Chapter Ten

Measurement and Instrumentation

Multiple Indicator Multiple Cause Modeling: Application to Children's Mental Health Research

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Introduction

Multiple Indicator Multiple Cause (MIMIC) models can be used in mental health services and clinical research to solve data analytic issues, providing a flexible approach to mixed latent-variable/ structural equation model (SEM) and measured variable models. MIMIC models can be used to examine the effect of measured covariates in SEM, to control for demographic characteristics, and as an alternative to multiple group models where there is more than one grouping variable and/or small sample size that limits the ability to analyze more complex models and multi-group models (Bollen, 1989; Muthen, 1989). A number of SEM programs can be used to estimate MIMIC models including Mplus, EQS, Lisrel, and AMOS, among others.

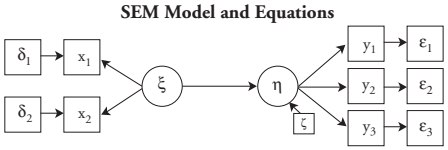
Two examples of MIMIC models are presented below. The examples represent two different types of research questions for both mental health services and clinical research. The first example examines the effect of demographic characteristics (caregiver education level) on endorsement of Attention Deficit Hyperactivity Disorder (ADHD) symptoms. The second example examines the effect of negative emotion, social anxiety, and substance use among high school students while controlling for demographic background variables. Thus, in the first example, the measured covariate or background variable is the primary variable of interest. In the second example,structural relations among the latent variables represent the primary relationships of interest while the measured variables are covariates to be controlled in the analysis.

Method

We begin with an examination of basic SEM and MIMIC models and associated equations. Figure 1 shows a basic structural equation model and fundamental model matrix equations. Note that the latent variable on the left (ξ) is indicated by the two measured variables x_1 and x_2. Figure 2 shows a MIMIC model. Note that while the right side of the model is identical to that in Figure 1, the left side of the model shows three measured variables (x_1, x_2, x_3) rather than a latent variable. Thus the left side of the model shows measured variables that can be included in a mixed measured and latent variable MIMIC model. Contrasting the SEM and MIMIC matrix equations in Figures 1 and 2 illustrates that while the SEM model discriminates between systematic and random/error variance in the predictor, the x variable in the MIMC model equation is equal to the construct and assumes no random/error variance. Such model assumptions are considered next.

Figure 1
Example Structural Equation Model and Equations

SEM Model and Equations

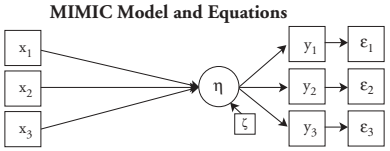


SEM Model Equations

$\eta = B\eta + \Gamma\xi + \zeta$ (structural model)
$y = \Lambda y\eta + \varepsilon$ (measurement of y, lv = construct)
$x = \Lambda x\sigma + \delta$ (measurement of x, lv = construct)

Figure 2
Multiple Indicator Multiple Cause Model and Equations

MIMIC Model and Equations



MIMIC Model Equations

$\eta_1 = \Gamma x + \zeta$ (structural model)
$y = \Lambda y\eta_1 + \varepsilon$ (measurement of y, lv = construct)
$x = \xi$ (mv = construct)

When conducting MIMIC modeling, a few statistical assumptions should be considered, including: (1) x is a perfect measure of ξ; (2) ξ (a latent independent variable) is indicated by one or more x variables; (3) η (a latent dependent variable) is indicated by one or more y variables, and; (4) the model can have more than one η (Robinson, 1974; Stapelton, 1977). Note that the first assumption will rarely be met in practice. However, most standard regression models use measured variables and so MIMIC models still provide a useful analytic approach for complex research questions. Next, two examples of MIMIC models are described.

The first example examines the differential effect of caregiver education on endorsement of ADHD Symptoms (Weckerly, et al., 2002). Factor analytic studies show that ADHD has two factors: Inattention and Hyperactivity/Impulsivity (e.g., Bauermeister et al., 1995; Gomez, Harvey, Quick, Scharer, & Harris, 1999; Lahey et al., 1994). Clinical observation suggests that parents/caregivers have more difficulty understanding Inattention symptoms compared to Hyperactivity/Impulsivity symptoms. The authors propose that Inattention may be less likely to be endorsed because it is less observable (more abstract) than Hyperactivity/Impulsivity, is often less of a problem for caregivers, and problems are often not recognized until a youth has school difficulties. The authors further suggest that caregivers with higher education levels may be more likely to recognize and endorse such symptoms.

Example 1: Method

The goal in example 1 was to test the effect of a measured variable (caregiver education) on endorsement of ADHD symptoms. The primary hypothesis was that higher caregiver education would be associated with greater endorsement of Inattention but not Hyperactivity/Impulsivity. The study included a sample of 1,341 caregivers of youth 6-18 years of age receiving services in one or more of five public sectors of care: Mental Health, School SED, Juvenile Justice, Alcohol-Drug Services, and/or Child Welfare. Approximately 28% of the youth sample met criteria for ADHD; 65% were male, and youth age distributions were 36% = 6-12 years, 23% =13-15 years, and 41% = 16-18 years. Caregiver Race/Ethnicity was 49% White, 21% Latino, 19% African-American, and 13% Other. Caregiver Education level of the sample was 20%Some High School, 34% High School Grad/GED, 34% Vocational or AA degree, and 12% BA degree or higher.

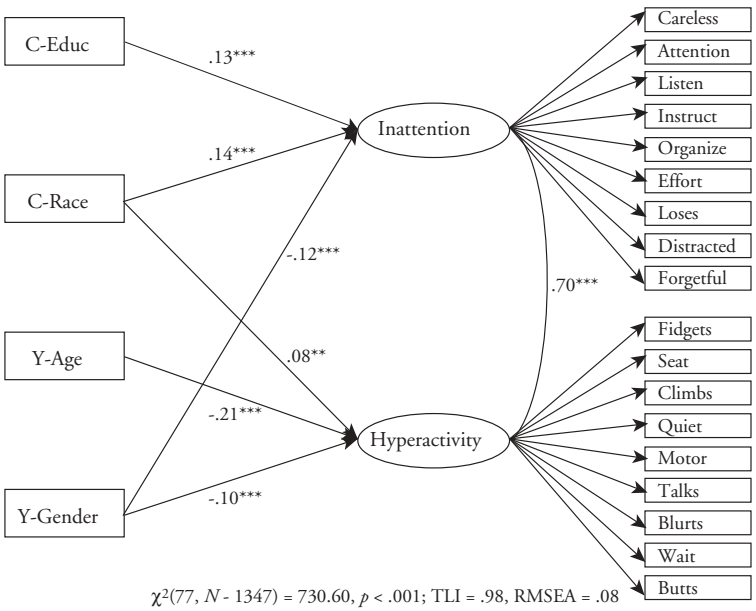
Example 1: Results

As shown in Figure 3, the MIMIC model supported the hypothesis that caregiver education was differentially associated with endorsement of Inattention, but not Hyperactivity/Impulsivity symptoms. Specifically, caregivers with more education were more likely than those with less education to endorse inattention symptoms. However, there was no education effect for Hyperactivity/Impulsivity symptoms. This example suggests that endorsement of symptoms representing diagnostic categories may be sensitive to respondent perceptions and characteristics. Specifically, the authors recommended that clinicians obtain both parent and teacher reports in the evaluation of ADHD. Clinicians may also need to gauge how sensitive a caregiver might be to Inattention symptoms and may need to give caregivers more examples of behaviors related to symptoms of Inattention. Finally, the authors conclude that diagnostic instruments may need greater sensitivity to demographic characteristic of respondents.

Example 2: Method

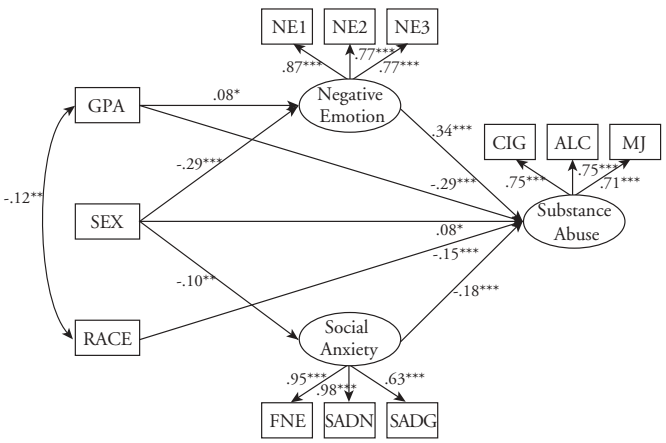
The second example is a MIMIC model examining the associations of negative emotion, social anxiety, and substance use among adolescents, controlling for the effect of measured covariates on latent variable predictors and outcomes (Myers, Aarons, Tomlinson, & Stein, 2003). As shown in Figure 4, in this example the latent variables include negative emotion, social anxiety, and substance use. The measured covariates include school performance, sex, and race/ethnicity. It was hypothesized that higher levels of negative emotion would be associated with increased substance use; however, the literature was equivocal on the effect of social anxiety on substance use. It was also expected that males, and White youth would be more likely to use substances, and that higher grade point average would be associated with lower negative emotion, lower social anxiety, and lower substance use.

Figure 3
MIMIC Model for the Differential Effect of Caregiver Education on Endorsement of ADHD Inattentive and Hyperactive Symptoms, Controlling for Covariates (Race, Youth Age, Youth Gender)



$\chi^2(77, N - 1347) = 730.60$, $p < .001$; TLI = .98, RMSEA = .08
$^*p < .05$, $^{**}p < .01$, $^{***}p < .001$
Source: Weckerly, et al. (2002)

Figure 4
MIMIC Model: Relationship of Negative Emotion and Social Anxiety to Teen Substance Use, Controlling for Covariates (School Performance, Sex, Race)



$\chi^2(46, N = 724) = 205.41$, $p < .001$; CFI = .96; TLI = .94;
RMSEA = .07; SRMR = .04; $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$
Source: Myers, Aarons, Tomlinson, & Stein, (In press).

