Institute on Quantitative Methods for
Social and Health Interventions

Time: May 11 to 15, 2020

Day 1 (May 11, 2020): Wei Pan

Title:

Propensity Score Methods for Comparative Effectiveness Research in Social and Health Interventions

Presenter:

Wei Pan, Ph.D., Associate Professor

Duke University School of Nursing

Email: wei.pan@duke.edu

Abstract:

Randomization is not always feasible or ethical in comparative effectiveness research in social and health interventions. Such research studies pose threats to the validity of evaluation of intervention effects due to selection bias. Propensity score methods (PSMs) have been increasingly used in comparative effectiveness research as a means of reducing selection bias. This course will introduce concepts and issues of PSMs (such as matching, stratification, and weighting) and discuss when and how to use PSMs, demonstrated with real-world examples in social and health interventions. Through lectures on theory as well as hands-on activities with R packages, this course will benefit faculty members, graduate students, and applied researchers improving the quality of research on social and health interventions. Example data and related R packages will be made available to participants through a course website. No prior knowledge of PSMs is required; a basic understanding of research design and statistics (such as t-tests and multiple regression) is preferable. Participants should bring their own laptop computers for hands-on activities.

Targeted Audience:

This short course is intended for faculty members, graduate students, and applied researchers who want to improve the quality of research on social and health interventions.

Learning Objectives:

At the end of this short course, participants will be able to:

- Understand the concepts and issues of PSMs;

- Know why and when to design social and health interventions with PSMs;

- Know how to design social and health interventions with PSMs;

- Know how to interpret the results of PSMs from R;

- Execute statistical programs for PSMs;

- Apply the knowledge gained from this course to design their own social and health interventions with PSMs in R.

Short Course Outline:

A. **Lecture 1**: Overview of propensity score methods (PSMs) (90 min.)

　　1. Causal inference in relation to social and health interventions

　　2. Concepts of PSMs (e.g., matching, stratification, and weighting)

　　3. Steps of propensity score matching, stratification, and weighting

　　4. Outcome analysis with PSMs

　　5. Issues and developments in PSMs

　　6. Current debates on PSMs

Break (15 min.)

B. **Lecture 2**: Design of social and health interventions with PSMs (75 min.)

　　1. Description of samples from a large-scale national survey

　　2. Forming research questions for social and health interventions

　　3. Practical considerations of the study design with PSMs

　　4. Step-by-step guidelines on the design of social and health interventions with PSMs

Lunch Break (60 min.)

C. **Demonstration**: Statistical programs for PSMs (60 min.)

　　1. Install necessary programs in R

　　2. Demonstrate detailed procedures in R for PSMs

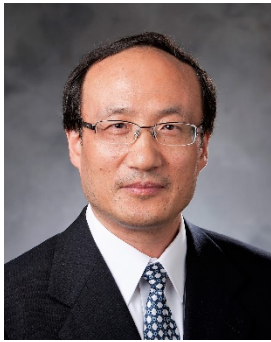　　3. Interpret PSM results of PSMs from R

Break (15 min.)

D. **Hands-on Activities**: Running program in R (90 min.)

　　1. Participants import their own data or the course provided data

2. Worksheets will be made available to participants who may not have laptops at hand

3. Participants do the guided hands-on activities using R

4. The instructor walks around the classroom to help participants with their questions

Wrap-up: Q&A (15 min.)

About the Instructor:

Dr. Wei Pan is an Associate Professor of Health Measurement, Statistics, and Dada Science at the Duke University School of Nursing. His research work focuses on causal inference, advanced modeling, data analytics, meta-analysis, psychometrics, and their applications in the social, behavioral, and health sciences. He has published numerous refereed journal articles on both methodological and applied research studies. In particular, his edited book "Propensity Score Analysis: Fundamentals and Developments" tackles both methodological and practical issues in propensity score methods, a set of statistical techniques for reducing selection bias so as to increase the validity of causal inference from non-randomized controlled trials and observational studies.

