Family Intervention Effects on Co-occurring Behavior and Emotional Problems in Early Childhood: A Latent Transition Analysis Approach

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ABSTRACT

This study used latent transition analysis (LTA) to examine changes in early emotional and behavioral problems in children age 2 to 4 years relative to participation in a family-centered intervention. A sample of 731 economically disadvantaged families were recruited from among participants in a national food supplement and nutrition program. Families with toddlers between age 2 and 3 were randomized either to the Family Check-Up (FCU) or to a nonintervention control group. The FCU’s linked interventions were tailored and adapted to each family’s needs. Assessment occurred at age 2, 3, and 4. The FCU followed age 2 and age 3 assessments. On the basis of mothers’ reports relevant to the Child Behavior Checklist, latent class analyses were used to study children’s transitions across the following four groups from age 2 to age 4: (a) externalizing only, (b) internalizing only, (c) comorbid internalizing and externalizing, and (d) normative. LTA results revealed that participation in the FCU decreased the likelihood of transitions into the comorbid and internalizing-only class at age 4, relative to the normative no-elevation class. These results are discussed with respect to changes in

Emotional and behavioral difficulties are common concerns that parents have about their young children. A large body of research has indicated that emotional difficulties, including anxiety and depression, and behavioral problems, including aggression and oppositionality, tend to be relatively stable across childhood (Briggs-Gowan, Carter, Bosson-Heenan, Guyer, & Horwitz, 2006). For instance, studies have consistently documented the developmental continuity of conduct problems from early childhood to antisocial behavior in middle childhood and adolescence (Brook, Whiteman, & Finch, 1992; Brook, Whiteman, Gordon, & Cohen, 1986; Campbell, Shaw, & Gilliom, 2000; Caspi, Moffitt, Newman, & Silva, 1998; Hawkins, Lishner, Catalano, & Howard, 1986; Lyons-Ruth, Zeneah, & Benoit, 1996; Shaw, Gilliom, Ingolsby, & Nagin, 2003; Vicary & Lerner, 1983). Similarly, modest continuity has been found for internalizing symptoms, in that youth exhibiting problems with anxiety and depression in early childhood are likely to continue to exhibit those problems into middle childhood and adolescence (Briggs-Gowan et al., 2006; Briggs-Gowan, Carter, Irwin, Wachtel, & Cicchetti, 2004; Warren, Huston, Egeland, & Sroufe, 1997).

Early emotional and behavioral difficulties may also predict the emergence of problems in other important domains of functioning, including academic and social difficulties, into adolescence. For instance, longitudinal studies with children as young as age 3 years (e.g., Caspi et al., 1998; Shaw & Gross, in press) have revealed associations between early behavior problems and long-term profiles of risk, including substance dependence in adolescence and young adulthood. Research has documented similar long-term outcomes associated with internalizing problems, including impairments in social, academic, and professional functioning (e.g., Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2003).

Emotional and behavioral difficulties tend to co-occur in childhood at a higher rate than would be expected by chance (Angold, Costello, & Erkanli, 1999; Lewinsohn, Rohde, & Seeley, 1995). Children who exhibit co-occurring emotional and behavioral difficulties tend to show more severe impairment
than do those with emotional or behavioral problems alone (Nottelmann & Jensen, 1999). Further, evidence suggests that children with co-occurring emotional and behavioral disturbances are the most at risk for several serious adjustment problems in adolescence, including high-risk sexual behavior (Dishion, 2000), drug abuse (Rhode, Lewinsohn, & Seeley, 1995), academic failure, suicide, and other serious outcomes (Asarnow & Carlson, 1988; Capaldi, 1992; Patterson & Stoolmiller, 1991; Rhode et al., 1995). Not surprisingly, youth comorbid mood and behavioral problems are also the most costly to society in terms of use of mental health and juvenile justice resources (Miller, 2004).

**Early Intervention**

In light of the prevalence and serious adverse consequences of early emotional and behavior problems, it is critical to improve our understanding of the etiology, developmental course, and prevention and treatment of co-occurring disorders. Early intervention may be particularly beneficial. A wealth of research has documented positive longitudinal associations between harsh, punitive parenting in early childhood and later child problem behavior (Campbell, Pierce, Moore, Marakowitz, & Newby, 1996; Shaw Vondra, Hommerding, Keenan, & Dunn, 1994; Shaw, Owens, Vondra, Keenan, & Winslow, 1996; Shaw, Gilliom, Ingoldsby, & Nagin, 2003), as well as associations between the lack of parental warmth, involvement, responsiveness, and positivity with later internalizing and externalizing problems (e.g., Gardner, 1987, 1994; Shaw, Winslow, Owens, & Hood, 1998; Supplee, Unikel, & Shaw, 2007). Numerous studies have also documented the link between parental mental health and child behavior problems, with maternal depression receiving wide support as a risk factor for the early development of childhood internalizing and externalizing symptoms (see Connell & Goodman, 2002).

