Welcome back to The Methodology Center Perspective!

I am back in the Center after a one-year sabbatical. Many thanks to Stephanie Lanza for serving so capably as acting director while I was away. I am happy to say that my sabbatical was productive. I was able to begin two collaborations with scientists who are interested in taking a phased optimization approach to intervention development and evaluation. I’m excited about these collaborations and will be telling you more about them as they develop. I also spent considerable time working on a book that Stephanie and I are writing on latent class and latent transition analysis. We expect the book will come out in late 2009 or early 2010; when we have a confirmed release date we will announce it in this newsletter.

We have two visiting scholars this academic year. One is Dr. Lisa Dierker, who is Professor of Psychology at Penn State University. The other is Dr. Jian-Jian Ren, who is Professor of Mathematics at the University of Central Florida. Both are here primarily to collaborate with Runze Li, but the rest of us are enjoying interacting with them as well.

Every fall marks the start of a new year of the Prevention and Methodology Training Program, one of our joint endeavors with the Prevention Research Center directed by Dr. Mark Greenberg. We currently have two post-doctoral fellows and seven predoctoral fellows. We recently said good-bye to several PAMT trainees who have gone on to positions elsewhere. Dr. Larissa Duncan is an Osher Fellow in the NCCAM Postdoctoral Training Program in Research in Integrative Medicine at the University of California, San Francisco. Dr. Mark Greenberg is currently a confirmed release date we will announce it in this newsletter.

It is great to be back for an exciting year at the Center!

Linda M. Collins, Ph.D.
Director, The Methodology Center
Penn State University

Using Latent Class Analysis to Describe Relations among Individual, Family, School, and Community Factors and Patterns of Adolescent Substance Use

This study investigated how individual risk factors interact with social contextual-level protective factors to predict problematic substance use among a sample of 12th grade students (N = 8879, 53% female). We identified six latent classes of adolescents based on their level of experience with alcohol, cigarettes, and marijuana. These classes were labeled: (1) Non-Users; (2) Alcohol Experimenters; (3) Alcohol, Tobacco, and Other Drug (ATOD) Experimenters; (4) Current Smokers; (5) Binge Drinkers; and (6) Heavy Users. Alcohol Experimenters was the most common substance use latent class (38% of adolescents), and was characterized by a high probability of reporting lifetime alcohol use and very low probability of reporting recent binge drinking or cigarette or marijuana use. A significant proportion of adolescents (18%) were likely to belong to the Heavy Users latent class, characterized by recent use of all three substances. Nearly as many adolescents (17%) were likely to belong to the No Use latent class.

Binary logistic regression was used to predict the odds of belonging to the Heavy Users latent class compared to the other five latent classes, as well as the odds of belonging to the Non-Users latent class relative to the other five latent classes. The results for the Heavy Users model suggested that family measures of protection significantly interacted with individual measures of risk (see Figure 1, top panel). At low levels of individual risk, family protection was related to a higher likelihood of being in one of the five other latent classes, compared to the Heavy Users latent class. However, the effects of family protection dissipated at higher levels of individual risk. The bottom panel of the figure displays the increase in the odds of membership in the Non-Users latent class relative to membership in any of the other five latent classes corresponding to a one-unit increase in the protective factors. In this case, the protective effect of community factors interacted with individual risk, with the strongest effect among students with low individual risk.

The models provided evidence that individual risk, family, school, and community protective factors were associated with membership in the substance use latent classes. However, the significance of interaction terms suggested that these protective influences differed according to the level of individual risk. Adolescents with high levels of individual risk benefited
Lisa Dierker Joins The Methodology Center for a Year of Collaboration

In September 2008 Lisa Dierker moved to Penn State to spend the academic year in The Methodology Center. Lisa is on leave this year from her position as Professor of Psychology at Wesleyan University. Lisa brings to the Center a background in developmental psychology and psychiatric epidemiology with particular interest in the use of state-of-the-art methods in the measurement of smoking and nicotine dependence across development.

Lisa was first introduced to the work of The Methodology Center in 2000 when she became acquainted with Linda Collins during their work together as members of the Tobacco Etiology Research Network (sponsored by the Robert Wood Johnson Foundation). Since their involvement in TERN, Linda Collins continued working with Lisa as a mentor on her successful K01 award funded by NIDA, which has provided critical resources necessary for ongoing work in the application of emerging quantitative methods in an effort to inform smoking intervention.

More recently, this interest in emerging methods and the role that they may play in research relevant to policy and practice led the way to a new collaboration between Lisa and Runze Li, also with The Methodology Center. Based on their mutual interests in more flexible group-based modeling strategies that may be employed with intensive longitudinal data, Lisa and Runze recently received a grant from NIDA as part of the NIH Roadmap Initiative for Medical Research. This support will allow them to advance the understanding of health behavior through the extension and dissemination of Dr. Li's innovative functional hierarchical linear modeling method (Li, Root and Shiffman, 2006). This method will extend beyond the functionality of many currently available group-based techniques by accommodating both intensive longitudinal data as well as data that includes hierarchical levels.