Day 2 (May 12, 2020): Din Chen

Title:

Integrative Data Harmonization with Meta-Analysis and Multi-Level Modeling

Presenter:

Din Chen, Ph.D. Wallace H. Kuralt Distinguished Professor

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

Email: dinchen@email.unc.edu

Abstract:

Data from social and health interventions are collected from different sources and analyzed separately. Typically, published summary statistics (SS) are collected from systematic reviews which are analyzed with meta-analysis techniques and individual participant-level data (IPD) are collected from investigators' intervention studies which are analyzed by statistical regression and multi-level modeling. To harmonize the power of multiple data sources, this short course is designed with a step-by-step illustration using R/SAS to review the meta-analysis for summary statistics and multi-level modeling for individual-level data with extension to analyze these two

sources of data simultaneously with the integrative data harmonization to achieve and increase statistical power. The example and programming code in R/SAS are presented in a stepwise approach to enable students to follow the logic and gain an understanding of the analysis methods so that they may use the existing R/SAS code to analyze their own intervention data. Participants are welcomed to bring their own data into the short course.

Targeted Audience:

This short course is intended for researchers in social and social work and public health intervention community, at all career levels, from doctoral students to late career scholars interested in learning about meta-analysis, multi-level modelling, integrative data harmonization to analyze their own intervention research projects.

Learning Objectives:

An experienced quantitative intervention research scholar who has extensive knowledge and publication records in meta-analysis, multi-level modelling, integrative data harmonization, causal inferences and structural equation modeling as well as computational skills in R/SAS will present this workshop that will:

- **Present the mechanism and techniques of meta-analysis** when study-level summary statistics (SS) are collected from published literatures with systematic review. We will review the fixed-effects and random-effects meta-analysis models which are commonly used for social and health intervention research to pool and meta-analyze the data to test treatment effects

- **Discuss the principle and methodology of multi-level modeling** when multi-level data and longitudinal individual-participant data (IPD) are collected. We will review the linear mixed-effects modeling to incorporate the within-cluster and between-cluster heterogeneity to more effectively test the treatment effects

- **Address the unique property of integrative data harmonization** when both study statistics (SS) are available for some studies and individual participant-level data (IPD) for other studies. We will discuss the integrative data harmonization to simultaneously pool and analyze these data to test intervention effects with increased statistical power

- **Review the implementation of meta-analysis, multi-level modeling and integrative data harmonization** in commonly used software, such as R/SAS, with data from public health vaccine clinical trials.

At the conclusion of this short course, participants will further understand the mechanisms of meta-analysis, multi-level modelling and integrative data harmonization. Participants will be able to better formulate research questions integrated with social and health intervention studies, more effectively design and collect data, more operationally analyze data using R/SAS, and correctly interpret results on causal relations and the associated inferences.

Short Course Outline:

Morning:

(Three 50-Minute Sessions from 9am to 12pm with 10 minutes comfort break between sessions)

- **Session 1:** Overview of study-level summary statistics (SS) collected from systematic review and individual participant-level data (IPD) from available social and health intervention studies
- **Session 2:** Overview of the principles of fixed-effects meta-analysis models and the implementations in R/SAS
- **Session 3:** Overview of the principles of random-effects meta-analysis models with R/SAS demonstration

(Lunch break from 12pm to 1pm: lunch will be provided as part of workshop fee)

Afternoon:

(Three 50-Minute Sessions from 1pm to 3pm with 10 minutes comfort break between sessions, 3pm to 4pm, Summary and Q&A)

- **Session 4:** Overview of the principles of multi-level modelling and the implementation in R/SAS for IPD data analysis
- **Session 5:** Overview on integrative data harmonization to simultaneously pool and analyze SS and IPD with demonstration and implementation in R/SAS
- **Session 6:** Summary of the course and Q&A from all participants.

Teaching Methods:

- The short course will integrate a multimodal PowerPoint presentation including method illustrations, real social and public health example, and software implementations with an R/SAS guide that all participants will receive for note-taking and future slide reference. The approach will include lecture interspersed with questions and answers, software demonstration, and discussions.

