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The Long-Term Effectiveness of the Family Check-up on Peer Preference: Parent-Child Interaction and Child Effortful Control as Sequential Mediators

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Abstract

We examined the longitudinal effects of the Family Check-Up (FCU) intervention beginning in toddlerhood on children's peer preference at school-age. Specifically, a sequential mediational model was proposed in which the FCU was hypothesized to promote peer preference (i.e., higher acceptance and lower rejection by peers) in middle childhood through its positive effects on parent-child interaction and child effortful control in early childhood. Participants were 731 low-income families (49 % female). Qualities of parent-child interaction were observed during structured activities at 2 to 5 years, child effortful control was assessed using behavioral tasks at 5 years, and peer acceptance and rejection were rated by teachers at 7.5 to 10.5 years. Results indicated that the FCU indirectly predicted peer preference by sequentially improving parent-child interaction and child effortful control. The findings are discussed with respect to implications for understanding mechanisms by which early parenting-focused programs may enhance child functioning across time and context.

Keywords

Parent-child interaction; Effortful control; Peer preference; Early prevention

Peer relations have been a major topic of research because of their relevance to adjustment over the life span (see Parker and Asher 1987 and Rubin et al. 2006 for reviews).

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Compliance with Ethical Standards

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Experiences with peers serve as a developmental context in which children acquire a wide range of values, norms, and skills for successful adaptation. Moreover, it may be particularly important to examine children's peer functioning in middle childhood because the nature of peer interaction changes dramatically in this period (McDowell and Parke 2009). For example, children spend more time with similar-aged peers, and engage in larger peer groups with less adult supervision (Rubin et al. 2006). If peers constitute a significant contributor to socialization, then children who are less preferred by peers might be at risk for maladjustment as they would be relatively deprived of learning opportunities in this context.

Indeed, peer social preference (i.e., acceptance/rejection by peers) has been found to predict a variety of outcomes in childhood and adolescence, including externalizing and internalizing psychopathology (Ladd 2006; Pedersen et al. 2007), attitude towards school and academic achievement (Buhs et al. 2006), violent antisocial activities and substance use (Vitaro et al. 2007), and even longer-term consequences such as criminality in young adulthood (Rabiner et al. 2005). Additionally, peer relationships have been found to mitigate or exacerbate the continuity of adjustment difficulties (Prinstein and La Greca 2004). As such, promoting the quality of peer relationship may contribute to child functioning across multiple domains.

One preventive approach to promoting prosocial peer relations is to target and modify early predictors of peer acceptance and rejection. This work involves identifying risk mechanisms that lead to low social preference and testing the malleability of those processes. Fortunately, previous studies have already accumulated knowledge about individual (e.g., self-regulation; Lengua 2003) and contextual (e.g., parent-child interaction; McDowell and Parke 2009) risk factors that are reliably linked to peer relationships. However, there is still a dearth of research investigating whether those pathways might be shifted in an early intervention. Thus, there were two goals for this prospective longitudinal study. First, a sequential mediational model was proposed in which parent-child interaction in the preschool period was expected to predict peer preference in middle childhood via its effects on child effortful control in the transition to school. Secondly, taking advantage of a randomized controlled trial, we tested the possibility that this indirect pathway to social preference might be improved by random assignment to a parenting-focused intervention targeting multi-risk, low-income families.

Parent-Child Interaction

Parent-child interaction is a primary context of socialization, particularly in early childhood when children are physically and psychologically dependent on parents. A robust body of research has investigated the association between parental behavior and diverse child outcomes, including the quality of peer relations (Kerns et al. 2000). For example, Dishion (1990) found that observed parent-child interaction in the home was prognostic of both academic skills and antisocial behavior at school, which in turn predicted both peer rejection and acceptance. Likewise, parent-child connectedness was related to higher levels of peer acceptance in 5-year-olds (Clark and Ladd 2000). More recently, the quality of observed mother-child relationships in the lab was associated with peer victimization (a more serious form of peer rejection) in kindergarten (Reavis et al. 2010).