Aside from developing collaborations with Methodology Center scientists and graduate students, Lisa will also offer a graduate seminar this spring that will introduce students to available methodologies for identifying population subgroups in the interest of delivering more targeted interventions.

Stephanie Lanza has served as the Scientific Director of The Methodology Center since 2004. Her interdisciplinary training is reflected in both her undergraduate degrees (in applied math and psychology from the University of North Carolina at Chapel Hill) and graduate training (she received a masters of applied statistics in 2002 and a Ph.D. in human development and family studies from Penn State in 2003). Stephanie's research is focused on the advancement of statistical methods for use in the health and behavioral sciences. In particular, she works to advance latent class analysis and latent transition analysis and disseminate the use of these methods in prevention science. In 2008 Stephanie was honored with the Society for Prevention Research ECPN Early Career award for her outstanding contributions to the field of prevention.

Stephanie has been awarded a research grant from the National Institute on Drug Abuse (NIDA) entitled Identifying Risk Profiles for Substance Use and Comorbid Behavior. She is collaborating with Mark Greenberg, Director of the Prevention Research Center at Penn State, on much of this work. Their initial work has focused on examining prototypical profiles of risk characterized by the multiple risk factors to which children are exposed (including factors at the individual, parental, household, school, and neighborhood levels) and linking these risk profiles to adverse developmental outcomes.

Part of Stephanie's dissemination efforts have involved spearheading the development of two new add-on procedures for the SAS system: PROC LCA, a user-friendly procedure for conducting latent class analysis, was first released in 2006 and currently has over one thousand registered users. PROC LTA, released in 2007, is a similar procedure for conducting latent transition analysis. Thanks to Center funding from NIDA (PI: Linda Collins), The Methodology Center has been able to make these new procedures and corresponding documentation available for download free of charge at http://methodology.psu.edu/.

In order to demonstrate the use of PROC LCA and PROC LTA to health and behavioral scientists, Stephanie has organized several symposia and technical demonstrations around this topic for annual meetings of the Society for Prevention Research. She also has collaborated on numerous manuscripts that include tutorials and empirical demonstrations of these procedures. For example, Lanza, Collins, Lemmon, and Schafer (2007) modeled latent classes of alcohol use behavior in high school seniors in the United States and examined the effects of grades and skipping school on alcohol use latent class membership. In another study, Lanza and Collins (2008) modeled transitions over time in membership in the following latent classes of sexual risk behavior: Nondaters, Daters, Monogamous, Multipartner Safe, and Multipartner Exposed (this high-risk latent class was characterized by unsafe sex with multiple partners). They found that past-year drunkenness and marijuana use were stronger predictors of high-risk sexual behavior than cigarette use, and that drunkenness placed Nondaters and Daters at particularly high risk for transitioning to the Multipartner Exposed latent class one year later.

Stephanie also has a five-year conference grant from NIDA to continue the popular, long-running Summer Institute on Longitudinal Methods series. Stephanie enjoys her research career, as well as serving in other roles such as mentor to students and postdoctoral fellows, member of Penn State's Graduate School Alumni Society Board of Directors, and editor of this newsletter. Stephanie is married to another Penn State alum; they have a daughter Sadie and another little girl on the way!
Using Latent Class Analysis continued from page 1

less from a positive family or neighborhood context than adolescents with low levels of individual risk. These findings suggest that the individual risk factors may undermine the protective effect of parental supervision, discipline and other family factors, as well as protective aspects of cohesive neighborhoods, among these adolescents. Multi-component and adaptive intervention efforts that account for different levels of ATOD use involvement, as well as distinct profiles of risk and protection, are likely to be most effective in preventing problematic substance use.

Figure 1. Effects of family, school, and community protective factors on ratio of odds of belonging to all other latent classes compared to the Heavy Users latent class (top panel) and the Non-Users latent class (bottom panel) across level of individual risk.


Recent Activity in The Methodology Center

Stephanie Lanza received the Society for Prevention Research ECPN Early Career Award at the 2008 annual meeting. In addition, Mark Greenberg, Director of the Prevention Research Center at Penn State, received the Friend of ECPN Award.

Penn State proudly brought home the Sloboda and Bukoski Society for Prevention Research Cup from the competition held at the 2008 annual meeting in San Francisco! Members of the winning team included Michael Cleveland of The Methodology Center and four predoctoral fellows of the Prevention and Methodology Training Program (Amy Syversten, Jochebed Gayles, Monique Faulk, and Melissa Tibbits). The team presented the research project titled Profiles of Protection Among Adolescents. (See photo on sidebar to the right.)