The toddler years represent a time of marked change for children in terms of cognitive, emotional, and physical maturation, requiring parents to provide positive behavioral support and scaffold developmentally appropriate behaviors (Gardner, Sonuga-Barke, & Sayal, 1999). During toddlerhood, the focus of the parent–child relationship changes from emotional responsivity and sensitivity to the infant’s needs to monitoring a highly active toddler (Shaw, Bell, & Gilliom, 2000). For many parents, this transition is associated with a decrease in parental pleasure in childdrearing from the first to second years (Fagot & Kavanagh, 1993), and families’ adaptation to this developmental transition forms the basis for subsequent developmental stages (Shaw et al., 2000). Intervening during this transitional period could be instrumental to preventing the later development of adolescent problem behaviors such as delinquency, deviant peer association, and internalizing disorders.

Given the centrality of family processes to the early development of conduct problems and symptoms of anxiety and depression, family interventions are likely to be critical to preventing the development of problems across early childhood. Along this line, a number of parenting interventions have been found to be effective for reducing early conduct problems (e.g., Brinkmeyer & Eyberg, 2003; Olds et al., 1997; Webster-Stratton, 1990). Less research has focused on family interventions for internalizing difficulties, although several such interventions have been shown to reduce emotional distress in youth (e.g., Asarnow, Scott, & Mintz, 2002; Brent et al., 1997; Diamond, Reis, Diamond, Siquelan, & Isaacs, 2002).

To date, few studies have examined the impact of parenting interventions on co-occurring emotional and behavioral difficulties. Unfortunately, youth with co-occurring internalizing and externalizing disorders are more frequently excluded from efficacy trials, compared with children with a single diagnosis. The severity of co-occurring internalizing and externalizing problems in childhood does not suggest that parents and children in these families will be unresponsive to interventions. Several studies support the hypothesis that children with comorbid emotional and behavioral problems and their families are responsive to interventions that are carefully tailored to meet their needs (e.g., Connell, Dishion, Yasui, & Kavanagh, in press; Dishion & Stormshak, 2007). Beauchaine, Webster-Stratton, and Reid (2005) reported that across six randomized intervention trials of a parent-training intervention for families with 3- to 8-year-old children with early conduct problems, children with co-occurring anxiety and depression demonstrated greater reductions in early externalizing problems from pre- to posttreatment and beyond to 1-year follow-up than did those with single disorders. Similarly, Beauchaine, Gartner, and Hagen (2000) reported more positive treatment outcomes following inpatient treatment for 4- to 12-year-old boys with conduct disorder/ADHD diagnoses if they also had comorbid depression/anxiety disorder diagnoses, relative to boys without the co-occurring disorders. Our study examined the impact of the Family Check-Up intervention on the progression of co-occurring emotional and behavior problems in young children from age 2 to 4 years.

**Previous Research on the Family Check-Up**

The FCU is a brief intervention that includes a broad assessment of family context and parenting practices...
(see Dishion & Stormshak, 2007). Unlike many parenting interventions during which parents receive all intervention components in a structured sequence, the FCU approach is an adaptive and tailored family intervention (see Collins, Murphy, & Bierman, 2004). An adaptive intervention framework recognizes that individual families may have differing needs and intervention targets and may vary in the extent to which they require services. The core feature of an adaptive intervention is that specific targets and doses are determined for each family based on a priori, theoretically derived, and empirically validated decision rules. Advantages of this approach include decreased likelihood of negative intervention effects, elimination of treatment components that are inappropriate for a given family, decreased waste of resources, potentially increased compliance with treatment, and increased intervention effectiveness (Collins et al., 2004). Intervention scientists are thus empowered to cost effectively address public health problems by using a framework that more directly meets the needs of families. Moreover, adaptive interventions may be particularly attractive to high-risk families for whom extended attendance and engagement may be difficult in light of challenging family or social circumstances.

The FCU was directly inspired by the motivational interviewing (MI) framework of Miller and Rollnick (2002). The MI approach is intended to motivate parents to engage with treatment services and to encourage behavior change in families of high-risk youth. The FCU is the first step in a menu of empirically supported and family-centered interventions designed to strengthen parenting skills and promote positive behaviors (Dishion & Kavanagh, 2003). In contrast to the standard clinical model, the FCU is rooted in a health maintenance model, which emphasizes periodic contact with families during the course of key developmental transitions. Our study focused primarily on the FCU for families with young children who were engaged in the Women, Infants and Children Nutrition Program (WIC) service system and who demonstrated risk for comorbid emotional and behavioral problems.

Previous research has examined the impact of the FCU on problem behavior in early adolescence, when offered in a public school setting. Using an intention to treat design, Dishion, Kavanagh, Schneiger, Nelson, and Kaufman (2002) found that proactive parent engagement reduced substance use among high-risk adolescents and prevented substance use among typically developing youth. Significant reductions in these problem behaviors resulted from an average of six direct contact meetings with parents during the course of three years. Compliance growth causal effect analyses supported the proposal that participation in the FCU and linked services as needed resulted in significant, long-term reductions in substance use and antisocial behavior, including decreased substance use diagnoses and fewer arrests by the end of high school (Connell et al., in press). Shaw and colleagues (2006) applied the Family Check-Up to a sample of 120 high-risk families of toddlers involved in the WIC program. Engagement in the FCU resulted in reductions in subsequent child problem behavior and improvement in parent involvement at child age 3 and 4, respectively (Gardner, Shaw, Dishion, Burton, & Supplee, in press; Shaw, Dishion, Supplee, Gardner, & Arnds, 2006).