Participants included 724 high school students in grades 9-12. Approximately 55% of the sample was female, the mean age was 16.4 years (*SD* = 1.1), 74% of the sample was White, 11% Latino, and 10% Other. Measures included the Social Anxiety Scale—Adolescent Version (La Greca, 1999), the Negative Emotionality Scale (NES; Buss & Plomin, 1984), and a substance use survey assessing past-month use of cigarettes, alcohol, and marijuana.

Example 2: Results

Results of the MIMIC model showed that social anxiety and negative emotion had qualitatively different effects on substance use. Specifically, higher negative emotion was associated

with more substance use while higher social anxiety was associated with less substance use. The model also allowed the investigators to control for the effects of school performance, sex, and race. The authors suggested that applied intervention and prevention efforts could incorporate these findings for program design, perhaps targeting subgroups of vulnerable teens (e.g., those with high levels of negative emotion).

Conclusions

As demonstrated in the two examples above, MIMIC models allow for the use of measured covariates in SEM models and can be used in both factor analytic (Example 1) and structural models (Example 2). MIMIC modeling is a useful method for better understanding the effects of background covariates in latent variable models and can be used for both theoretical and applied research questions in mental health services and clinical research. A further benefit is that they can be used with smaller sample size than might be required for multigroup analysis. These types of analyses can be conducted with a variety of statistical programs. Most importantly, MIMIC models allow for theoretically driven tests of simple and complex relationships of covariates with constructs of interest.

References

Bauermeister, J. J., Bird, H. R., Canino, G., Rubio-Stipec, M., et al. (1995). Dimensions of attention deficit hyperactivity disorder: Findings from teacher and parent reports in a community sample. *Journal of Clinical Child Psychology, 24*, 264-271.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.

Buss, A. H., & Plomin, R. (1984). *Temperament: Early developing personality traits*. Hillsdale, NJ: Erlbaum.

Gomez, R., Harvey, J., Quick, C., Scharer, I., & Harris, G. (1999). DSM-IV ADHD: Confirmatory factor models, prevalence, and gender and age differences based on parent and teacher ratings of Australian primary school children. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 40*, 265-274.

La Greca, A. M. (1999). The social anxiety scales for children and adolescents. *Behavior Therapist, 22*, 133-136.

Lahey, B. B., Applegate, B., McBurnett, K., Biederman, J., et al. (1994). DSM-IV field trials for attention deficit hyperactivity disorder in children and adolescents. *American Journal of Psychiatry, 151*, 1673-1685.

Muthen, B. O. (1989). Latent variable modeling in heterogeneous populations. *Psychometrika, 54*, 557-585.

Myers, M. G., Aarons, G. A., Tomlinson, K., & Stein, M. B. (2003). Social anxiety, negative affectivity and substance use among high school students. *Psychology of Addictive Behaviors, 17*, 277-283.

Robinson, P. M. (1974). Identification, estimation, and large sample theory for regressions containing unobservable variables. *International Economic Review, 15*, 680-692.

Stapelton, D. C. (1977). Analyzing political participation data with a MIMIC model. In K. F. Schuessler (Ed.), *Sociological Methodology 1978* (pp.52-74). San Francisco: Jossey-Bass.

Weckerly, J. Aarons, G. A., Leslie, L.K., Landsverk, J., Hough, R. L., & Wood, P.A. (April, 2002). *Attention on inattention: Effects of caregiver education on endorsement of inattentive symptoms*. Paper presented at the 15th International Conference on Mental Health Services Research: Evidence in Mental Health Services Research: What types, how much, and then what? National Institute of Mental Health: Washington, DC.

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Symposium

CAFAS Outcomes and Functioning for Youths Served by Schools, Mental Health, and Juvenile Justice

Chair
Kay Hodges

Authors
Rick Loseth et al.
Scott Rosas
James T. Yoe et al.

Symposium Introduction

Kay Hodges

In this symposium, we report on findings for three studies that identify treatment needs based on patterns of differential functioning on the Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 2000) or which utilize the CAFAS to track outcomes for youths. These studies represent a spectrum of youth served in terms of severity of impairment and demographic characteristics. In the first paper, Scott Rosas identified different CAFAS profile patterns for elementary school children referred by teachers for school-based intervention services due to one of four possible presenting problems. He discusses how the CAFAS differentiated these youths on the dimensions of presence and type of impairment across various domains, despite the fact that most of the youths were characterized by relatively low levels of overall impairment.

Next, Rick Loseth and his colleagues present their results to-date for a study in progress with preschoolers attending Head Start. This study assesses the usefulness of a screening tool developed for the Preschool and Early Childhood Functional Assessment Scale (i.e., a preschool version of CAFAS; PECFAS, Hodges, 1990). The tool is a 10-minute screening interview with parents to determine if more in-depth assessment is required for children who may have need for prevention or intervention services.

The other end of the continuum is represented by the study of youths in public mental health in Maine who are sufficiently impaired in functioning to be recipients of targeted case management, in-home treatment, crisis intervention, residential treatment and/or inpatient hospitalization. In this paper, Yoe and colleagues identified three clusters having strikingly different profiles of functional impairment, service use, cost, and treatment outcome. Each of these studies provides useful ideas about how to identify the needs of youth in order to better match the type and extent of functional impairment to various prevention and intervention services. The study of Yoe and colleagues extends this research to actually evaluating treatment outcome for different client profile-service use patterns.

References

Hodges, K. (1995). *The Preschool and Early Childhood Functional Assessment Scale*. (Revised). Ypsilanti, MI: Eastern Michigan University.

Hodges, K. (2000). *Child and Adolescent Functional Assessment Scale*. Ypsilanti, MI: Eastern Michigan University.

Assessing Behavioral Functioning in Children Referred for School-Based, Early Intervention Services

Scott Rosas

Introduction

Delaware's Department of Services for Children, Youth, and Their Families uses the Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 2000) to determine the effectiveness of interventions delivered within its mental health systems of care. The early intervention services to which children in this study have been referred represent the front end of the Department's services continuum, and are for some their first contact with the mental health system. These services are

flexible in approach, and focus on the amelioration of behavior and social problems within the school setting. This study is predicated upon the notion that children referred to early intervention programs display behavior that distinguishes them from the normative population, but do not yet meet clinical thresholds for treatment services.

This study investigated whether the CAFAS subscale profiles of children referred for school-based, early intervention services differed when the children were grouped according to their primary referral reason. Furthermore, the study determined whether the reason for referral was associated with the overall level of functioning, and if the subscale pattern of the combined group revealed a distinctive profile. Finally, the study assessed how well the CAFAS was able to discriminate between the referral groups for this particular community sample.

Method

This study included 677 children in kindergarten through fourth grade who attended 54 elementary schools throughout Delaware. The sample was predominantly African American (53%) and Caucasian (40%), with smaller numbers of children who were Hispanic American (6%) and of other groups or mixed background (1%). Seventy-three percent participants were male, , and ranged in age from 5 to 11 years (M = 7.5 years, SD = 1.32). Single parent households headed by mothers was the most common type of family structure noted, accounting for more than half of the sample; slightly less than one-quarter had both parents present in the home.

Teachers selected the primary reason for referring the child for early intervention services from a standardized list on the services referral form defined by problems associated with: (1) daily social interactions with peers and adults (interaction problems); (2) mood and anxiety (emotional difficulties); (3) acting out behaviors that disrupt the learning process (disruptive behaviors); and (4) learning impediments making academic progress difficult (learning barriers). One hundred sixty six children (24.5%) were referred for interaction problems, 133 (19.6%) for emotional difficulties, 214 (31.6%) for disruptive behavior, and 164 (24.2%) for learning barriers.

Children were evaluated using the CAFAS within 30 days of securing parental permission by school-based social workers trained in the completion of the assessment. Students in the sample were not known to be receiving any concurrent mental health treatment services while referred for school-based early intervention services.

Analysis

Two sets of multivariate analyses were employed. A profile analysis was conducted on the seven subscales of the CAFAS to assess the degree to which profiles of children differed by referral reason. The Substance Use subscale was not included in the analysis because all subjects scored 0, *no impairment*. Using Wilk's criterion, the profiles deviated significantly from parallelism, $F(21, 1915.8) = 6.53$, $p < .001$, partial $\eta^2 = .06$. For the levels of impairment test, there were no reliable differences among the groups when scores were averaged over all subscales, $F(3, 673) = 1.91$, $p = .13$. When averaged over the four referral groups, however, the subscales were found by Hotelling's criterion to deviate significantly from flatness $F(7, 667) = 318.12$, $p < .001$, partial $\eta^2 = .77$. The second set of analyses involved a discriminant function analysis with all variables entered simultaneously to determine the degree to which the CAFAS discriminated between referral groups. Three discriminant functions were calculated, with a combined $\chi^2(21) = 133.14$, $p < .001$. After removal of the first function, there was still a strong association between groups and predictors $\chi^2(12) = 32.71$, $p = .001$. Only the first two discriminant functions were interpreted, since removal of the second function did not result in any reliable association between groups and predictors. The two discriminant functions accounted for 76.5% and 19.2%, respectively, of the between group variability.

Results and Discussion

Findings indicated that children with different subclinical problems in need of early intervention services were: (a) functioning at the same level overall, yet had distinctive profiles on the CAFAS, (b) referral groups differed along two dimensions, with functioning in mood, behavior, and school performance emerging as significant predictors of group membership, and (c) a lack of discrimination was found between children referred for interaction problems and disruptive behaviors.