Linda Collins, Stephanie Lanza and Bethany Bray conducted a Masterclass workshop at the Department of Mathematics and Statistics Postgraduate Statistics Centre of Lancaster University, England, September 29 through October 2, 2008. Their four-day workshop was titled Latent Class Analysis for Cross-Sectional and Longitudinal Data.

Bethany Bray gave an invited talk at the 22nd National Conference on Problem Gambling in June 2008. The talk, given in conjunction with receiving the NCPG outstanding dissertation award, focused on the examination of gambling and substance use using advanced latent class modeling techniques.

Linda Collins and Bethany Bray presented a workshop on latent class and latent transition analysis at the University of Kentucky in October 2008. The workshop was part of a day-long conference on statistical methods in drug abuse and health-related research, sponsored by the Center for Drug Abuse ResearchTranslation (CDART).

Stephanie Lanza served on the faculty for the NIDA-sponsored Mini Medical School on Addiction, titled Understanding Drug Addiction: Focus on African Americans, held July 21 at the Morehouse School of Medicine in Atlanta, GA.

Linda Collins served on the faculty for the NIH Summer Training Institute on Randomized Controlled Trials Involving Behavioral Interventions. Her presentation was titled Building More Efficacious and Effective Behavioral Interventions Using the Optimization Cycle Approach.

David Mackinnon of Arizona State University presented on mediation at the 13th annual Summer Institute on Longitudinal Methods, held June 2-4 at University Park, PA. Each participant received a copy of his new book, Introduction to Statistical Mediation Analysis. We are grateful to the National Institute on Drug Abuse for continued support of this Institute!

Donna Coffman has a manuscript in the upcoming issue of the journal Methodology. This study reports findings from a simulation study of the degree to which model specification error impacts the test of close fit, the test of exact fit, and power analysis procedures in structural equation modeling:


Michael Cleveland, along with colleagues from the Prevention Research Center at Penn State, recently had a manuscript appear in the Journal of Adolescent Health. The authors used generalized linear mixed models to compare the relative influence of risk and protective factors on several domains of adolescent substance use among 8th, 9th, 10th, and 12th grade students:


Helene White (Center for Alcohol Studies, Rutgers University), Bethany Bray (The Methodology Center), and colleagues used Markov models to estimate transitions into and out of light and intermittent smoking across five time points during emerging adulthood. The article will appear in a special issue of the journal Nicotine and Tobacco Research on light and intermittent smoking:


Linda Collins gave an invited talk at the Institute of Applied Health Sciences at the University of Aberdeen, Scotland on October 3. The title of the talk was Building Better Behavioral Interventions: One View of the Future of Intervention Development.
Befuddled by Fit

Coffman (2008) found that the RMSEA was biased in most conditions; specifically, she found that this fit statistic underestimated the population value, which means that investigators would be more likely to conclude that their model fits when in some cases it does not. However, she found that the RMSEA confidence interval maintained 95% coverage, which is a very desirable characteristic. In other words, she found in a simulation study that roughly 95/100 times the RMSEA confidence interval contained the true population value of the RMSEA. This means that the Type I error rate based on the confidence intervals matched the specified alpha of .05. In addition, both the test of exact fit (i.e. RMSEA = 0) and the test of close fit (e.g. RMSEA < .05) based on these confidence intervals worked well in terms of Type I error rates and power.

Based on these findings, I recommend reporting either the Relative Normed Index or the Comparative Fit Index (since these two indices are quite similar), along with the RMSEA confidence interval, noting its width and the upper bound of the interval.


Ask a Methodologist

I am interested in examining the role of three variables (family drug use, family conflict and family bonding) as mediators of the effect of neighborhood disorganization on adolescent drug use. I fit a structural equation model, but wonder which of the many fit statistics I should report?

— Befuddled by Fit

Dear Befuddled,

Generally, in structural equation modeling you should report several fit indices rather than only one. More specifically, simulation studies have shown that the Relative Normed Index and the Comparative Fit Index are both essentially unbiased (that is, they correctly estimate what the fit would be if the model were fit to the whole population).

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Based on these findings, I recommend reporting either the Relative Normed Index or the Comparative Fit Index (since these two indices are quite similar), along with the RMSEA confidence interval, noting its width and the upper bound of the interval.


A Note to Readers

Do you have a burning question you would like to ask a methodologist? We would like to hear from you! Submit questions you would like to see answered in the spring newsletter to mc@psu.edu. Be sure to put ‘Ask a Methodologist’ in the subject line. If we select your question you will receive one of our highly sought-after mugs from the Summer Institute on Longitudinal Methods!