:00-11:50):
Other applications of HLM: power analysis for HLM, HLM and SEM, multiple outcome variables, structured covariance matrix within subjects.

Readings:


(Hand out Assignment 5)

**Assignment 5 (Due: 4/28/10):** Choose one article from two that are provided by the course to perform a critical review. The provided articles employed (or potentially should have employed but did not) either a survival model or an HLM. This review (no more than two pages, single-spaced) should focus on: (1) strengths and limitations (very briefly), (2) major statistical problems, and (3) recommendations for revisions.

(Hand out Final)

**Final Exam (Due: 5/2/10):** Use data sets provided by the course or data set you choose to run an HLM. Write a paper (no more than 14 pages, double spaced) to present findings. The paper should include: (1) research objectives and questions; (2) methods and model specifications; (3) findings; and (4) conclusions and implications.

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**4/28/10**  
15. **Hierarchical generalized linear Models (HGLM)**

Overview of generalized linear model (GLM)  
Multilevel logistic regression  
Multilevel ordered logistic regression  
Multilevel Poisson regression

Readings:  

**Course summary**

Topics for future study

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**5/2/10**  
**Final Exam Due**