As expected, children in this study were functioning at the mild to moderate level. Few children presented with a level of dysfunction that would warrant care that is more intensive than outpatient services (marked impairment). Even fewer presented with a level of dysfunction where it is likely the child needed intensive treatment (severe impairment). The highest levels of impairment were evident in school functioning, where 12% of children were found to exhibit severe levels of impairment. Across the other areas of functioning, no more than 6% were found to have severe levels of dysfunction in any one domain and none of the children exhibited functional problems with regard to the use of substances. This finding is of potential importance in that the absence of marked or severe impairment could effect the assessment of children's outcomes over time. That is, children referred for early intervention services may show little or no improvement on measures of functioning since many of them exhibit mild problems initially. Consequently, it may be more important to focus on the maintenance of behavior and social functioning in an effort to avoid deteriorating behavior and increased impairment.

Examination of the profiles of children in the study revealed that when group differences were ignored, 77% of the variance across the CAFAS subscale scores was accounted for by the non-flatness of the pooled profile. Furthermore, contrasts of each referral type's profile to the pooled profile revealed reliable differences on a number of CAFAS subscales with particular referral groups. Higher levels of functional impairment on the Moods/Emotion and Self-Harm subscales characterized children referred for emotional difficulties. These children were also functioning better at school and home than the other three groups. Elevated impairment in emotional functioning and reduced impairment in school performance played a significant role in predicting membership in the emotional difficulties referral group from the other groups.

A high level of functional impairment in behavior toward other children and adults was indicative of children referred for disruptive behaviors and interaction problems. Indeed, a higher level of functional impairment in interactions with other children and adults was significant in predicting referrals for disruptive behaviors and interaction problems, distinguishing children in those groups from children referred for learning barriers. This finding suggests that teachers' reasons for referral differentiated between conduct related problems and other problems associated with success in the learning environment, such as cognitive deficits and attention problems.

Children referred for interaction problems exhibited reliably higher levels of functional impairment at home than did children in the other groups. Thus, children in this group displayed more general disobedience and irresponsible behaviors at home. It may be that for children with interaction problems, functional impairment in their relationships with others was more closely associated with functioning at home than at school. However, unlike children referred for interaction problems, children in the disruptive behaviors group showed a propensity toward functional impairment in school performance. A significant positive relationship between the level of behavioral impairment and school functioning was also found, suggesting that children with problems in their behavioral interactions with others are more likely to have functional problems in school. This finding is consistent with research suggesting that problem behaviors are negatively predictive of concurrent academic achievement in elementary school children (Malecki & Elliot, 2002), and that intellectual functioning is negatively associated with behavioral problems in elementary schools (Cook, Greenberg, & Kusche, 1994).

The results of the classification analysis emphasized the difficulties in assessing the overlap of indicators in externalizing behavioral functioning. The lack of distinction between groups of externalizing

type problems is supported by empirical evidence highlighting the barriers in accurately defining such problems. Research has shown that academic deficiencies, poor interpersonal relationships and hyperactivity are highly correlated behaviors indicative of clinically impaired children (Kazdin, 1995).

The results of the analyses provided useful information regarding the ability of the CAFAS to accurately describe a subclinical sample of children. Differential assessments among the four groups of children were made reliably from a set of CAFAS subscale scores, despite the presence of low overall functioning problems. Thus, while the use of the overall summed score on the CAFAS revealed no clear distinctions between groups of children referred for early intervention services, examination of the profile patterns indicated differences unique to each referral grouping.

The results of these analyses indicate that the use of the CAFAS does have limited utility with subclinical, community-based populations and may require review of subscale and item level scores as a method for understanding service need and outcome. However, some of these children may outgrow the problems identified in this study, making prediction of future impairment more difficult. The best way to know whether these subclinical patterns have some bearing on predicting future serious impairment is to conduct a longitudinal study.

References

Cook, E. T., Greenberg, M. T., & Kusche, C. A. (1994). The relations between emotional understanding, intellectual functioning, and disruptive behavior problems in elementary aged children. *Journal of Abnormal Child Psychology, 22*(2), 205-219.

Hodges, K. (2000). *Child and Adolescent Functional Assessment Scale*. Ypsilanti, MI: Eastern Michigan University.

Kazdin, A. E. (1995). *Conduct disorders in childhood and adolescence, 2nd ed*. Thousand Oaks, CA: Sage.

Malecki, C. K., & Elliot, S. N. (2002). Children's social behaviors as predictors of academic achievement: A longitudinal analysis. *School Psychology Quarterly, 17*(1), 1-23.

The PECFAS Screener Within Head Start: A System for Early Identification

Rick Loseth, Sara Carlson, & Ed Downey

Introduction

The identification and successful treatment of mental health problems in preschool aged children is a continuing challenge. Factors that contribute to this challenge include the lack of age-appropriate assessment measures and diagnostic criteria that account for developmental factors. The lack of suitable instruments along with the limited expertise of staff regarding early childhood mental health problems, and paucity of treatment resources for the young child contribute to the difficulty. These challenges are magnified in rural communities where staff expertise and resources are further lacking.

This study addresses these concerns by examining the effectiveness of the Preschool and Early Childhood Functional Assessment Scale (PECFAS Screener; Hodges, 1995a, 1997). This instrument, is a measure for identifying early mental health concerns. The full PECFAS Interview (Hodges, 1995b), referred to as here as the "full PECFAS," is being utilized to measure the impact of follow up services and programs provided by a local Head Start service provider agency.

Research questions guiding this study asked whether the PECFAS Screener can predict concerns as measured by the full PECFAS, and how effective the PECFAS Screener and the full PECFAS can be, as part of a comprehensive system for early childhood mental health intervention and follow up.

PACT (Putting All Communities Together) 4 Families

PACT (Putting All Communities Together) 4 Families is a children's mental health and family service collaborative that operates in four rural counties in West Central Minnesota. PACT 4 Families is a grant site for three Substance Abuse and Mental Health Services Administration (SAMHSA)-funded projects. PACT 4 has been piloting the PECFAS Screener for the last four years to address the challenges of identification of early childhood mental health concerns. PACT 4 is also utilizing the information attained through the use of this instrument to develop a system for early childhood mental health intervention and referral. This project grew out of high interest, both statewide and nationally, in developing an effective mental health screening tool that can be used with the preschool aged population, and in creating an effective system for early intervention and follow up.

The PECFAS Screener is used as part of preschool screening and within Head Start in four rural counties in west central Minnesota. It has been included as part of a larger system of early intervention for preschool aged children. If the PECFAS Screener identifies concerns, then the full PECFAS Interview is administered and referral is made to appropriate community resources.

Method

PECAS. Studies by researchers such as Murphy and colleagues (Murphy et al., 1999) have previously illustrated the usefulness and validity of the Full PECFAS (PECFAS; Hodges, 1995b) in rating mental health concerns in children. The Full PECFAS consists of seven scales assessing the child (i.e. School/Daycare, Home, Community, Behavior toward Others, Moods/Emotions, Self-harmful Behavior, and Thinking/Communication) and two scales assessing the caregiver (Material Needs and Family/Social Support). The rater endorses the behavioral items that are true for the youth. The items are then grouped into four levels of impairment within each scale, with a numerical score associated with each level (i.e., *Severe* = 30, *Moderate* = 20, *Mild* = 10, *No Impairment* = 0). Scores for each of the seven subscales are summed to generate a total score for the child. A higher score indicates greater impairment.

Piloting the PECAS Screener. In consultation with PACT 4 staff, Hodges developed the PECFAS Screener by selecting representative questions from the PECFAS Interview (referred to as PECFAS Parent Report; Hodges, 1995b), and refining them into a 21-question format. The PECFAS Screener is meant to be less time intensive and typically takes only ten minutes to complete. It uses information provided by the caregiver to identify possible mental health and behavioral concerns in preschool aged children. If concerns are identified through the Screener, a more extensive interview, utilizing the full PECFAS, is done at a later date to better understand the concerns and to determine whether further follow up is needed.

In piloting the PECFAS Screener over the past four years, over 2,000 preschool aged children have been screened through preschool screening and the local Head Start organization. An average of 4 to 5 percent of the population screened have indicated a need for further follow up. Follow up conversations with the parent have utilized the full PECFAS Interview, with scoring results supporting the need for further assessment and referral. Follow up discussion with the parent resulted in approximately half being referred to parenting supports or other related community resources, and the remaining half being referred to resources for further evaluation, testing, or medical treatment.

Validity study procedures. A training protocol for use of PECFAS Screener and follow up use of the full PECFAS was established. Staff involved in this study were trained with this protocol. An inter-rater reliability study of the PECFAS Screener was then completed. Results indicated a 100% inter-rater reliability with a sample of 20 children. A validity study of the PECFAS Screener was then conducted to predict concerns as measured by the full PECFAS. A sample of 50 children were screened through Head Start with the PECFAS Screener; half were identified as needing follow up, and the other 25 children (for whom no concerns were indicated), were selected to be interviewed with the full PECFAS Interview by a neutral rater.

Results

Due to a combination of circumstances (e.g., families moving, inability to successfully contact families, and families choosing not to participate in further interviews), the final sample size was reduced to less than 25 in each group. As shown in Table 1, 8 children who were initially identified as needing follow-up inquiry and 13 who were not identified as needing follow-up inquiry participated in a full PECFAS interview. The total PECFAS scores for each group are shown in Table 1.

Table 1
Total Scores for Full PECFAS Interview

Screening Indicated Need for Follow Up (N=8)		*Screening Indicated No Need for Follow Up (N=13)*	
Score	*No. of Children*	*Score*	*No. of Children*
0	2	0	4
10	1	10	3
20	2	20	3
100	1	30	1
110	1	40	1
150	1	50	1

Full-scale scores from the limited samples in each group show that the PECFAS Screener helped identify concerns that were subsequently reflected in the scores on the full PECFAS Interview. Three children from the sample in which the Screener indicated possible need for follow up scored 100 or higher. One child scored at the severe level of impairment in one scale, and the other two scored at the severe level on two or more scales. Of the children identified by the Screener as likely not needing further assessment, none scored above 50.