Parents may affect children's peer relations in multiple ways (Ladd and Pettit 2002). Specifically, it has been proposed that parent-child interaction, parental advice giving, and parent provision of opportunities are distinct, albeit related, ways by which parents might shape child behavior in the peer context (Ladd 1999; McDowell and Parke 2009). Among parent-related factors, the effects of direct interaction between parents and children are perhaps most established. Based on both attachment and social learning perspectives, parent-child interaction may serve as a context in which children acquire appropriate social behavior and develop internal working models that impact interaction with others (e.g., peers). Additionally, parents may influence peer functioning by offering explicit advice about peer interaction, and providing children with opportunities for social contact. The unique role of each factor has been empirically supported. For instance, high parental warmth/responsiveness and low parental control (McDowell and Parke 2009; McDowell et al. 2003), high quality of parental advice about peer interaction issues (McDowell and Parke 2009; McDowell et al. 2003), and the frequency of social interaction and activities (McDowell and Parke 2009; O'Neil et al. 2001) have each been found to predict children's peer competence. Although the findings contribute to the literature on direct pathways by which parent-related factors become associated with child peer outcomes, we also thought that parents may have indirect, and possibly longer-term effects on children's peer functioning by bolstering positive child attributes that contribute to better child behavior in peer relational contexts (e.g., child self-regulation).

Child Effortful Control

Effortful control refers to a child's ability to suppress automatic responses and initiate alternative responses to fulfill contextual demands (Rothbart and Bates 2006). As a key component of self-regulation, effortful control is a critical determinant of a variety of child outcomes, including peer competence (Riggs et al. 2006). This is not surprising because children are expected to follow rules and share resources with peers, modulate their behavior in the given circumstances, and resist impulses that often involve strong negative emotions detrimental to relationships, all of which rely heavily on the child's effortful control.

Although effortful control is a trait-like construct, it is also reflective of and influenced by children's social experiences, such as parent-child interaction (Olson and Lunkenheimer 2009). Although studies have largely examined parenting behavior rather than parent-child interaction, a robust body of research suggests that both positive parenting (e.g., warmth, scaffolding) and negative parenting (e.g., coercive discipline) affect children's development of effortful control (Chang et al. 2011; Kochanska et al. 2000). Positive parenting may promote effortful control by encouraging the child's autonomy, providing timely and appropriate help when necessary, explicitly teaching effective regulatory strategies, and increasing the child's motivation to cooperate with parental demands based on the dyad's positive relationship. Negative parenting may impact effortful control via similar processes but in the opposite direction. Moreover, parental display of positive or negative strategies may model regulatory skills (or the lack of) for children as well.

In this study, we focus on parent-child interaction rather than parental behavior towards children because we are most interested in dyadic patterns of interaction rather than

parenting behavior by itself. Parenting in isolation does not take into account how a child may be evoking or responding to parental behavior. Children's spontaneous or responding behaviors are important aspects to consider in the study of relational patterns with parents and peers, and in understanding how such interactions may promote or hinder the development of effortful control.

Integrative Model: Parent-Child Interaction, Effortful Control, and Peer Relations

Together, the findings point to the possibility that more positive parent-child interaction leads to greater child effortful control, which in turn leads to increased competence in peer relations. Hence, it might be that associations between positive parenting and social preference are mediated by effortful control. However, with a few exceptions, researchers have rarely tested a mediational model including all three factors. For example, parental expressive emotionality (a construct that captures affective component of parental behavior) predicted child social competence via its effects on child regulatory abilities in early school-age children (Eisenberg et al. 2001; Eisenberg et al. 2003). Similarly, in a sample of toddlers, effortful control was found to mediate the relation between supportive parenting and social competence (Spinrad et al. 2007).