**The Current Study**

This study examined data from 731 families participating in WIC service systems who were recruited when the children were approximately 2 years old. These children had been deemed at-risk for showing early-starting pathways of behavior problems on the basis of sociodemographic risk (i.e., low income and parental education), family risk (e.g., maternal depression, parental drug abuse, teen parent), and child risk (e.g., high levels of conduct problems). Half of the families were randomly assigned to receive the FCU. Analyses focused on the age 4 follow-up reports of child conduct and internalizing problems, collected two years after initial contact with families. Families in this study, which we refer to as the Early Steps Multisite study (ES-M), were recruited from three geographically and culturally unique regions: metropolitan Pittsburgh, Pennsylvania, suburban Eugene, Oregon, and rural Charlottesville, Virginia. The sample reflects cultural diversity in that it includes a high percentage of African American, European American, and Latino families. In addition to receiving the FCU, families in the intervention group were provided adaptive, tailored services following the Family Check-Up, as needed.

This study’s analyses extend two earlier reports on the ES-M sample that described reductions in child conduct problems and internalizing symptoms as a result of participation in the FCU. Dishion and colleagues (2007) used LGM procedures to separately examine internalizing and externalizing problems from age 2 to 4. They found that treatment-related reductions in externalizing trajectories mediated increases in positive parenting behavior. Similarly, Shaw and colleagues (2007) found that reduced maternal depressive symptoms from child age 2 to 3 mediated improvements in both internalizing and externalizing problems from age 2 to 4.

Although these studies provide important evidence for the effectiveness of the FCU intervention, LGM analyses have limitations. For example, analyses of
growth do not account for within-child differences in profiles of internalizing and externalizing symptoms. It is likely that some children in this sample exhibited elevations solely in either internalizing or externalizing domains, while others demonstrated co-occurring symptoms. It is also possible that the FCU intervention may be differentially effective for youth with different symptom profiles, exerting strongest effects for youth with co-occurring problems. Such a possibility may best be examined using a person-centered analytic approach (see Connell, Dishion, & Deater-Deckard, 2006).

In our study, we used latent transition analysis (LTA) to identify clusters of youth exhibiting distinct profiles of internalizing and externalizing symptoms from age 2 to 4. This strategy enabled us to examine whether participation in the FCU affected the transition between symptom classes across age 2 to 4. LTA, which was originally described by Graham, Collins, Wugalter, Chung, and Hansen (1991), is particularly suited to examining changes in group membership over time (i.e., comorbid, internalizing-only, or externalizing-only classes of youth). It treats symptom clustering as an unobserved, latent underlying nominal classification. That is, groups of children with distinct symptom profiles are not directly observed, but are instead identified by using a classification model, which provides the basis for studying transitions from one group to another over time. As such, LTA provides a means of dealing with measurement error and reducing bias in estimates of stability and change over time (see Nylund, Muthén, Nishina, Bellmore, & Graham, 2007; Pickles & Hill, 2006). In light of Shaw and colleagues’ (2007) results for maternal depression, we included maternal depression as a covariate in the current analyses, examining the effect of maternal symptoms on symptom classes at child age 2 and 4. Although Dishion and colleagues (2007) also examined positive parenting behaviors, because LTA is computationally intensive and performs best with large sample sizes (See Collins, Hyatt, & Graham, 2000), and parenting data were available only for a smaller subset of families, we decided not to include the parenting data in this report.

Methods

Study Participants
Participants included 731 mother–child dyads recruited between 2002 and 2003 from WIC programs in the metropolitan areas of Pittsburgh, Pennsylvania, Eugene, Oregon, and Charlottesville, Virginia (Dishion, Shaw, Connell, Gardner, Weaver, & Wilson, 2007). Families were approached at WIC sites and invited to participate if they had a son or daughter between age 2 years 0 months and 2 years 11 months. Recruited families were screened to ensure that they met the study criteria of having socioeconomic, family, and/or child risk factors for future behavior problems. Risk criteria for recruitment were defined as at or above one standard deviation above normative averages relevant to the following three domains: (a) child behavior (conduct problems, high-conflict relationships with adults), (b) family problems (maternal depression, daily parenting challenges, substance use problems, teen parent status), and (c) sociodemographic risk (low education achievement and low family income using the WIC criterion). Two or more of the three risk factors were required for inclusion in the sample.