Discussion

The results from this small sample support the usefulness of the PECFAS Screener in identifying concerns that reflect higher levels of impairment as measured by the full PECFAS Interview. The trends in this limited sample suggest that there were more false positive then false negative findings. A study with a larger sample and better methodological rigor is clearly needed in order to adequately assess the predictive validity of this 10-minute survey tool for preschool children. Anecdotal reports from the neutral interviewers who conducted the full PECFAS Interview suggested that the extended length of time between the two interviews may have contributed to fewer endorsements by several parents on the second interview.

Feedback from Head Start staff strongly support the utility of a tool such as the PECFAS Screener. They report an increased ability to understand concerns being expressed by the parent and to assist the families in obtaining more focused resources. Staff report an increased level of understanding of early childhood mental health issues and of the need for early intervention. The identification of severe levels of impairment on the School/Daycare, Home and Behavior Towards Others subscales helped the Head Start staff address behavioral concerns both at home and in the Head Start setting.

The PECFAS Screener has been an extremely valuable tool in both the early identification of mental health and behavioral concerns in young children and in the development of resources within a Head Start organization and early childhood staff. It is important to note, however, that this study reports on findings from a very small sample, and that results should be interpreted with this fact in mind. We will continue to refine the PECFAS Screener and to improve the methodological rigor of our evaluative efforts.

References

Hodges, K. (1995a). *The Preschool and Early Childhood Functional Assessment Scale* (Revised edition). Ypsilanti, MI: Eastern Michigan University.

Hodges, K. (1995b). *The Preschool and Early Childhood Functional Assessment Scale (PECFAS): Parent Report.* Unpublished manuscript, Ypsilanti, MI: Eastern Michigan University.

Hodges, K. (1997). *The PECFAS Parent Report Screener.* Unpublished manuscript, Ypsilanti, MI: Eastern Michigan University.

Murphy, J. M., Pagano, M. E., Ramirez, A., Anaya, Y., Nowlin, C., Jellinek, M. S. (!999). Validation of the Preschool and Early Childhood Functional Assessment Scale (PECFAS). *Journal of Child and Family Studies, 8,* 343-356.

Understanding Child and Adolescent Users of Targeted Case Management Services in Maine: An Exploratory Study

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Introduction

The Maine System for Tracking Child and Adolescent Progress (MSTCAP), implemented in 1999, is a statewide project designed to assess functional and strength-based outcomes for children and adolescents receiving Target Case Management services in Maine. Currently, three assessment instruments are used to capture functional outcome information, including: the Child and Adolescent Level of Care Utilization System (CALOCUS), the Child and Adolescent Functional Assessment Scale (CAFAS) and the Family Empowerment Scale (FES).

This current exploratory study investigated the independent contributions of child demographic, diagnostic, behavioral/functional and service use factors in understanding treatment outcomes. The questions guiding this study asked: (1) What are the demographic and diagnostic characteristics of children and adolescents served in Targeted Case Management Services?, (2) Can distinct subgroups of children and adolescents be identified based on demographic, diagnostic, behavioral/functional, and service use characteristics?, and (3) To what extent do functional/behavioral outcomes and service use differ for these identified child and adolescent subgroups over time?

Method

Study Sample Selection Criteria

The sample included 492 children and adolescents who were enrolled in Targeted Case Management Services in either FY 2000 or FY 2001. All study participants were enrolled in Targeted Case Management Services for at least 12 months. Functional assessments were completed at baseline, six months, and 12 months. All study participants were active Medicaid service recipients who recorded some service use during FY 2000, FY 2001 or FY 2002.

Study Data Sources and Measures

Service utilization data were obtained from the automated Maine Medicaid Service Claims Data system. Service encounter, reimbursement, and child descriptive data were captured for: (a) Child descriptive information (age at baseline; child gender and diagnosis); (b) Targeted Case Management (annual units & cost); (c) In-Home Support Services (annual units & cost); (d) Crisis Intervention Services (annual encounters & cost); (e) Residential Treatment Services (annual units & cost); and (f) Inpatient Psychiatric Hospital (annual episodes, LOS & cost).

Two child and adolescent functional assessment tools were used to measure child outcomes at three points in time (i.e., baseline, 6 months, and 12 months). A brief description of each assessment tool follows.

Child and Adolescent Level of Care Utilization System (CALOCUS; Klaehn, O'Malley, Vaugan, & Kroeger, 2003). Developed Jointly by the American Association of Community Psychiatrists and the American Academy of Child and Adolescent Psychiatry, this instrument derives a level of resource intensity appropriate to the needs of the child and family, and includes two primary components: (a) an assessment of the child/adolescent and family along six clinical/functional dimensions (i.e., Risk of Harm, Functional Status, Co-Morbidity or Co-Occurring Conditions, Recovery Environment, Environmental Stress and Support, Resiliency and Treatment History, and Acceptance and Engagement);

and (b) a structured decision making guide that uses the assessment results to determine an appropriate level of resource intensity of level of care that may be needed.

The CALOCUS specifies six levels of behavioral health resource intensity. Using a 5-point scale, each assessment dimension is rated from 1, *least*, to 5, *most severe* or *challenged*. Assessments are completed by the primary clinician or case manager based on knowledge of the child and family. Scores are generated for each dimension listed above and a composite score is obtained by summing the individual dimension ratings. Higher scores reflect a greater degree of behavioral/functional challenge.

Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 2000). The CAFAS is designed to measure the degree of functional impairment in children and adolescents with emotional, behavioral, and/or substance abuse problems. The instrument contains eight subscales or domains, including: School/Work, Home, Community, Behavior Toward Others, Moods/Emotions, Self-Harmful Behaviors, Substance Use, and Thinking. Assessments are completed by the primary clinician or case manager based on knowledge of the child and family. The degree of impairment is determined by item endorsements of behavioral descriptions. These endorsements determine the scores for each subscale/domain, using a 4 point scale (*Severe Impairment* = 30, *Moderate Impairment* = 20, *Mild Impairment* = 10, *Minimal* or *No Impairment* = 0). Scores are obtained for each of the eight domains and a Total youth functioning score is derived by summing the individual domain ratings. Higher scores reflect greater functional challenges.

Analyses

Exploratory cluster analysis was performed using SPSS K-Means Clustering procedure. Clusters were formed using the following input variables: (a) Child age at baseline; (b) Gender; (c) Diagnostic categories (Conduct/oppositional; Attentional/impulse control; Bipolar or psychosis related; Trauma related; Depression related); (d) Service Use /Cost (Annual reimbursements for each of three fiscal years in the following service areas: Targeted case management; Crisis intervention service; In-home support service; Inpatient psychiatric hospitalization; Residential treatment); and (e) Baseline CALOCUS Composite Scores and CAFAS Total Youth Scores.

Results

Descriptive Characteristics

The first study question was "What are the demographic and diagnostic characteristics of children and adolescents served in Targeted Case Management Services?" Table 1 presents information on sex, age, type of diagnosis, and extent of functional challenge as assessed by the CAFAS and the CALOCUS.

Table 1
Demographic and Diagnostic Characteristics for Youth Served by Targeted Case Management (*N*=492)

Child and Adolescent Demographic Characteristics		
Gender (%male)		69%
Age: Average		12.19
(Range)		(4.3 to 18.9)
Primary diagnosis		
Adjustment disorder		2.9%
Anxiety related		4.0%
Conduct/oppositional		19.5%
Trauma related		12.8%
Attentional/impulse		26.2%
Depression related		11.9%
Bipolar illness related		10.5%
Psychotic disorders		2.5%
Other diagnosis		10.1%
Missing diagnosis		9.1%
Child and Adolescent Functional Assessment Scale (CAFAS)		
Average CAFAS Total youth score at baseline		87.42
CAFAS Levels at Baseline:		
0 to 10	No Challenges	0%
20 to 40	Mild Challenges	13.8%
0 to 90	Moderate Challenges	44.3%
100 to 130	Marked Challenges	28.0%
140 & Higher	Severe Challenges	12.8%
Child and Adolescent Level of Care Utilization System		
Average CALOCUS composite score:		19.64
CALOCUS Levels at Baseline:		
10 to 13	Level I	4.5%
14 to 16	Level II	2.7%
17 to 19	Level III	26.3%
20 to 22	Level IV	8.4%
23 to 27	Level V	49.6%
28 & Higher	Level VI	8.4%

The second study question asked, "Can distinct subgroups of children and adolescents be identified based on demographic, diagnostic, behavioral/functional, and service use characteristics?" See Table 2 for a description of the three clusters identified.

Table 2
Cluster Analysis Results

	Cluster I (N=91)	*Cluster II (N=229)*	*Cluster III (N=157)*
Cluster Description	Moderately challenging combination of behaviors. Moderate to high service users.	Less challenged externalizing and internalizing behavior. Lowest service users.	Most challenging combination of externalizing and internalizing behaviors. Highest trauma history. Highest service users.
Age at Baseline	*M*=11.27 Range: 4.26 to 17.61	*M*=12.01: Range=5.10 to 18.89	*M*=12.99; Range: 5.56 to 18.01
Gender (Percent Male)	71%	67%	71%
Diagnostic Profile	Attentional/Impulse Control; Conduct/Oppositional	Attentional/Impulse Control; Depression Related	Conduct/Oppositional Trauma Related Bipolar and Psychotic
Behavioral/Functional Status:			
CAFAS (% Marked or Severe Functional Challenge)	66%	27%	53%
CALOCUS (% Level 5 and Level 6)	70%	48%	66%
Functional/Behavioral Profile	Higher Functional Challenge Higher Co-existing Conditions Higher Mood & Emotions Higher Behavior Toward Others	Lower Functional Challenge on all Domains.	Higher Functional Challenge Higher Environmental Stress and Lower Support. Poorer Resiliency & Tx History.
Service Use Profile	High Hospitalization Highest In-home Support Moderate Crisis Use No Residential Treatment	Moderate In-home Support Low Crisis Use No Hospitalization No Residential Treatment	High Crisis Use High Residential Treatment High Hospitalization Lowest In-home Support
Service Costs	Mod - High	Low	Highest

Outcome and Service Use by Cluster

Finally, we asked, "To what extent do functional/behavioral outcomes and service use differ for these identified child/adolescent subgroups over time?" The children/adolescent represented by the clusters shown in Table 2 differed substantially over time in their use of service system resources and in their response to treatment and supports. Children and adolescents in Clusters I and II exhibited significant improvement in function over the 12 month study period as reflected by decreases in both CALOCUS and CAFAS scores. The findings indicate that children in cluster III showed no significant functional improvement. Cluster I children exhibited the highest hospitalization rates and showed the greatest reduction in hospitalization over time. The number of hospitalizations did not change for Cluster III children.

