

**Society for Prevention Research
26th Annual Meeting
Washington, DC**

Pre-Conference Workshop I

Date: Tuesday, May 29, 2018

Time: 8:30 am – 5:30 pm

Bayesian Causal Mediation Analysis

Organizer and Presenter: David P. MacKinnon, Ph.D., Arizona State University

Presenters: Milica Miočević, Ph.D., Utrecht University, Netherlands, Matthew J. Valente, M.A., Arizona State University, Oscar Gonzalez, M.A., Arizona State University

Description:

The goal of the workshop is to describe statistical, methodological, and conceptual aspects of Bayesian causal mediation analysis. The one-day workshop consists of four parts. Part 1, covers definitions, history, and applications for the mediation model followed by estimation of mediation effects including assumptions, statistical tests, and confidence intervals. The methods described in this section serve as the foundation for causal inference methods in Part 2 and Bayesian mediation analysis in Part 3. Part 2 describes the potential outcomes framework and applies it to the single mediator model. Participants will learn about the causal estimators for the single mediator model and the assumptions necessary to make causal inferences. Part 3 describes methods for Bayesian mediation analysis and the extension of these techniques to Bayesian causal mediation analysis. Differences between frequentist and Bayesian frameworks are described, and inferences from the posterior distributions of the causal estimators are discussed. In Part 4, participants are taught how to perform Bayesian causal mediation analysis in SAS, Mplus, and R.

Target workshop audience:

The target audience is prevention and treatment researchers with some knowledge of statistical analysis including multiple regression. We recommend reading the following articles before the workshop:

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annu. Rev. Psychol.*, *58*, 593-614.

Miočević, M., Gonzalez, O., Valente, M. J., & MacKinnon, D. P. (2017). A Tutorial in Bayesian Potential Outcomes Mediation Analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, 1-16.

Materials provided to attendees.

The audience will receive access to workshop slides and handouts and materials will be made available either on a website or in printed form.

Outline of the Workshop

Dr. MacKinnon will teach the first part of the workshop on mediation analysis, Matt Valente will teach the second part of the workshop on the potential outcomes framework and causal inference, Dr. Miočević will teach the third part of the workshop on Bayesian methods, and Oscar Gonzalez will teach the fourth part of the workshop on software for the described methods.

Tentative Agenda for Society for Prevention Research Mediation Analysis Workshop, 2018

Morning

8:30-9:00	Computer Set up
9:00-10:30am	Introduction, workshop goals, definitions, history, examples (Chapter 1 and 2 from MacKinnon (2008))
	Single Mediator Model (Chapter3, MacKinnon (2008))
10:30-10:45am	Break
10:45-12:15	Potential Outcomes framework
	Causal inference in mediation analysis
12:15-1:30pm	Lunch on your own
1:30-3:00pm	Bayesian mediation analysis
	Bayesian computation of causal estimators in mediation analysis
3:00-3:15pm	Break
3:30-5:00pm	Bayesian causal mediation analysis in SAS, Mplus, and R (hands-on; participants should bring their own computers with one of the software packages)
5:00-5:30pm	Available to Answer Questions

Presenters: The four presenters are authors of the only published tutorial on Bayesian causal estimation for the single mediator model (Miočević, Gonzalez, Valente, & MacKinnon, 2017). The material in the workshop is based on the book “Introduction to Statistical Mediation Analysis” by Dr. MacKinnon (2008) and on this tutorial paper. The workshop includes extensive discussions about Bayesian methods, causal inference, and example data sets from real prevention studies for estimating Bayesian causal mediation effects.

David P. MacKinnon, Ph.D., is a Foundation Professor in the Department of Psychology at Arizona State University. He received the Ph.D. in measurement and psychometrics from

UCLA in 1986. He was an Assistant Professor of Research at the University of Southern California's Institute for Prevention Research from 1986 to 1990. He has been at Arizona State University since 1990 and is affiliated with the Prevention Intervention Research Center and the Research in Prevention Laboratory. Dr. MacKinnon teaches graduate analysis of variance, mediation analysis, and statistical methods in prevention research. He has given numerous workshops in the United States and Europe. In 2011 he received the Nan Tobler Award from the Society for Prevention Research for his book on statistical mediation analysis. He has served on federal review committees and was a consulting editor for the journal, *Prevention Science*. Dr. MacKinnon has been principal investigator on several National Institute on Health grants and is a Fellow of the Association for Psychological Science and American Psychological Association Measurement and Statistics Division. His primary interest is in the area of statistical methods to assess how prevention and treatment programs achieve their effects. He has given over 40 workshops on mediation analysis over 100 invited lectures on mediation analysis.

Milica Miočević, Ph.D, is an Assistant Professor in the department of Methods and Statistics, faculty of Social and Behavioral Sciences, at Utrecht University. Her research focuses on the pros and cons of Bayesian methods for mediation analysis. In addition to the tutorial on Bayesian causal mediation analysis, she has coauthored papers on the statistical properties of the mediated effect with diffuse and informative prior distributions (Miočević, MacKinnon, & Levy, 2017), on statistical properties of effect size measures for the mediated effect computed in the Bayesian framework (Miočević, O'Rourke, MacKinnon, & Brown, 2017), and introductory papers on how to perform mediation analysis in the Bayesian framework (Miočević & MacKinnon, 2014). Dr. Miočević teaches courses on Bayesian statistics, mediation analysis, multivariate statistics, and structural equation modeling.

Matthew J. Valente, M.A., is a graduate research assistant in the Research in Prevention Laboratory at Arizona State University. He recently received his M.A. in Quantitative Psychology from Arizona State University and is pursuing his Ph.D. in Quantitative Psychology from Arizona State University. His research interests include causal inference in longitudinal mediation models, statistical mediation, and health and safety interventions. His work in causal inference in longitudinal mediation models has focused on comparing models of change for estimating mediated in the pretest-posttest control group design and his work in statistical mediation analysis has focused on statistical tests of mediated effects in structural equation models and Bayesian approach to Potential Outcomes estimators in the single mediator model. As a member of Dave MacKinnon's Research in Prevention Laboratory, he has worked as a methodologist for health promotion programs and has worked as a teaching assistant for several graduate level methodology courses at Arizona State University. He has published several articles on the application and methodological development of statistical mediation analysis.

Oscar Gonzalez is a National Science Foundation Graduate Research Fellow in the Department of Psychology at Arizona State University, where he is currently pursuing a Ph.D. in Quantitative Psychology. Previously, he received a B.A. in Psychology with a minor in European Studies from the University of Notre Dame and studied abroad in Spain and South Africa. Under the mentorship of Dr. David P. MacKinnon, Oscar works extensively on developing and evaluating methods in the area of statistical mediation analysis, specifically in incorporating innovative psychometric methods and measurement theory to the mediation model to enhance its

conclusions. His research is funded by the National Science Foundation. To be at the forefront of psychometric and assessment research, he has also interned at Educational Testing Service (ETS) to work on the National Assessment of Educational Progress (NAEP – the Nation's Report Card) research agenda on innovative assessment strategies with virtual object manipulatives. His current research stems from his proposed framework of statistical mediation and as *measurement problem*, which includes exploring how psychometric issues, such as measurement invariance and measurement error, influence the conclusions of the statistical mediation model, and the representation of mediating constructs with item response theory latent variable models.