As shown in Figure 1 and partitioned by site in Table 1, of the 1666 parents who were approached at WIC sites across the three study sites and had children in the appropriate age range, 879 families met the eligibility requirements (52% in Pittsburgh, 57% in Eugene, 49% in Charlottesville) and 731 (83.2%) agreed to participate (88% in Pittsburgh, 84% in Eugene, 76% in Charlottesville). The children in the sample had a mean age of 29.9 months (SD = 3.2) at the time of the age 2 assessment.

Of the 731 families (49% female), 272 (37%) were recruited in Pittsburgh, 271 (37%) in Eugene, and 188 (26%) in Charlottesville. More participants were recruited in Pittsburgh and in Eugene because of the larger population of eligible families in these regions. As such, LTA, which was originally described by Graham, Collins, Wugalter, Chung, and Hansen (1991), is particularly suited to examining changes in group membership over time (i.e., comorbid, internalizing-only, or externalizing-only classes of youth). It treats symptom clustering as an unobserved, latent underlying nominal classification. That is, groups of children with distinct symptom profiles are not directly observed, but are instead identified by using a classification model, which provides the basis for studying transitions from one group to another over time. As such, LTA provides a means of dealing with measurement error and reducing bias in estimates of stability and change over time (see Nylund, Muthén, Nishina, Bellmore, & Graham, 2007; Pickles & Hill, 2006). In light of Shaw and colleagues’ (2007) results for maternal depression, we included maternal depression as a covariate in the current analyses, examining the effect of maternal symptoms on symptom classes at child age 2 and 4. Although Dishion and colleagues (2007) also examined positive parenting behaviors, because LTA is computationally intensive and performs best with large sample sizes (See Collins, Hyatt, & Graham, 2000), and parenting data were available only for a smaller subset of families, we decided not to include the parenting data in this report.

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relative to Charlottesville. Across sites, the children were reported to belong to the following racial groups: 27.9% African American, 50.1% European American, 13.0% biracial, and 8.9% other races (e.g., American Indian, Native Hawaiian). In terms of ethnicity, 13.4% of the sample reported being Hispanic American. During the 2002–2003 screening period, more than two-thirds of those families enrolled in the project had an annual income of less than $20,000, and the average number of family members per household was 4.5 (SD = 1.63). Forty-one percent of the population had a high school diploma or GED equivalency, and an additional 32% had one to two years of post–high school training.

Retention. Of the 731 families who initially participated, 659 (89.9%) were available at the one-year follow-up and 619 (84.7%) participated at the two-year follow-up when children were between age 4 and 4 years 11 months. At age 3 and 4, selective attrition analyses revealed no significant differences relevant to project site, children's race, ethnicity, gender, levels of maternal depression, or children's externalizing behaviors (parent reported). Furthermore, no differences were found in the number of participants who were not retained in the control versus in the intervention groups at both age 3 (n = 40 and n = 32, respectively) and age 4 (n = 58 and n = 53, respectively).

Measures

Demographics questionnaire. A demographics questionnaire was administered to the mothers during the age 2 and age 4 visits. This measure included questions about family structure, parental education and income, parental criminal history, and areas of familial stress.

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000). The CBCL is a well-established and widely used 99-item questionnaire that assesses parental reports of behavioral and emotional problems in young children from age 1.5 to 5 years. Mothers completed the CBCL at the child age 2 and age 4 visits. The CBCL has two broad-band factors, Internalizing and Externalizing. The Internalizing scale comprises four subscales, including Emotional Reactivity, Anxiety and Depression, Somatic Problems, and Social Withdrawal. The Externalizing scale comprises two subscales, Aggression and Attention Problems. For use in the latent class analyses (LCAs) and LTAs, scores on these six subscales were dichotomized to reflect youth being rated in the normative range or above.

Center for Epidemiological Studies on Depression scale (CES-D). The CES-D (Radloff, 1977) is a well-established and widely used 20-item measure of depressive symptomatology that was administered to mothers at the child age 2 and age 4 home assessments. Mothers reported how frequently they had experienced listed depressive symptoms during the past week on a scale ranging from 0 (less than 1 day) to 3 (5–7 days). Items were summed to create an overall depressive symptoms score. For the current sample, internal consistencies were .76 and .75 at the age 2 and age 4 assessments, respectively. Average levels of self-reported depressive symptoms were moderately elevated at age 2 (M = 16.75, SD = 10.66), and age 4 assessments (M = 14.99, SD = 10.88), with scores greater than 16 reflective of clinically significant symptom levels (Radloff, 1977).

Child gender. Child gender was coded as 0 = “male” and 1 = “female.”

Child ethnicity. Youth-reported ethnicity was coded as 0 = “Caucasian” and 1 = “ethnic minority.”

Intervention status. Random assignment was coded as 0 = “control” and 1 = “intervention.”