Discussion

This study identified a potentially important subpopulation (Cluster III) of child and adolescent users of Targeted Case Management for whom treatment has not been effective. Compared to the rest of the sample, these youths have more complex clinical profiles, are more likely to have experienced trauma, are heavy users of high cost system services and resources, and show minimal behavioral/functional improvements over time.

Targeted Case Management Services in combination with intensive In-Home Behavioral Support services appears to be most effective with younger children with moderate to severe behavioral challenges and generally less complex clinical profiles.. Findings also call attention to the need for child and adolescent systems of care to adequately identify, assess, and provide effective treatment to child and adolescent trauma survivors.

These results suggest several interesting areas for further study, including: (a) More focused studies of the effect of untreated trauma on treatment effectiveness and outcomes for children and adolescents with behavioral and emotional challenges, (b) Comparative studies examining the service use and cost implications of untreated trauma in children and adolescent users of system of care services, and (c) Further study of the child, family, and service system factors associated with poor treatment outcomes along with the development of predictive models and practical criteria useful in the early identification of these high-risk users of system of care services.

References

Hodges, K. (2000). *The Child and Adolescent Functional Assessment Scale*. Ypsilanti, MI: Eastern Michigan University.

Klaehn, R., O'Malley, K., Vaugan, T., & Kroeger, K. (2003). *CALOCUS User's Manual*. Washington, DC: American Academy of Child and Adolescent Psychiatry, American Association of Community Psychiatrists.

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Evaluating a Continuum of Care with the Ohio Scales

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Introduction

The evolving system of care for children and adolescents with severe emotional disturbances (SED) attaches greater emphasis on placing children in a setting with the least restrictive level of care. One of the framing values for building a system of care includes the following principle: "Children with emotional disturbances should receive services within the least restrictive, most normative environment that is clinically appropriate" (Stroul & Friedman, 1986, p. 20). Therefore, the current emphasis is placed on providing services that are less restrictive, and more likely to keep a child in his or her home environment (Fields & Ogles, 2002).

Based on least restrictive alternative principles, there should be correspondence between the restrictiveness of a particular treatment program and the severity of the emotional or behavioral disorder that a child displays. If such a relationship did not exist, then it would be more difficult for clinicians to justify the usage of more restrictive types of treatment (e.g., residential treatment, inpatient care) for children. Indeed, researchers in the past have found evidence that this relationship may not be solid, and that youth with less severe problems are sometimes served in environments that may be overly restrictive (Friedman & Street, 1985; Gottlieb, Reid, Fortune, & Walters, 1990).

Few investigators have evaluated the relationship between program restrictiveness and youth functioning. Table 1 provides a summary of all empirical studies that have been conducted to date on this topic. As can be seen by the paucity of research, more work needs to be done. Furthermore, the results have been equivocal in all but the most recent studies on restrictiveness and youth functioning. In fact, only two of the nine studies revealed a hierarchical relationship among youth groups on various levels of the continuum of care. The present study was designed to evaluate the continuum of care and determine whether there indeed is a relationship between restrictiveness of care and youth functioning.

Table1
Relationships Found in Restrictiveness of Program and Youth Functioning Studies

Author, Year	*Difference*	*Hierarchical*	*Functioning Measures*	*Setting*
1. Peterson et al. 1983	No	No	Categorical measure	Educational
2. Bullock et al. 1985	No	No	Behavioral Dimensions Rating	Educational
3. Hundert et al. 1988	No	No	Child and Adolescent Adjustment Profile (CAAP); Bristol Social Adjustment Guide (BSAG); The Family Assess Measure (FAM); Piers-Harris Children's Concept Scale	Mixed: Educational and Treatment
4. Dore et al. 1992	Yes	No	Child Global Assessment (CGAS)	Treatment
5. Friman et al. 1993a	No	No	Eyberg Child Behavior Inventory Child Behavior Checklist (CBCL)	Mixed Treatment and Non-clinic
6. Friman et al. 1993b	Yes	Yes	Child Behavior Checklist (CBCL)	Treatment
7. Zimet et al. 1994	Yes	No	Louisville Behavior Checklist	Treatment
8. Bickman et al. 1996	Yes	No	Child Assessment Schedule (CAS) Burden of Care Questionnaire	Treatment
9. Handwerk et al. 1998	Yes	Yes	Child Behavior Checklist (CBCL)	Treatment

Method

Participants

The parents of 141 youth aged 12 to 17 years receiving mental health services in four programs of varying restrictiveness were solicited for voluntary participation in the study. The four program types, in ascending order of restrictiveness were: 1) outpatient therapy, 2) therapeutic foster care, 3) partial hospitalization, and 4) residential group home.

Measures

Ohio Scales. The Ohio Scales (Ogles, Melendez, Davis, & Lunnen, 1998) is a practical, brief, easy to administer, psychometrically sound instrument that can be given at regular intervals throughout the treatment of children and adolescents. One advantage of the Ohio Scales is that it has parallel rating forms for youth (12-17 years), primary caregivers, and agency workers.

Restrictiveness of Living Environments Scale. The ROLES (Hawkins, Almeida, Fabry, & Reitz, 1992) is a clinical measure of the restrictiveness of residential settings for adolescents and children, where higher scores represent more restrictive settings. The scale ranges from 0 (independent living by self) to 10 (jail), with each increasing score of .5 representing one step toward greater restrictiveness of living environments.

Procedure

Those parents who agreed to have their child included in the study participated in a brief assessment. Identifying data on the Ohio Scales was gathered to begin the assessment, followed by administration of the Restrictiveness of Living Environments Scale (ROLES) based on the residence of the adolescent for three months prior to treatment. The agency worker completed the ROLES, and the Ohio Scales were filled out by the youth, agency worker, and primary care provider.

After six to eight weeks of treatment, the Ohio Scales were again completed by the youth, agency worker, and primary care provider. Statistical analyses were performed on data obtained. The sample was divided based on program type, and Ohio Scales scores were compared among the four groups.

Results and Discussion

Previous Placement and Current Functioning

Zero-order correlations provided an illustration of how restrictiveness of living environments for three months prior to assessment related to youth functioning and problem severity at the time of the initial assessment from various rater perspectives. Results did not indicate a relationship among the ROLES scores and the six Ohio Scales scores, although the Ohio Scales scores were generally correlated to one another.

Current Placement and Current Functioning

In order to determine the effects of current treatment program assignment at intake (i.e., functioning and problem severity), a one-way analysis of variance (ANOVA) was performed for each Ohio Scales functioning and problem severity variable for each source (e.g., agency worker, youth, and parent). In addition, only the outpatient, therapeutic foster care, and youth groups contained data from all three sources as the residential care group had only agency worker data.

Each of the six Ohio Scales functioning and problem severity scores were examined and compared among the four treatment groups to determine if they differed significantly (see Table 2). Five of the six analyses attained significance, indicating a link between treatment program and Ohio Scales scores. As can be seen, the analyses for Ohio Scales Agency Worker and Youth ratings were significant for both functioning and problem severity measures ($p < .05$). The Ohio Scales Primary Caregiver rating was significant only for the Problem Severity measure ($p < .01$). In general, youth in the partial

Table 2
Ohio Scales Scores One-Way ANOVA for Intake

	Treatment Group											
	Outpatient			*Ther. Foster Care*			*Partial Hosp.*			*Residential*		
Ohio Scales Measure	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*
1. Agency Problem Severity[b]	25	28.5	14.9	35	20.0	14.9	25	36.8	12.2	44	26.2	11.5
2. Agency Functioning[b]	25	42.6	12.5	34	45.8	9.7	24	31.7	9.9	44	43.8	10.9
3. Parent Problem Severity[a]	25	30.0	18.1	11	16.8	9.6	26	35.8	14.2	0	N/A	N/A
4. Parent Functioning	25	41.2	12.6	11	49.9	10.6	24	39.3	13.2	0	N/A	N/A
5. Youth Problem Severity[a]	23	24.2	18.2	12	12.0	10.4	23	26.6	16.3	0	N/A	N/A
6. Youth Functioning[a]	23	59.4	13.6	11	61.3	11.3	21	49.6	16.8	0	N/A	N/A

[a]Ohio Scales *F* significant, $p < .05$, [b]*F* significant, $p < .001$

hospitalization program were the most impaired, and youth in the therapeutic foster care program were the least impaired. Youth in the outpatient and residential programs were not different in terms of functioning and problem severity.

Current Placement and Changes Over Time in Treatment

In order to determine the effects of treatment program over time on Ohio Scales scores, scores for the four treatment programs were examined together in three separate one-within, one-between multivariate analyses of variance (MANOVA) with treatment program as the between-subjects factor and time of assessment as the within-subjects factor. Since there were three raters, analyses were performed for Ohio Scales agency worker, primary caregiver, and youth ratings with problem severity and youth functioning examined in each of the separate analyses.

The multivariate tests indicated no significant main effects for the within-subjects factor (time) or the interaction for all three tests. There was a significant main effect for the between-subjects factor (treatment program) for the youth ratings, but this difference was already highlighted in the prior section detailing the ANOVA's for current placement and current functioning.