- Participants are also welcomed to bring their research questions and collected data to be used as extra examples in the workshop to facilitate and strengthen the teaching-and-learning interactions. Handouts with R/SAS syntax will be provided to the participants.
- The proposed approach will help advance scientific knowledge, improve the rigorousness of quantitative intervention research, and provide a more accurate guidance for intervention practices.

About the Instructor:

Dr. Din Chen is a fellow of "Society of Social Work and Research" (SSWR) (2020), an elected fellow of the "American Statistical Association" (ASA) (2016) and an elected member of the "International Statistical Association" (ISI) (2016). He is now the Wallace H. Kuralt distinguished professor at School of Social Work and a professor in biostatistics at the Gillings School of Global Public Health, University of North Carolina at Chapel Hill, USA. Dr. Chen's research is to develop quantitative methodologies for evaluation and intervention research. He has more than 200 professional publications and co-authored/co-edited 27 books on evaluation research, randomized controlled trials, statistical meta-analysis, public health statistical methods, causal inferences and statistical Monte-Carlo simulation and big data analytics for public health applications. Dr. Chen has more than 30 years' teaching experience in statistical methodology. He has been invited to give seminars and workshops at national and international conferences.

Day 3(May 13, 2020): Todd Jensen

Title:

Latent Class Analysis and Latent Growth Modeling: Methods for Discovering and Understanding Patterns and Trends in Our Data

Presenter:

Todd Jensen, PhD, MSW

Research Associate | Jordan Institute for Families

Research Assistant Professor | School of Social Work

University of North Carolina at Chapel Hill

Email: jensen@unc.edu

Abstract:

Program evaluators and data analysts across disciplines often seek to unearth important patterns and trends in their data. For instance, one might seek to uncover what is called "unobserved population heterogeneity," or the presence of latent subgroups marked by unique patterns of characteristics. Program evaluators might especially be interested in assessing whether such patterns influence how participants respond to an intervention. In addition, one might seek to understand trends in individual-level change over time, perhaps with respect to outcomes being targeted by an intervention. The purpose of this workshop is to overview two latent variable modeling methods that can support efforts to achieve these, and other, analytic aims. Specifically, the workshop will introduce participants to *Latent Class Analysis* (LCA) and *Latent Growth Modeling* (LGM), with attention given to the rationale, strengths, and limitations of each method. The workshop will serve as a step-by-step guide to applying LCA and LGM using Mplus, a commonly used statistical software package. Participants will also receive a compilation of source materials and references to support future application of LCA and LGM.

Targeted Audience:

This short course is intended for scholars and graduate students at various levels of statistical and methodological proficiency who want to expand their knowledge of latent variable modeling approaches to explore response patterns or longitudinal trends in their data for basic or applied research projects.

Learning Objectives:

At the end of this short course, participants will be able to:

- Understand the rationale, strengths, and limitations of LCA and LGM.
- Prepare and structure data for appropriate use with LCA or LGM
- Navigate key syntax to execute LCA and LGM using Mplus
- Interpret Mplus output associated with LCA or LGM
- Understand how LCA or LGM can be used to answer a variety of research questions
- Draw from relevant resources to support future learning and application of LCA or LGM

Short Course Outline:

Morning

(Three 50-Minute Sessions from 9am to 12pm with 10 minutes comfort break between sessions)

- **Session 1:** When should I use LCA?

- o Person-centered analysis versus variable-centered analysis
- o Strengths and limitations of LCA
- **Session 2:** How do I run LCA and interpret findings?
  - o Step-by-step overview of running LCA in Mplus and interpreting output
- **Session 3:** What can I do with LCA and where can I learn more?
  - o Assessing latent-class membership as an outcome, predictor, or moderator.
  - o Variations of LCA
  - o Overview of LCA resources for future learning and application

Lunch Break (from 12pm to 1pm, box lunch will be served for free)

Afternoon

(Three 50-Minute Sessions from 9am to 12pm with 10 minutes comfort break between sessions)

- **Session 4:** When should I use LGM?
  - o Longitudinal modeling with three or more time points
  - o Strengths and limitations of LGM
- **Session 5:** How do you run LGMs and interpret findings?
  - o Step-by-step overview of running LGM in Mplus and interpreting output
- **Session 6:** What can I do with LGM and where can I learn more?
  - o Assessing latent growth curves as an outcome, predictor, or parallel process
  - o Variations of LGM
  - o Overview of LGM resources for future learning and application

Teaching Methods:

- Material for this short course will be delivered using a combination of didactic content delivery, software demonstrations, and opportunities for attendees to interact with and engage course material directly via handouts and discussion.