Assessment protocol. Parents (i.e., mothers and, if available, alternative caregivers such as fathers or grandmothers) who agreed to participate in the study were scheduled for a 2.5-hour home visit. Each assessment began by introducing the children to an assortment of age-appropriate toys and having them play for 15 minutes while the mothers completed questionnaires. After the free play (15 minutes), each primary caregiver and child participated in several tasks: (a) a clean-up (5 minutes), (b) child delay of gratification (5 minutes), (c) four teaching tasks (3 minutes each, with the final task being completed by alternate caregiver
and child), (d) a second free play (4 minutes), (e) a second clean-up task (4 minutes), (f) the presentation of two inhibition-inducing toys (2 minutes each), and (g) a meal preparation and lunch task (20 minutes). The exact home visit and observation protocol was repeated at age 3 and 4 for both the control and the intervention group. Families received $100, $120, and $140 for participating in the age 2, 3, and 4 home visits, respectively.

Computer-generated randomization to FCU and control groups was conducted by a staff member who had not been involved in recruitment. Randomization was balanced by gender to ensure an equal number of males and females in the control and intervention groups. To ensure examiner blindness to the intervention condition, a sealed envelope revealing the family’s assignment was opened and shared with the family after the assessment was completed. Examiners who carried out follow-up assessments were never informed of the family’s randomly assigned condition.

For purposes of this study, only maternal reports of child problem behavior were used from the age 2 and 4 assessments, and maternal reports of depression were used from the age 3 assessment.

**Intervention protocol.** The FCU. Families randomly assigned to the intervention condition were then scheduled to meet with a parent consultant for two or more sessions, depending on the family’s preference. Typically, the three meetings include an initial contact session, an assessment session, and a feedback session (Dishion & Kavanagh, 2003). To optimize the internal validity of the study (i.e., prevent differential drop out for experimental and control conditions), the assessments were completed before random assignment results were revealed to either the research staff or the family. Thus, for purposes of research, the sequence of contacts was as follows: assessment (baseline), randomization, initial interview, feedback session, and follow-up sessions based on the needs of individual families. Each family was given a $25 gift certificate at the end of the feedback session for completing the FCU.

Essential objectives of the feedback session were to explore the caregivers’ willingness to change problematic parenting practices, support existing parenting strengths, and identify services appropriate to the family needs. During this session the parent was offered follow-up sessions focused on parenting practices, other family management concerns (e.g., coparenting), and contextual issues (e.g., child care resources, marital adjustment, housing, vocational training).

Parent consultants who facilitated the FCU and follow-up parenting sessions were a combination of Ph.D.- and master’s-level clinicians, all with previous experience in implementing family-based interventions. Parent consultants were initially trained for 2.5–3 months using a combination of strategies, including didactic instruction and role playing, followed by ongoing videotaped supervision of intervention activity. Before working with study families, parent consultants were certified by lead parent consultants at each site, who had previously been certified by Dr. Dishion. Certification was established by reviewing videotapes of feedback and follow-up intervention sessions to evaluate whether parent consultants were competent in all critical components of the intervention as described later in this article. This process is repeated yearly to reduce drift from the intervention model, consistent with the methods of Forgatch, Patterson, and DeGarmo (2005), who found that direct observations of therapist fidelity to parent management training predicted change in parenting practices and child behavior. In addition, cross-site case conferences were convened weekly using videoconferencing to further enhance fidelity. Finally, annual parent consultant meetings were held to update training, discuss possible changes in the intervention model, and address special intervention issues reflected by the needs of families across sites.

Of the families assigned to the treatment condition, 77.9% participated in the initial parent consultant meeting and feedback sessions at child age 2, 65.4% at age 3, and 65.3% at age 4 (see Table 1). Of those families who met with a parent consultant, the average number of sessions per family was 3.32 (SD = 2.84) at child age 2 and 2.83 (SD = 2.70) at age 3, including the initial parent consultant meeting and feedback as two of those sessions.

**Analysis strategy.** The central analyses used an LTA framework to examine changes in latent class membership over time, relative to participation in the intervention program. LTA is an advanced autoregressive model in which class membership at each time point is not directly observed, but represents a categorical latent variable identified with a measurement model. LTA includes both a measurement component and a structural component. For the measurement component, item probabilities are class-specific parameters.

![Table 1: Descriptive Statistics for CBCL Subscales](image)
that describe the likelihood of an individual in a given class to endorse each item. Two structural components include class probabilities, which describe the size of each latent class at each time point, and transition probabilities, which are conditional probabilities describing the probability of being in a given state at time \( t \), conditional on the state at time \( t - 1 \) (and on the status of covariates, if present).

In this study, we followed the general guidelines put forth by Nylund and colleagues (2007), proceeding through the LTA process in several steps. First, separate LCAs were used to examine the optimal number of latent classes at each study wave. Second, an LTA without covariates examined transitions across latent classes from age 2 to 4. Finally, covariates were added to the LTA model to examine the effect of treatment, child gender, ethnicity, maternal depressive symptoms on latent class membership at age 2 and 4, and transition probabilities over time. Detailed statistical presentations of the general LTA framework are available in Nylund and colleagues (2007), Humphreys and Janson (2000), and Reboussin, Reboussin, Liang, and Anthony (1998).