Functioning, Problem Severity, and Three Rater Perspectives

Table 3 displays the group means and standard deviations for each scale by rater as well as denotations for significant findings. Of the three paired samples *t*-tests on treatment informants for problem severity, two were significant, The *t*-test for parents versus youth was significant, $t(55) = -3.30$, $p < .01$ and the *t*-test for agency workers versus youth was also significant, $t(55) = -4.38$, $p < .001$. Thus youth, on average, rated problems as less severe than did parents or agency workers. In regard to youth functioning, all three of the paired samples *t*-tests were significant. The *t*-test for parents versus youth was significant, $t(52) = 5.65$, $p < .001$, the *t*-test for agency workers versus youth was significant, $t(53) = 7.97$, $p < .001$, and the *t*-test for parents versus agency workers was significant, $t(57) = 3.05$, $p < .01$. Youth tended to rate their own functioning highest, while agency workers rated their functioning lowest, and primary caregivers were the intermediary raters.

Table 3
Comparison of Ohio Scales Scores by Raters

	Functioning[a]		*Problem Severity*[a]	
	M	*SD*	*M*	*SD*
Youth	22.7	16.7	55.6	5.3
Parent	29.8	16.2	42.6	13.4
Agency Worker	30.8	14.4	37.8	12.4

[a]Overall *t* significant, $p < .001$

The present study found that there was indeed a relationship between program restrictiveness and youth functioning; however, that relationship was not hierarchical. In fact, youth receiving services on opposite ends of the continuum of care were not significantly different in terms of functioning and problem severity.

Clinical Implications

The present study and the preceding review (see Table 1) indicate that more research needs to specifically investigate the use of the least restrictive setting necessary in the treatment of children and adolescents (Fields & Ogles, 2002). It appears that the link between program restrictiveness and youth functioning is not supported by research, and that other factors are involved in youth program placement. While youth are sometimes placed in more restrictive environments because that is what may be warranted given the severity of their emotional and behavioral problems at that time (Friman, Soper, Thompson, & Daly 1993; Handwerk, Friman, Mott, & Stairs, 1998), at other times, factors such as child strengths (Oswald, Cohen, Best, Jenson, & Lyons, 2001) and the amount of familial stability and the resources available in a community are important in determining where a child is placed for treatment (Wells, 1991).

One clear-cut clinical implication of the present study is that of the importance of using multiple raters for youth behavior. Consistent with prior research, the present study found that parents and youth did not generally agree in terms of the severity of youth problems and functioning. In fact, youth in the present study followed a well-established research pattern of underestimating the magnitude of their behavioral problems in comparison to parent report (Kazdin, Esvelft-Dawson, Unis, & Rrancurello, 1983; Thurber & Osborn, 1993).

References

Bickman, L., Summerfelt, W. T., & Noser, K. (1997). Comparative outcomes of emotionally disturbed children and adolescents in a system of service and usual care. *Psychiatric Services, 48*, 1543-1548.

Bullock, L. M., Zagar, E. L., Donahue, C. A., & Pelton, G. B. (1985). Teacher's perceptions of behaviorally disordered students in a variety of settings. *Exceptional Children, 52*, 123-130.

Dore, M. M., Wilkinson, A. N., & Sonis, W. A. (1992). Exploring the relationship between a continuum of care and intrusiveness of children's mental health services. *Hospital and Community Psychiatry, 43*, 44-48.

Fields, S. A., & Ogles, B. M. (2002). The system of care for children and the least restrictive alternative: Legal origins and current concerns. *Children's Services: Social Policy, Research, and Practice, 5*, 75-93.

Friedman, P. R., & Street, S. (1985). Admission and discharge criteria for children's mental health services: A review of the issues and options. *Journal of Clinical Child Psychology, 14*, 229-235.

Friman, P. C., Evans, J., Larzelere, R., Williams, G., & Daly, D. L. (1993a). Correspondence between child dysfunction and program intrusion: Evidence of a continuum of care across five child mental health programs. *Journal of Community Psychology, 21*, 227-233.

Friman, P. C., Soper, S. H., Thompson, R. W., & Daly, D. L. (1993b). Do children from community-based parent training programs have clinically significant behavior problems? *Journal of Community Psychology, 21*, 56-63.

Gottlieb, S. J., Reid, S., Fortune, A. E., & Walters, D. C. (1990). Child/adolescent psychiatric inpatient admissions—Is the "least restrictive treatment" philosophy a reality? *Residential Treatment for Children and Youth, 7*, 29-39.

Handwerk, M. L., Friman, P. C., Mott, M. A., & Stairs, J. M. (1998). The relationship between program restrictiveness and youth behavior problems. *Journal of Emotional and Behavioral Disorders, 6*, 170-179.

Hawkins, R. P., Almeida, M. C., Fabry, B., & Reitz, A. L. (1992). A scale to measure restrictiveness of living environments for troubled children and youths. *Hospital and Community Psychiatry, 43*, 54-58.

Hundert, J., Cassie, J. R. B., & Johnson, N. (1988). Characteristics of emotionally disturbed children referred to day-treatment, special-class, outpatient, and assessment services. *Journal of Clinical Child Psychology, 17*, 121-130.

Kazdin, A. E., Esvelft-Dawson, K., Unis, A. S., & Rrancurello, M. D. (1983). Child and parent evaluations of depression and aggression in psychiatric inpatient children. *Journal of Abnormal Child Psychology, 11*, 401-413.

Ogles, B. M., Melendez, G., Davis, D. C., & Lunnen, K. M. (1998). *The Ohio Youth Problems, Functioning, and Satisfaction Scales: Technical Manual.* Unpublished document. Athens, OH: Ohio University.

Oswald, D. P., Cohen, R., Best, A. M., Jenson, C. E., & Lyons, J. S. (2001). Child strengths and the level of care for children with emotional and behavioral disorders. *Journal of Emotional and Behavioral Disorders, 9*, 192-199.

Peterson, R. L., Zabel, R. H., Smith, C. R., & White, M. A. (1983). Cascade of services model and emotionally disabled students. *Exceptional Children, 49*, 404-408.

Stroul, B. A., & Friedman, R. M. (1986). *A system of care for children and youth with severe emotional disturbances*. (Revised Edition). Washington, DC: Georgetown University Child Development Center, CASSP Technical Assistance Center.

Thurber, S., & Osborn, R. A. (1993). Comparisons of parent and adolescent perspectives on deviance. *The Journal of Genetic Psychology, 154*, 25-32.

Wells, K. (1991). Placement of emotionally disturbed children in residential treatment: A review of placement criteria. *American Journal of Orthopsychiatry, 61*, 339-347.

Zimet, S. G., Farley, G. K., & Zimet, G. D. (1994). Home behaviors of children in three treatment settings: An outpatient clinic, a day hospital, and an inpatient hospital. *Journal of the American Academy of Child and Adolescent Psychiatry, 33*, 56-59.

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Psychometric Properties of the Behavioral and Emotional Rating Scale-Second Edition: Parent and Youth Forms

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Introduction

Strength-based assessment has been defined as the measurement of emotional and behavioral skills and characteristics that "create a sense of personal accomplishment; contribute to satisfying relationships with family members, peers, and adults; enhance one's ability to deal with adversity and stress; and promote one's personal, social, and academic development" (Epstein & Sharma, 1998, p. 3). Strength-based assessment allows for the collection of a broad range of important information related to an individual's capabilities and weaknesses (Epstein, Harniss et al., 2002; McConaughy & Ritter, 2002). This holistic approach to evaluation has contributed to the wide acceptance that strength-based assessment has gained among practitioners in child welfare, family services, mental health, and education (e.g., Dunst, Trivette, & Deal, 1994; Lourie, Katz-Leavy, & Stroul, 1996; Nelson & Pearson, 1991). This focus on strengths and competencies is in direct contrast to the more familiar and traditional deficit-oriented assessment models (Epstein, 1999).

Strength-based assessment has been taking place informally for years (Van Den Berg & Grealish, 1998). While these informal assessments often have succeeded in identifying vital information, they are generally carried out without consistency and stability. To address concerns with the fidelity and technical adequacy of these informal strength-based assessments, standardized, norm-referenced instruments have been developed in recent years. The Behavioral and Emotional Rating Scale-Second Edition (BERS-2) is a standardized, norm-referenced set of strength-based assessment instruments. The BERS-2 includes three scales: Teacher Form (the original 52-item Behavioral and Emotional Rating Scale*;* Epstein & Sharma, 1998), Parent Form, and Youth Form. This summary reports on a series of studies investigating the validity and reliability of the BERS-2 Parent and Youth Forms.

Method

Participants included a total of 218 parents of elementary or middle school students and 133 middle school students. For the BERS-2 Parent Form, 140 parents were involved in the assessment of convergent validity, with 85 parents completing both the BERS-2 Parent Form and the Social Skills Rating System (SSRS Parent; Gresham & Elliott, 1990) and 55 others completing both the BERS-2 and the Child Behavior Checklist (CBCL; Achenbach, 1991a). Seventy-eight parents were involved in the assessment of test-retest reliability. The gender breakdown was 54% male. Nearly all of the participants were European-American.

For the BERS-2 Youth Form, 91 middle school students were involved in the assessment of convergent validity, with 49 completing both the BERS-2 and the SSRS Secondary Level Student Form (SSRS Youth; Gresham & Elliott, 1990) and 42 others completing the BERS-2 and the Youth Self-Report (YSR; Achenbach, 1991b). Forty-two students were involved in the assessment of test-retest reliability. Overall, the gender breakdown was 54% male. Students ranged in age from 11 years, 2 months to 14 years, 10 months. All of the participants were European-American. Eleven percent of the sample indicated they were verified with a disability.

Instruments included the BERS-2, SSRS, CBCL, and YSR. The BERS-2 is a psychometrically sound, norm-referenced, standardized set of instruments designed to aid in the process of strength-based assessment. The BERS-2 Parent and Youth Forms consist of 58 Likert-type items and provide an overall

strength index and six factor-analytically derived subscales that assess important areas of functioning. The subscales include: (a) Interpersonal Strength (e.g., reacts to disappointment in a calm manner), which measures ability to control emotions and behaviors in social situations; (b) Family Involvement (e.g., participates in family activities), which measures participation and relations with the family; (c) Intrapersonal Strength (e.g., demonstrates a sense of humor), which assesses the child's perception of competence and accomplishment; (d) School Functioning (e.g., pays attention in class), which addresses competence in school and classroom tasks; (e) Affective Strength (e.g., acknowledges painful feelings), which focuses on the ability to give and receive affect; and (f) Vocational Strength (e.g., I have a plan for my future career), which assesses career and vocational strengths.