Although the findings offer valuable insight about how intra- and inter-individual factors might influence children's peer relations, they are also limited in a couple of ways. First, prior investigations have typically used a short-term longitudinal design involving two waves of data, which compromises the study's potential to examine long-term processes that underlie the link between early risk factors and later child outcomes across developmental transitions. In addition, studies have commonly focused on parenting (i.e., parental behavior directed toward children) rather than dyadic relational qualities. Although the two constructs likely overlap in many aspects, as noted above, parent-child interaction directly assesses the context of socialization, and thus may be a more proximal predictor of child outcomes. Further, relatively little is known about how parent-child interaction, effortful control, and social preference might relate to one another in children growing up in impoverished environments. Lastly, no study to date has explored the possibility that an early pathway to peer relations that involves parent-child interaction and effortful control might be effectively targeted in an early intervention.

The Family Check-up

A novel question of our investigation was the modifiability of the indirect pathway by which positive parent-child interaction may promote the quality of peer relations via its effect on children's effortful control abilities. In addition to testing the long-term efficacy of an early intervention on peer functioning at school-age, clarifying mechanisms of change would further inform preventive efforts to facilitate this critical aspect of children's development. In this study, we used the Family Check-Up (FCU), an ecologically-based program focused on motivating parents to engage in positive parenting practices. A unique aspect of the FCU is its health maintenance approach in which the families are offered brief, but regular (i.e., once a year) sessions for continuous support through multiple transitions (Dishion and

Stormshak 2007). To maximize the benefits of brief intervention, the FCU relies heavily on an in-depth assessment of the child and family ecology, as well as motivational interviewing techniques. Specifically, the FCU typically involves three sessions: an initial contact, a home-based comprehensive assessment, and a feedback session (Dishion et al. 2008). Motivational interviewing techniques are utilized in the feedback session during which the results of the assessment are shared with the family, highlighting areas of strengths and areas for improvement. Subsequently, parents are invited to participate in additional sessions tailored to meet each family's needs and based on an empirically-validated parent management curriculum (Dishion et al. 2011).

Despite its brevity, the FCU has been found to increase positive parenting (e.g., proactive strategies; Dishion et al. 2008) and positive engagement and decrease coercive engagement over the course of early childhood (Sitnick et al. 2015). Although the FCU was originally designed to address child conduct problems by preventing the escalation of coercive cycles (Dishion et al. 2008), positive changes in parental behavior and parent-child interaction have also been highlighted as a contributor to child development. Indeed, accumulating evidence supports that the FCU may affect diverse child outcomes primarily by increasing parent's use positive behavior support strategies in early childhood (see Dishion et al. 2008; Shelleby et al. 2013).

For example, the FCU was found to reduce both the emergence of early problem behavior (Connell et al. 2008; Dishion et al. 2008; Shaw et al. 2009) and the growth in conduct problems through the school-age years (Dishion et al. 2014). Additionally, children in the FCU group have been shown to demonstrate more positive attributes such as inhibitory control (Chang et al. 2014; Lunkenheimer et al. 2008), behavioral control (Shelleby et al. 2013), effortful control (Chang et al. 2015), verbal ability (Lunkenheimer et al. 2008), and academic achievement (Brennan et al. 2013) from ages 3 to 7.5, effects that often were mediated by improvements in positive parenting between ages 2 and 3 (Lunkenheimer et al. 2008; Shelleby et al. 2013; Chang et al. 2015).

On the basis of prior findings of the FCU effects on parenting and child effortful control, and the literature on associations among those factors and social preference, we believed that improvements in parent-child interaction in the preschool period as a function of the FCU would sequentially promote children's effortful control in the transition to school and their peer relations at early school-age. To date, this possibility has not been tested in the context of a parenting-focused intervention. Such an investigation could contribute to the literature by expanding the scope of prevention research over time and context, and more importantly, by revealing processes that may underlie positive intervention effects.