**Results**

Descriptive statistics for CBCL subscales are shown in Table 2. Correlations for all variables from age 2 to 4 are shown in Table 3. It is important to note that no significant associations were found between treatment group and child gender or ethnicity, levels of maternal depressive symptoms, or any type of child problem behavior at age 2, suggesting that randomization was successful. Modest to moderate associations were consistently found between maternal depression and factors of child problem behavior concurrently and over time, and among different factors of child problem behavior.

**Latent Class Analyses at Age 2 and 4**

We first examined separate LCAs at age 2 and 4 to determine the optimal number of classes needed to best characterize data at each age. Mixture modeling (of which LCA is a specific form) is an active area of methods research regarding the optimal approach to determining the number of latent classes (e.g. Nylund, Asparouhov, & Muthén, 2006). Fit indices were obtained for unconditional models with 1–6 classes at each age. Models with different numbers of latent classes are not nested, so Muthén and Muthén (2000) have recommended the following three criteria for selecting the optimal number of latent classes in factor mixture models: (a) the Bayesian information criteria (BIC) and a sample-size adjusted version of the BIC (Adj BIC), with lower scores representing better-fitting models; (b) the quality of classification across models, represented by entropy, with higher entropy values indicating better classification of individuals into their most likely trajectory class; (c) the bootstrapped likelihood ratio test (BLRT), which provides a

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<th>Table 3: Correlations among Study Variables</th>
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<tr>
<td>1. Intervention group</td>
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<tr>
<td>2. Gender</td>
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<td>3. Ethnicity</td>
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<td>4. CBCL Age 2</td>
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<td>5. Age 2 emotionally retracted</td>
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<td>6. Age 2 anxious, depressed</td>
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<td>7. Age 2 conductive compliance</td>
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<td>9. Age 2 sleep problems</td>
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<td>10. Age 2 attention problems</td>
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<td>11. Age 2 aggressive behavior</td>
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<td>12. CBCL Age 4</td>
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<td>13. Age 3 emotionally retracted</td>
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<td>18. Age 4 attention problems</td>
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<td>19. Age 4 aggressive behavior</td>
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Note: * Correlation is significant at the 0.05 level (2-tailed). CBCL variables are scores.
statistical comparison of the fit of a given model with a model of one fewer classes; and (4) the theoretical relevance and usefulness of latent trajectory classes. Recent simulation studies by Nylund and colleagues (2006) supported the use of Adj BIC and BLRT for selection of the optimal number of classes in LCA models, with the BLRT providing particularly consistent correct results. In light of these findings, we placed primary weight on the BLRT and the Adj BIC values in selecting the number of classes. All analyses were conducted using 100 randomized start values run for 10 iterations each, with the best-fitting 25 randomized start values run to model convergence.

As shown in Table 4, both the Adj BIC and the BLRT supported a four-class solution at age 2. At age 4, the BLRT supported a four-class solution and the Adj BIC supported a three-class solution. We chose the four-class solution to represent optimal fit in light of Nylund and colleagues’ (2006) recommendations, and consistency of the four-class solution with hypotheses and theories, as well as the consistency of the four-class solution at age 4 with the four-class solution at age 2. The resulting four classes at age 2 and 4 are depicted in Figures 2 and 3. Most youth at each age are in a class with low probability of being in the borderline/clinical range on any scale. Because of the relative size and low likelihood of problems, we label this class normative throughout the remainder of this article. A second class showed relatively elevated probabilities of significant problems on the two Externalizing subscales, along with the Withdrawal scale. We refer to this class as externalizing. A third class showed relatively elevated likelihoods of being in the clinical range on the four Internalizing scales, so we refer to this class as internalizing. Finally, a fourth class showed elevations on all six subscales, so this class is labeled comorbid.

These four classes match well with the four classes that would be expected on the basis of theory and past research, lending increased confidence that they reflect meaningful clusters of youth. It is worth emphasizing that the sizes of the classes were somewhat different at age 2 than at age 4, particularly for the externalizing class, which decreased in size over time (30.4% at age 2 and 18.3% at age 4), and the normative class, which increased in size over time (46.9% at age 2 and 62.7% at age 4).

Latent Transition Analyses from Age 2 to 4

LTAs were conducted next, which permitted the examination of transitions across classes from age 2 to age 4. We first examined an unconditional LTA model. Class proportions from this model are shown in Table 5. As was found in the LCA models, the externalizing class decreased in size across age 2 and age 4, while the normative class grew substantially over time. Conversely, the internalizing and comorbid classes were relatively stable in size across age 2 and age 4, showing a slight decline.

Latent transition probabilities from this unconditional model are shown in Table 6. As shown, the normative group was highly stable over time, with 90.8% of youth in this group at age 2 remaining in this group at age 4. Nearly 25% of the age 2 internalizing class transitioned into the age 4 comorbid class, while no youth in this group transitioned into the age 4 externalizing class, and 42.7% transitioned into the normative class. Very few youth in the age 2 externalizing class transitioned into either the age 4 internalizing or comorbid classes, with nearly 50% of
those transitioning out of this class transitioning into the normative class at age 4. Only 9.5% of the age 2 comorbid class transitioned into the normative class, while nearly 33% transitioned into the age 4 internalizing class.