Each item is rated on a scale of 0 to 3 (0 = *not at all like the child*; 1 = *not much like the child*; 2 = *like the child*; 3 = *very much like the child*). Scores are calculated for each strength dimension and are then combined to provide an overall strength index. Higher scores reflect greater perceived emotional and behavioral strengths. The Parent and Youth Forms were standardized on a nationally representative sample of 1,015 parents and 896 youth without disabilities nationwide (Epstein, 2003). Factor analyses of this data identified six factors, i.e., the original five factors of the BERS and the career/vocational factor, for both forms. Additionally, the strength index and all six subscales on each form have demonstrated acceptable levels of internal consistency (Epstein, 2003; Epstein, Ryser, & Pearson, 2002).

The SSRS is a series of instruments designed to screen and classify students suspected of having social behavior problems as well as assist in the development of appropriate interventions. SSRS Secondary offers a Social Skills standard score and four subscale raw scores, while SSRS Parent offers two standard scores (i.e., Social Skills and Problem Behaviors) and seven subscale raw scores (i.e., 4 social skills and 3 problem behaviors). SSRS items are phrased positively, meaning the higher the score, the more competent the individual.

The CBCL is an instrument designed so that a parent or caregiver can judge a child's problems and competencies in a standardized format. The YSR is an instrument designed to obtain a report of a youth's problems and competencies in a standardized format. In the present study, only data from the problem item scales were are reported.

Procedures included consent and administration activities. For consent, parents received mailings detailing the purpose of the study and consent procedures, along with a consent document they could sign and return if they were interested in having their children participate . If consent was given for children to participate, then the process was explained to the children and assent obtained. For administration, graduate students collected data for each study on two occasions during the 2001-2002 school year. Parent administration involved the individual mailing of test instruments, while youth were involved in group administrations at the school.

Analysis involved the calculation of Pearson product-moment correlations. For convergent validity calculations, adjustments were made for restricted range and attenuation.

Results and Discussion

For the BERS-2 Parent Form, 90% of all convergent validity correlations (i.e., 82 of 91) were statistically significant at the 0.05 alpha level. Moreover, 48% of the correlations (i.e., 44 of 91) were large in magnitude (Hopkins, 2002). All test-retest reliability correlations were at or above .80 and more than one-third (i.e., 9 of 21) were at or above .90.

For the BERS-2 Youth Form, 84% of all convergent validity correlations (i.e., 91 of 108) were statistically significant. Moreover, 32% of the correlations (i.e., 35 of 108) were large in magnitude (Hopkins, 2002). All test-retest reliability correlations were at or above .80, with the overall strength index and one subscale above .90.

Overall, validity and reliability findings strengthen researchers' and practitioners' confidence in using the BERS-2 Parent and Youth Forms as measures of emotional and behavioral strengths for children and adolescents in comprehensive (i.e., multimodal) evaluation processes.

Implications

There are two important implications to the current findings. First, the documented psychometric soundness of the BERS-2 Parent and Youth Forms add to the options available to practitioners and researchers involved in the assessment of children and youth. Assessing an individual's emotional and behavioral strengths is an important part of a holistic evaluation. Unfortunately, the most common assessment procedures, particularly in the area of youth with emotional and behavioral disorders, tend to focus on the measurement of deficits, problems, and pathologies, and lead to data geared toward fixing, changing, or remedying a situation (Epstein, Harniss, Pearson, & Ryser, 1999). Strength-based assessment, on the other hand, offers the practitioner the opportunity to focus decisions more positively on ways that support and maximize children's strengths. With the BERS-2 Parent and Youth Forms demonstrating adequate psychometric properties, professionals now have the means to formally examine strength-based data from parents and youth. Moreover, professionals can now compare perceived strengths across informants (i.e., parents, teachers, and youth). Standardized, cross-informant assessment that is strength based adds to the assessment options available to researchers and practitioners.

Second, there are research-related implications. The present study involved a small and largely European-American sample from the midwestern United States. Future studies should be conducted using larger and more culturally diverse samples of youth and parents of children with and without disabilities who are selected from all regions of the country. Furthermore, the present results focused on convergent validity and test-retest reliability. Future researchers will do well to conduct other types of validity and reliability studies, including studies of inter-rater reliability (i.e., both parents), longer-term (i.e., six month) test-retest reliability, and discriminant validity (i.e., emotional and behavioral disabilities vs. learning disabilities vs. no disability). Finally, considering that the Vocational Strength subscale was a new addition to the BERS-2 Parent and Youth Forms, additional validation is needed.

References

Achenbach, T. M. (1991a*). Integrative Guide for the 1991 CBCL/4-18, YRS, & TRF Profiles.* Burlington: University of Vermont, Department of Psychiatry.

Achenbach, T. M. (1991b). *Manual for the Youth Self-Report and 1991 Profile*. Burlington: University of Vermont, Department of Psychiatry.

Dunst, C. J., Trivette, C. M., & Deal, A G. (Eds.) (1994). *Supporting and strengthening families: Methods, strategies, and practice* (Vol. 1). Cambridge, MA: Brookline Books.

Epstein, M. H. (1999). The development and validation of a scale to assess the emotional and behavioral strengths of children and adolescents. *Remedial and Special Education, 20,* 258-262.

Epstein, M. H. (2003). *Behavioral and Emotional Rating Scale-Second Edition*. Austin, TX: PRO-ED.

Epstein, M. H., Harniss, M. K., Pearson, N. & Ryser, G. (1999). The *Behavioral and Emotional Rating Scale*: Test-retest and inter-rater reliability. *Journal of Child and Family Studies, 8,* 319-327.

Epstein, M. H., Harniss, M. K., Robbins, V., Wheeler, L., Cyrulik, S., Kriz, M., & Nelson, J. R. (2002). In M. Weist, S. Evans, & N. Tashman (Eds.), *School mental health handbook* (pp. 285-299). New York: Kluwer Academic/Plenum Publishers.

Epstein, M. H., Ryser, G., & Pearson, N. (2002). Standardization of the *Behavioral and Emotional Rating Scale*: Factor structure, reliability and criterion validity. *Journal of Behavioral Health Services and Research*, *29*, 208-216.

Epstein, M. H., & Sharma, H. M. (1998). *Behavioral and Emotional Rating Scale: A strength based approach to assessment.* Austin, TX: PRO-ED.

Gresham, F. M., & Elliott, S. N. (1990). *Social Skills Rating System manual*. Circle Pines, MN: American Guidance Service.

Hopkins, W. G. (2002, June 23). A scale of magnitudes for the effect statistics. In *A new view of statistics*. Retrieved from: http://www.sportsci.org/resource/stats/effectmag.html.

Lourie, I. S., Katz-Leavy, J., & Stroul, B. A. (1996). Individualized services in a system of care. In B. A. Stroul (Ed.), *Children's mental health: Creating systems of care in a changing society*. Baltimore: Brooks.

McConaughy, S. H., & Ritter, D. R. (2002). Best practices in multidimensional assessment of emotional or behavioral disorders. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology IV* (Vol. 2) (pp. 1303-1320). Bethesda, MD: The National Association of School Psychologists.

Nelson, C. M., & Pearson, C. A. (1991). *Integrating services for children and youth with emotional and behavioral disorders*. Reston, VA: Council for Exceptional Children.

Van Den Berg, J. E., & Grealish, E. M. (1998). *The wrap-around process: Training manual.* Pittsburgh: Community Partnership Group.

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Show, Don't Tell: Animated Graphics Show Longitudinal Models in Action

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Introduction

Measuring change over time is a core feature of research and evaluation in children's mental health. However, because tables of longitudinal results do not speak for themselves to consumers of data, we turn to graphics to show, rather than tell. Microsoft Windows offers new ways to show dynamic processes, so they can be seen rather than just imagined. This summary presents two ways of making animated graphics that can be accomplished without special computers, software, or steep learning curves, using either SAS Graph or Microsoft Excel. These two approaches are accessible by intermediate SAS or Excel programmers.

Animated Graphics are Now Practical

SAS Graph can make animated GIFs. SAS Graph is a computer graphics system for producing color or monochrome plots, charts, maps, and other displays on screens, printers and plotters (SAS, n.d.). No special software or expertise is needed beyond intermediate SAS skills and experience with SAS Graph. When these animated charts are opened with PowerPoint, Internet Explorer, Netscape, or various photo viewers, charts come alive with motion. For example, to see whether a longitudinal model makes sense, we can watch observed and model scores for each participant, making it possible to judge how well the model captures the data. Seeing individual growth curves is much more transparent than fit indices, such as -2 Log Likelihood = 20027.9

Excel charts can be animated with simple macros to show a whole range of outcomes (e.g., for clients ranging from symptom-free to seriously disturbed). As the slope of the animated timeline repeatedly changes, the relationship between severity and improvement appears with a concreteness and obviousness that words or tables cannot convey.

In the sections below, we will see how animated graphics can assist with problem solving: (1) Does the model fit the data? An animated SAS GIF can show the observed and model scores for each participant; (2) How does severity affect mental health outcomes in a large behavioral health organization? A macro in Excel types in a range of values into the spreadsheet model, making it possible to see how severity influences outcome.