- Attendees are welcome to follow along with software demonstrations to the extent they are able, but this is not an expectation given that some attendees may not have access to Mplus. Software demonstrations will be detailed and attendees will receive necessary materials to reference following the course.

- The instructor encourages questions and discussion to promote learning and understanding throughout the course.

About the Instructor:

Dr. Todd Jensen is a Research Associate in the Jordan Institute for Families and a Research Assistant Professor in the School of Social Work at the University of North Carolina at Chapel Hill. As a researcher and educator, Dr. Jensen is committed to promoting family resilience and youth well-being, and transforming the systems that best support them. Dr. Jensen has extensive experience applying quantitative methods in his work, including finite mixture modeling, structural equation modeling, and longitudinal data analysis.

Day 4 (May 14, 2020): Kirsten Kainz

Title:

Complexity and Systems Science Perspectives on Social & Health Intervention Interventions: Evaluation Methods & Tools

(participants should bring a laptop computer in preparation for independent and group activities)

Presenter:

Kirsten Kainz, Ph.D.

Research Professor and Associate Director of Research Development and Translation

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

kirsten.kainz@unc.edu

Target Audience:

The proposed workshop is designed for new and expert practitioners of complex intervention development and evaluation. Workshop activities will support sharing of participant expertise and access to additional resources for students and junior evaluators who are new to the topic of complexity and systems science. Funders, government officials, and other stakeholders interested in the use of evaluation information for social change are encouraged to participate.

Learning Objectives:

In this workshop participants will learn about the application of complexity and complex systems concepts in the development and evaluation of early childhood interventions. The workshop will be structured around four foci:

1. An overview of complexity science and complex systems perspectives
2. Exploration of policy, research, and funding frameworks related to complex systems evaluation
3. Review of families of methods for complex evaluations: Developmental Evaluation, Systemic Evaluation, Realist Evaluation, and Continuous Quality Improvement
4. Participatory modeling and visualization techniques

Participants will actively explore complexity concepts and engage with relevant methods during the workshop engaging in discussion, tool review, and agenda setting activities. The activities will support discussion about international diversity of frameworks and methods in use. By the end of the workshop participants will have achieved a working knowledge of complexity principles pertinent to early childhood intervention research and familiarity with relevant publications and resources for complex evaluation design.

Short Course Outline:

Morning Session

- Welcome
- History and Overview of Systems Theory
- Connections to Complexity Theory
- *Activity: Systems Evaluation Methods*
- Complex Adaptive Systems: Implications for Social & Health Interventions
- Policy & Funding Frameworks
- *Activity: Evaluation Examples*

(Lunch break from 12pm to 1pm: lunch will be provided as part of workshop fee)

Afternoon Session

Deeper Dive into Methods and Analysis Tools
- Local Example of Complex Intervention and Evaluation

- *Participant Agenda Setting: Designing a complex intervention and/or evaluation*
- Closing Discussion

About the Instructor: Kirsten Kainz, PhD, is research professor and associate director of research development and translation in the School of Social Work and a research fellow at the Frank Porter Graham Child Development Institute (FPG) at the University of North Carolina at Chapel Hill in the United States. Dr. Kainz teaches research design and statistics in the doctoral program in social work, has been a statistical consultant for 15 years, has served as the director of statistics for four years at FPG, and has served as methodologist for over 27 evaluations and research projects at FPG. Dr. Kainz has provided methodological workshops and presentations at annual meetings of the Society for Social Work and Research, the Society for Research on Educational Effectiveness, and the American Education Research Association. She has been awarded the Dean's Recognition of Teaching Excellence and the Doctoral Student Mentoring Award in social work and has received outstanding teaching evaluations for five years consecutively.