Next, we added three time-invariant covariates, including intervention status, child gender, and child ethnicity, and one time-varying covariate, maternal depressive symptoms, to the model. The conditional LTA model is depicted in Figure 4. As a first step, we examined whether to allow intervention to predict age 2 class membership. Effects such as these would be problematic because intervention was not delivered until after the age 2 assessment, so age 2 intervention effects would reflect problems with randomization. However, none of these effects was significant, so we followed a more parsimonious approach of permitting intervention effects only for age 4 classes. The addition of covariates changed the latent transition probabilities somewhat, as shown in Table 7, and appeared to slightly increase the cross-time stability of each of the classes. Covariate effects on class membership are shown in Table 8. Most notably, intervention predicted a significantly reduced likelihood of being in the comorbid class at age 4, and a trend-level (p < .06) effect on the likelihood of membership in the internalizing class at age 4, relative to the normative class. That is, youth who received intervention were less likely to be in either of these two classes and more likely to be in the normative class instead, compared with the other groups of children. The odds ratios for being in the comorbid versus normative class at age 4 associated with the receipt of intervention is .16, as is the odds ratio for being in the age 4 internalizing versus normative class in relation to treatment status. However, intervention was unrelated to the likelihood
of membership in the externalizing-only class.

The analysis of other significant covariate effects on class membership resulted in findings only at age 2. Male gender predicted a significantly greater likelihood of membership in the externalizing class at age 2, and ethnic minority status predicted a trend-level increase in the likelihood of membership in the age 2 comorbid class. Elevated maternal depressive symptoms predicted a significantly greater likelihood of membership in the age 2 comorbid class, and a trend-level increase in the likelihood of membership in the age 2 externalizing class, relative to the normative class.

Discussion
The goal of this study was to examine the hypothesis that the FCU would result in decreases in young children’s transitions into co-occurring emotional and behavioral problems by age 4. Steps that led to the test of this hypothesis included establishing the number of classes (LCA) of young children at age 2 and 4, examining the distribution of these classes, and then testing the impact of a randomized intervention when controlling for ethnicity, maternal depression, and gender.

As expected, results of LCA models supported the existence of four classes at age 2 and 4 years, corresponding with the internalizing, externalizing, comorbid, and normative groups that were expected to become apparent on the basis of past research and theory. Several findings are noteworthy regarding these classes. First, membership in the comorbid group at age 2 was predicted by elevated symptoms of depression in mothers, and by ethnic minority status. Second, membership in the age 2 externalizing group was predicted by maternal depressive symptoms alone. Interestingly, maternal depressive symptoms did not predict membership in the internalizing-only class at this early age, which is inconsistent with previous research (Connell & Goodman, 2002).

It is important to note that “psychopathology” at this early age is a transient phenomenon. Many youth in the three at-risk classes transitioned into the normative group by age 4. This transition into lower risk status was particularly pronounced for early externalizing-only problems, with nearly half of the early externalizing group moving into the normative group by age 4. This pattern of findings is consistent with that of other research (e.g., Cote, Vaillancourt, Leblanc, Nagin, & Tremblay, 2006; NICHD Early Child Care Research Network, 2004), suggesting that early problems with aggression may abate for many youth (although other forms of early conduct problems may persist).

An unexpected finding was that many youth with early internalizing problems appeared to develop co-occurring externalizing problems by age 4, but no youth switched from the early internalizing to the age 4 externalizing class. Conversely, few youth moved from the early externalizing class into either the later internalizing or later comorbid classes. These results may suggest that early emotional problems may set the stage for the later emergence of co-occurring behavioral problems, but that early behavioral problems, by themselves, may not predict the emergence of problems with anxiety or depression by age 4. At this stage, it is unclear whether this is an assessment issue or one of developmental significance. Individual differences in internalizing and externalizing problems are impacted by method variance and therefore are vulnerable to reporting biases and inadequate item pools. With respect to the latter issue, we suspect there is a need to develop measures of emerging psychopathology that are uniquely sensitive to patterns evident in early childhood.

It is important to consider that children with early behavior problems may develop internalizing problems as they enter school and are exposed to peers who may accept or reject them. This possibility would be predicted by Patterson’s dual-failure model (Patterson & Stoolmiller, 1991), in which children with early externalizing problems are at risk for accumulating social and academic failure experiences, which may in turn lead to the emergence of later problems with anxiety and depression. As we follow these children into early elementary school, we will be able to examine later transition patterns for children in all 4 classes.

Intervention Effects
Results revealed that participation in the FCU significantly reduced the likelihood of child comorbid emotional and behavioral problems at age 4. Children in the comorbid problems class were less likely to have been randomly assigned to the FCU intervention, indicating that intervention substantially decreased the likelihood of either remaining in or transitioning into this class from age 2 to age 4. Similar effects were observed for the internalizing-only group.