How To Do It: Nuts and Bolts

Animation In SAS

Table 1 shows beta weights that estimate a longitudinal model. The parameters tell a story, but it's one that most people can't read. Other outputs from longitudinal analysis, such as fit indices, don't reveal which model is right, or which one is "more wrong." A model could be badly mis-specified, but fit indices may not show it. Often, however, the appropriateness of a longitudinal model becomes obvious when individual growth curves (model scores) are compared with each individual's observed scores. An easy way to view individual growth curves is to use SAS Graph to make a single animated GIF that contains all individuals in a stack. While SAS Graph can be frustrating, once a chart is programmed, it can be used over and over again. Adding animation layers to existing SAS graphs is not difficult.

Table 1
Estimated Longitudinal Parameters Requiring Much Explanation

Effect	ß	ß *Std Error*	*DF*	*t-test*	*Prob*
Intercept	0.08	0.19	103	0.45	0.65
Group	0.04	0.23	347	0.19	0.85
Time	-0.07	0.03	90	-2.78	0.01
Group*time	0.07	0.03	347	2.13	0.03

If you are already hardened to SAS GRAPH, making animated GIFs is very easy. You just ask for an animated GIF in GOPTIONS, as shown in Table 2, and you use a "BY" group in the plot. For individual growth curves the BY group would be each individual participant. The code in Table 2 makes a separate plot for each person, and them stacks them into a single animated GIF. The animated GIF "plays" itself automatically in PowerPoint and most picture viewers, including MS Internet Explorer 6.

Table 2
SAS Code for Animated GIF Graphic Output

```
filename webout 'D:\Data\SAStoGIFjobs\Animated.GIF' ;

goptions device  = gifanim   /* animated GIF file output          */
         gsfname   = webout      /* Logical SAS name for the ouptput */
         gsfmode   = replace     /* Write over old charts            */
         iteration = 0           /* Keep going, don't stop           */
         delay     = 010         /* Pause in milliseconds            */
         xpixels   = 1600        /* X asis size in pixels            */
         ypixels   = 1200        /* Y asis size in pixels            */
         ftext=SWISSb            /* Font for chart                   */
         display;                /* Display graph on chosen device   */

proc gplot;
     plot1 Predictd * Time = 1/overlay haxis = axis9 vaxis = axis1 ;
     plot2 Observed * Time = 2/overlay haxis = axis9 vaxis = axis1 ;
    by subject ;
     title1 "Individual Intercept, Classic Random Intercepts HLM";
     run ;

For a complete coded example, please e-mail the authors.
```

Figure 1 is an animated SAS graph; it shows the model scores and observed scores for one individual mouse who is observed 34 times during three hours. Slope as outcome model shows an increase in activity over time. On four occasions, no activity is recorded when an injection is given. This effect appears as a transient downward spike in the model scores.

Originally an animated GIF, it was easy to import into PowerPoint (e.g., insert, picture, from file). In the slideshow, you can see the animation run through 18 individual subjects giving the model scores (black line) and the observed scores (blue stars). If you watch the observed and model scores for a while, it you can see which statistical model does the best job of fitting the scores[1].

Modern model-based analysis has made so many models possible that it often isn't obvious how to choose the best one. Examining an animated plot of individual observed and model scores offers help for this problem. For example,

Figure 1
Comparing Observed Scores and Model Scores* for One Subject

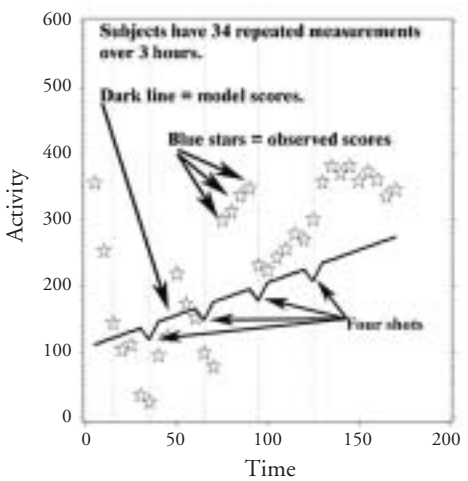
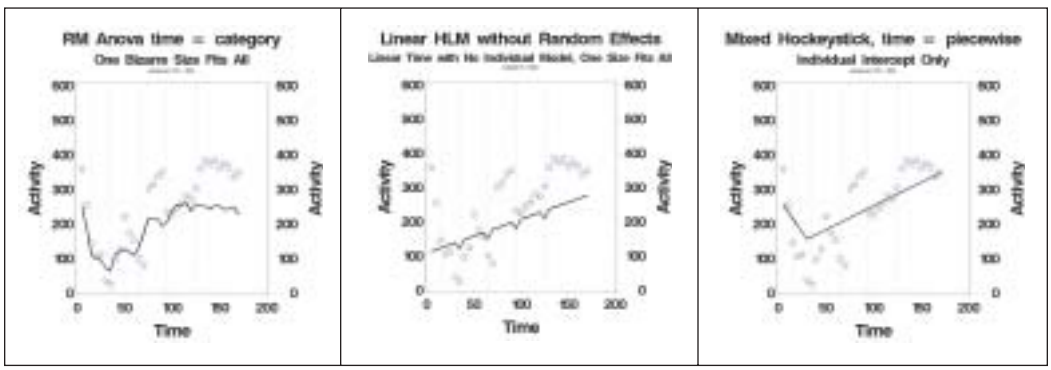


*Figure shows the model scores and observed scores for one individual mouse who is observed 34 times during 3 hours. Slope as outcome model shows that an increase in activity over time. On 4 occasions, no activity is recorded when an injection is given. This effect appears as a transient downward spike in the model scores.

[1] *The PowerPoint animations are available for review from the first author.*

Figure 2 again shows the experiment with 34 repeated measurements, but this time a PowerPoint slide compares three separate statistical models: repeated measures analysis of variance, a slope-as-outcome linear model, and a piecewise linear model with random effects. As you watch the three models try to fit individual scores, it soon becomes obvious that only the random effects model tries to fits each individual as well as possible. Models without random effects just sit, one size fits all, making no attempt to describe each unique individual.

Figure 2
See Which Model Fits Best*



*As observed scores and model scores flash by on the screen for different models, as shown in this figure, it soon becomes obvious which models show the best fit to observation.

Animation In Microsoft Excel

Jeb Brown uses Excel to animate spreadsheet models of outcome of mental health treatment. He enters his statistical model in the usual way, and then adds a macro that takes on different values.

Table 3
Animation in Microsoft Excel:
Change a Cell over a Range of Possible Values

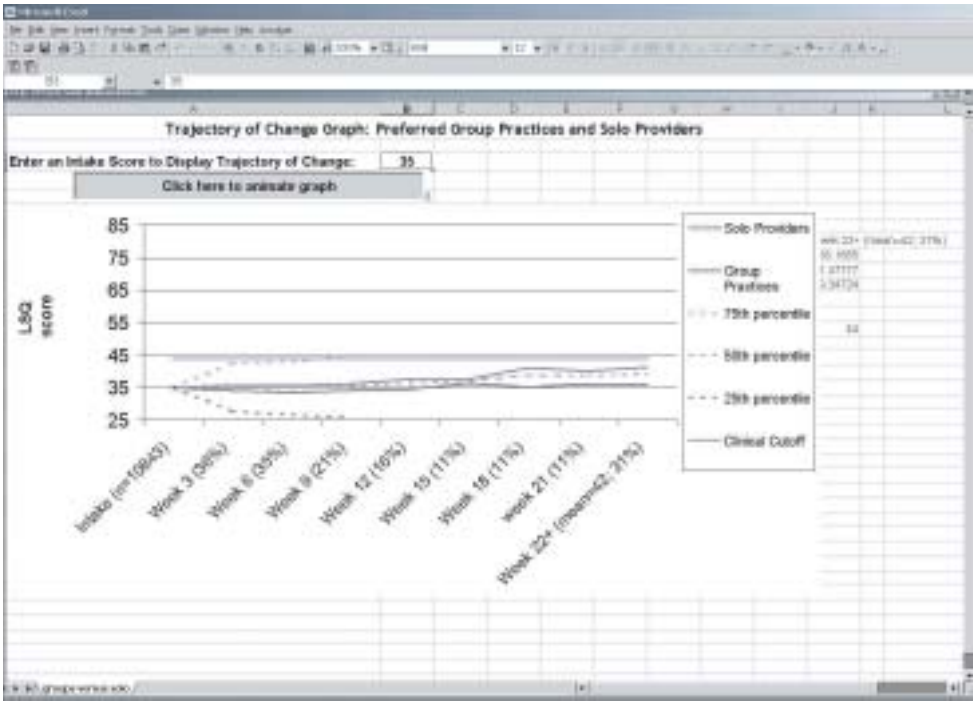
```
Sub intake()
'
' intake Macro
' Macro recorded 5/25/2002 by Jeb Brown
'
' Keyboard Shortcut: Ctrl+i
'
   Range("B3").Select
    ActiveCell.FormulaR1C1 = "25"
    Range("B3").Select
    ActiveCell.FormulaR1C1 = "25"
    Range("B3").Select
    ActiveCell.FormulaR1C1 = "26"
    Range("B3").Select

[missing lines continue the progression to
the maximum and then back down]

    ActiveCell.FormulaR1C1 = "26"
    Range("B3").Select
    ActiveCell.FormulaR1C1 = "25"
    Range("B3").Select
    ActiveCell.FormulaR1C1 = "25"

End Sub
```

Figure 3
Screen Shot of Animated Excel Chart of Therapy Outcomes



By clicking on the gray box, people reading the web site can see what happens as client intake severity varies over the entire range. The interaction between severity and early and late improvement can be seen in action, rather than imagined from a table of parameters[2].

Conclusion

Animated graphics offer a new way to understand longitudinal data. Animated GIFs from SAS or macro animations in Microsoft Excel have made active longitudinal displays practical for ordinary data analysis with everyday desktop PCs.

References

SAS (n.d.). Retrieved from: http://www.sas.com/technologies/bi/query_reporting/graph/

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[2]To see more, go to Jeb's web site at www.clinical-informatics.com. The animated spreadsheet above appears at this address: http://www.clinical-informatics.com/papers_and_presentations_for_200.htm (click on: group versus solo providers comparison).