Day 5(May 15, 2020): David Ansong

Title:

Geo-Spatial Analysis and Modeling for Intervention Research

Presenter:

David Ansong, PhD, MSW

Associate Professor | School of Social Work

University of North Carolina at Chapel Hill

Email: ansong@email.unc.edu

Abstract:

Researchers and non-geospatial professionals sometimes find themselves needing to utilize location-based data to reveal patterns and trends in environments ranging from neighborhoods to multi-state regions. This workshop will introduce participants to the application of spatial analytic tools for analyzing spatial patterns and geographically varying relationships and strategies for displaying them on great-looking maps. The first half of the workshop will focus on Hot Spot

analysis and other tools for highlighting statistically significant spatial clusters. The second half of the workshop will provide participants with a relatively quick and simple way to learn how to examine, quantify, predict, and map spatially varying relationships. All demonstrations and hands-on exercises will use two open-source software suits (QGIS and GWR4). At the end of the workshop, participants will have the capability to analyze spatial patterns and relationships, and a general ability to use QGIS and GWR4. Participants will also receive resources to enable them to continue learning on their own using the data and tutorials provided.

Targeted Audience:

The course covers a range of contents from basic to advance level. For beginners, the course will serve as an excellent introductory GIS course for those who wish to learn what GIS is and the basics of what it can do, as well as students exploring a potential career with GIS. The course also covers a selection of several advanced topics intended for researchers, students, and practitioners seeking to use GIS tools to spatial trends in their data.

Learning Objectives:

Upon completion of this short course, participants will:

1. Understand the role of GIS in research, program development, and practice.
2. Know how to access and integrate data from various sources to create geographically referenced data.
3. Know how to use open-source GIS software (QGIS and GWR4) to analyze and display spatial patterns and relationships.
4. Know how to develop thematic maps to inform research and program development.
5. Know how to use spatial modeling tools to assess spatial variability and identify hot spots.
6. Know how to run geographically weighted regression to assess spatial relationships and map out the results.

Short Course Outline

MORNING

Session 1: Introduction to Geographic Information Systems (GIS)
— Overview of GIS and its utility in intervention research, program development, and practice
— Introduction to the QGIS user interface and its elementary functions

Session 2: Preparing and Visualizing Spatial Data
— Accessing and joining shapefiles and attribute data

- Manipulating map layers and attribute tables
- Creating map layers
- Creating and exporting custom map layouts for multiple maps

Session 3: Designing maps for intervention studies

- Creating choropleth and point maps to show the distribution of outcomes and subject characteristics
- Creating thematic maps with overlays of graduated/proportional symbols to highlight relationships (Bivariate analysis)

AFTERNOON

Session 4: Performing cluster analysis

- Analyzing spatial data to highlight hot and cold spots (Hot spot & heatmap analysis)
- Overlaying graduated/proportional symbols over heatmaps to highlight correlations (Bivariate analysis)

Session 5: Conducting Geographically Weighted Regression

- Conceptualizing and formulating research questions/hypothesis about spatial relationships
- Introduction to the GWR4 user interface and its elementary functions
- Preparing data for geographically weighted regression
- Conducting geographically weighted regression and displaying local coefficients in maps

Course Structure:

Generally, each session is divided into two parts. With a few exceptions, Part I will comprise a brief overview/lecture and discussion to deepen participants' understanding of the conceptual underpinning of various analytic strategies. Part II will focus on the hands-on application of various GIS tools to help learn how to participants to address important practice and research questions. The instructor will provide feedback on maps and mini-projects throughout the course. Participants should bring their laptops to every session.

About the Instructor: Dr. David Ansong is an Associate Professor in the School of Social Work at the University of North Carolina at Chapel Hill. He has applied GIS analytic tools in his work for over a decade to uncover hidden geospatial inequalities in financial inclusion, educational outcomes, and other social development outcomes.