These results are particularly noteworthy because these children may be particularly at risk for continued problems later in development, and are often excluded from intervention studies because of their dual diagnosis. Results of this study indicate that children in the comorbid group may be particularly responsive to early family intervention efforts, showing significant reductions in the likelihood of continued problems. Given that most intervention studies either exclude comorbid cases or focus on only one outcome of interest, it is difficult to fit the findings...
of this study in with the general prevention or child clinical literature. It would be very helpful if future research on intervention outcome focused on multiple domains (e.g., depression, problem behavior) to evaluate the overall effectiveness of diverse interventions of child and adolescent mental health, more broadly conceptualized.

These results are in line with the limited number of past intervention studies (i.e., Beauchaine et al., 2000; Beauchaine et al., 2005), in finding that youth with co-occurring emotional and behavior problems appear to be particularly responsive to early intervention. Interestingly, research from a study of 2- to 4-year-old twins found that co-occurring emotional and behavioral problems were strongly related to shared family environmental influences, a relatively rare finding in the behavior genetics literature (Gregory, Eley, & Plomin, 2004). That finding supports the efficacy of family-centered interventions to ameliorate the development of comorbid internalizing and externalizing problems in childhood. Further research is needed to examine mediating processes relative to the intervention, as well as their association with the onset and course of comorbid emotional and behavioral problems in childhood. Consistent with past research involving this sample (Dishion et al., 2007), we suspect that improvements in family functioning such as increased parental warmth and proactive structuring will mediate the effects of intervention on the likelihood of exhibiting comorbid problems by age 4. Methodological research is needed, however, to improve the examination of mediation in the context of LTA models.

Similar intervention effects were found for reduced likelihood of showing only internalizing problems by age 4, although these results were at trend level. These results indicate that improving parent and family functioning may also be important for youth exhibiting early symptoms of anxiety and depression, alone. They are consistent with other studies in which the FCU was associated with reductions in internalizing problems in early adolescence (Connell & Dishion, 2007). Taken together, these results support the notion that family-centered interventions are likely to be important for reducing problems with anxiety and depression in youth.

It is important to note that intervention effects were not found for the externalizing-only class. Despite the fact that the FCU was originally designed to prevent early conduct problems, the externalizing class was the only high-risk latent class that did not demonstrate an intervention effect. One possible reason for the lack of effect for this class of children is that many moved out of this class and into the normative class on their own. The current findings may also qualify prior results for this sample (Dishion et al., 2007; Shaw et al., 2007), in which LGM was used to document that children whose parents participated in the FCU exhibited greater declines in externalizing problems from age 2 to age 3 relative to those in the control group. The current LTA results suggest that those intervention effects on changes in externalizing problems may have been primarily driven by children exhibiting co-occurring emotional and behavior problems rather than by those with only early behavior problems.

**Limitations**

Several methodological limitations to the current study merit consideration. First and foremost is the issue of potential reporter bias. There is consistent evidence in the literature that mothers with elevated levels of depressive symptoms show a tendency to report higher levels of children’s problem behavior (Fergusson, Lynskey, & Horwood, 1993). Because mothers reported on both their own depressive symptoms and on children’s externalizing and internalizing problem behavior, reductions in maternal depressive symptoms that appeared to be a function of randomization to the intervention group may have also amplified group differences in problem behavior and maternal perceptions of the severity of externalizing symptoms. On the one hand, it is possible that group differences are partially responsible for perceived changes in child problem behavior. However, Dishion and colleagues (2007) recently found that observed parenting behaviors predicted improvements in mother-rated behavior problems in this sample, supporting the notion that mother-reported problems related to independently observed parenting behavior in this study. It should also be noted that as elevated levels of depressive symptoms during the toddler period have been related to teacher reports of low-income children’s conduct problems, it is still possible that modifying maternal depression during the toddler period will be associated with reduced problem behavior during the school-age period. Future planned assessments that include teacher and after-care provider reports will shed light on the extent to which improvements in problem behavior are limited to maternal perceptions and the home environment, as well as time.

Second, although we presented evidence to suggest that the FCU is associated with improvements in child problem behavior and maternal depressive symptoms, effect sizes, albeit meaningful from a public health perspective, were relatively modest (ds ranged from .14 to .19). Further refinement of the FCU will be needed to increase its efficacy for families with young children.
Implications and Future Directions
This study’s findings corroborate previous evidence that longitudinal changes in child emotional and behavioral difficulties can be achieved with a brief family-centered intervention for toddlers. The changes observed in our study were achieved among low-income families participating in an existing, nationally available service delivery setting (WIC). The families had children at risk for early-starting pathways of externalizing behavior and did not typically use mental health services (Haines, McMunn, Nazroo, & Kelly, 2002). We hope that future follow-up of the present cohort will clarify concerns regarding the intervention’s endurance and generalizability to other contexts, and later developmental transitions in children’s patterns of emotional and behavioral difficulties as they enter school age.

References
Connell, A., & Goodman, S. (2002). The association between child internalizing and externalizing behavior problems and psychopathology in mothers versus fathers: A meta-


