Advanced Methodology and Statistics Seminars

The AMASS program is a special series of offerings for applied researchers, presented by nationally renowned research scientists.

Thursday, 8:30 a.m. – 5:00 p.m.

AMASS 1

Developing Dynamic, Sequential Interventions that Optimize Mental Health Outcomes: Novel Clinical Trial Design and Data Analysis Strategies

Susan Murphy, *University of Michigan*
Daniel Almirall, *University of Michigan*

Basic level of familiarity with the material

The effective management of mental health disorders often requires individualized, sequential decision making whereby treatment is dynamically adapted and re-adapted over time based on a patient's on-going response to treatment. An adaptive treatment strategy (ATS) operationalizes individualized sequential decision making via a sequence of decision rules that specify whether, how, for whom and when to alter the intensity, type, or delivery of pharmacological and/or psychosocial treatment at critical decision points in the management of chronic mental health. ATSs can be used to develop or supplement clinical treatment guidelines, and they inform the evidence-base for treating mental health disorders. In this workshop, we present a novel, experimental design (namely, sequential multiple assignment randomized trials, or SMARTs) intended specifically for the purpose of developing and optimizing adaptive treatment strategies. The workshop will include an introduction to ATSs and SMARTs, a discussion of SMART design principles including the choice of primary and secondary aims, and an introduction to primary and secondary data analysis strategies. Participants will have the opportunity to both verbally pose questions as well as to anonymously submit questions, concerns, or points of confusion. For questions not addressed during the workshop, Drs. Almirall and Murphy will follow-up with participants over email.

You will learn:

1. How adaptive treatment strategies (ATSs) operationalize the tactics and strategies of individualizing treatment for mental health disorders

2. About sequential multiple assignment randomized trials (or SMARTs) that can be used to inform the development of individually tailored clinical decision rules in mental health research. Learn about SMART study design principles
3. About the types of primary and secondary scientific aims a scientist can specify in the design of, and grant application involving, a SMART

Recommended Readings:

S.A. Murphy, L.M. Collins, A.J. Rush (2007). Customizing Treatment to the Patient: Adaptive Treatment Strategies. Drug and Alcohol Dependence, 2007;88(2):S1-S72.
S.A. Murphy, K.G. Lynch, J.R. McKay, D. Oslin, T. TenHave (2007). Developing Adaptive Treatment Strateiges in Substance Abuse Research. Drug and Alcohol Dependence, 88(2):S24-S30 PMC1922034
S.A. Murphy (2005). An Experimental Design for the Development of Adaptive Treatment Strategies. Statistics in Medicine. 24:1455-1481.
L.M. Collins, S.A. Murphy, V. Strecher (2007). The Multiphase Optimization Strategy (MOST) and the Sequential Multiple Assignment Randomized Trial (SMART): New Methods for More Potent e-Health Interventions. American Journal of Preventive Medicine, 32(5S):S112-11.

Thursday, 2:00 p.m. – 6:00 p.m.

AMASS 2

Item Response Theory: Fundamentals and Application of Modern Psychometric Analysis

James Henson, *Old Dominion University*
Abby Braitman, *Old Dominion University*

Basic level of familiarity with the material

Traditional psychometric analysis (e.g., factor analysis) of psychological assessments requires all items to be measured on a continuous response scale; items with dichotomous (e.g., true / false) or ordinal (e.g., strongly disagree to strongly agree) response scales do not meet traditional model assumptions. Item Response Theory (IRT) is a modern psychometric approach for scale development and analysis that is designed to combine latent variable estimation (i.e., factor analysis) with items that use non-continuous response scales. In addition, IRT provides much more detailed psychometric information regarding the individual items and scale as a whole, and engenders many powerful IRT applications, such as item information analysis, differential item functioning analysis, and adaptive testing. The

purpose of this AMASS is to introduce the fundamentals of IRT, to discuss the advantages and applications of IRT as compared to traditional psychometric approaches, to provide an approachable treatment of the fundamental IRT models, and to teach the beginning user how to conduct and interpret a unidimensional IRT analysis. The presentation will also include a discussion of advanced IRT applications and available software. This AMASS is targeted toward individuals interested in scale analysis or development who have had minimal exposure to traditional factor analytic techniques.

You will learn:

1. The advantages and the appropriateness of IRT over traditional measurement approaches
2. The necessary steps for conducting, evaluating, and interpreting a unidimensional IRT model.
3. How to interpret the parameter estimates from 1-, 2-, and 3-parameter models with both dichotomous and polytomous response formats

Recommended Readings:

Bock, R. D. (1997). A brief history of item response theory. Educational Measurement: Issues and Practice, 16, 21-33. doi: 10.1111/j.1745-3992.1997.tb00605.x

Embretson, S. E. (1996). The new rules of measurement. Psychological Assessment, 8, 341-349. doi: 10.1037/1040-3590.8.4.341

Embretson, S. E., & Reise, S. P. (2000). Item Response Theory for Psychologists. Mahwah, NJ: Lawrence Erlbaum Associates.

Sunday, 8:00 a.m. – 12:00 p.m.

AMASS 3

An Introduction to Modern Missing Data Handling Techniques

Craig Enders, *Arizona State University*

Basic level of familiarity with the material

There have been substantial methodological advances in the area of missing data analyses during the last 25 years. Methodologists currently regard maximum likelihood estimation (ML) and multiple imputation (MI) as two state of the art missing data handling procedures. The purpose of this

course is to familiarize participants with ML and MI and to demonstrate the use of these techniques using popular software packages (e.g., SPSS, SAS, Mplus). The goal of this course is to provide participants with the skills necessary to understand and appropriately implement ML and MI in their own research. To this end, the course will provide a mixture of theoretical information and computer applications. The course content will be accessible to researchers with a foundation in multiple regression.

The course will be designed for researchers and graduate students who (a) are not familiar with missing data handling techniques, and (b) have statistical training that includes a graduate-level multiple regression course.

You will learn:

1. The theoretical foundations for modern missing data handling approaches
2. About recent methodological developments in the area of missing data handling, in particular maximum likelihood estimation and multiple imputation
3. How to use popular computer packages to implement maximum likelihood and multiple imputation

Recommended Readings:

Enders, C.K. (2010). Applied missing data analysis. New York: Guilford.

Baraldi, A.N., & Enders, C.K. (2010). An introduction to modern missing data analyses. Journal of School Psychology, 48, 5-37.

Graham, J.W. (2009). Missing data analysis: Making it work in the real world. Annual Review of Psychology, 60, 549-576.

Schafer, J.L., & Graham, J.W. (2002). Missing data: Our view of the state of the art. Psychological Methods, 7, 147-177.