The Present Study

As reviewed, although early individual and contextual predictors of peer functioning have been identified, fewer studies initiated during the toddler years have focused on elucidating mechanisms by which those factors may become associated with the quality of children's peer relationship during middle childhood. Furthermore, even less is known about the malleability of those processes as a result of an early intervention. Thus, there were two

major goals for this investigation. First, we aimed to reveal early pathways to peer relations that may involve parent-child interaction and child effortful control. Specifically, a sequential mediational model was proposed in which positive qualities of dyadic behavior between parents and children in the preschool years (3 to 5 years) were hypothesized to predict higher levels of peer preference in middle childhood (7.5 to 10.5 years) through improvements in children's effortful control in the transition to school (5 years). Second, we tested whether the FCU might promote children's peer relations in the school context by affecting this indirect pathway in the early years.

It was hypothesized that, compared the control group, families in the intervention group would successively demonstrate higher levels of positive dyadic engagement, higher levels of child effortful control, and higher levels of peer preference. Data were used from a multisite prevention trial for toddlers of low-income families who are likely to develop conduct problems. Children living in poverty are more vulnerable to less than optimal levels of functioning in many areas, including parent-child interaction, child self-regulation, and peer relations (Evans and Kim 2013). Thus, the use of the current sample offered an opportunity to investigate risk mechanisms and their modifiability among children who are at most risk for maladjustment.

Method

Participants

Participants were 731 families who were part of a randomized controlled trial of early prevention for children at risk for developing conduct problems. The families were recruited from the Women, Infant, and Children (WIC) programs in Pittsburgh, PA, Eugene, OR, and Charlottesville, VA, if they had a 2-year-old child and fulfilled the study criteria by having child (i.e., conduct problems, high conflict with adults), family (i.e., maternal depression, substance problems, teen parent status, daily parenting challenges), and/or socioeconomic (i.e., low family income, low education) risk factors for problem behavior. To be eligible for participation, the family must be at high risk (i.e., at or above 1 SD above the mean of each screening measure) in two or more of the three risk domains (see Dishion et al. 2008 for more details). At the age-2 assessment, children (49 % girls) had a mean age of 29.9 months ($SD = 3.2$). The majority of children were of European American (50 %) and African American (28 %) heritage, with smaller numbers of biracial (13 %) or other ethnic backgrounds (e.g., Asian American, Native American; 9 %). Fifty-eight percent of children lived with two parents and more than two thirds of the families had an annual income of less than \$20,000. Forty-one percent of primary caregivers (97 % mothers) had graduated from high school; 24 % had attained less than high school education.

Retention—Of the 731 families, 662 (91 %), 627 (86 %), 621 (85 %), 568 (78 %), 565 (77 %), 588 (80 %), and 573 (78 %) participated in the follow-ups at the ages of 3, 4, 5, 7, 8, 9, and 10 years, respectively. Attrition analyses comparing families who participated in the study at age 2 versus age 10.5 indicated that those with lower levels of maternal education were more likely to drop out of the study across time, $F(1, 730) = 14.99, p < 0.001$. Otherwise, attrition was not selectively associated with intervention status, project site, child

gender or ethnicity, maternal depression, or child problem behavior. Teacher data were available for 314, 370, 386, and 358 children at age 7.5, 8.5, 9.5, and 10.5 years, respectively, which represented 56 %, 65 %, 66 %, and 62 % of the families retained at each age. Relatively low rates of school data was largely due to difficulties in getting cooperation of two of the largest school districts at two of the three sites, which resulted in a significant reduction of teacher ratings in those sites. Availability of school data was not related to any other factor in this study.

Procedure

Assessment Protocol—The initial, 2.5-h assessment was administered at the family's home when the child was 2 years old. Children were first invited to play with age-appropriate toys while their parents filled out questionnaires. Subsequently, children engaged in a series of structured activities with the examiner (e.g., effortful control tasks) or their parents (e.g., cleanup, teaching, delay of gratification tasks). Similar procedures were repeated annually at the ages of 3, 4, and 5 except for slight modifications to reflect the child's developmental status. At 7.5, 8.5, 9.5, and 10.5 years, teachers were asked to complete a set of questionnaires about the target child. Families and teachers received compensation for their time.

Families were randomized to the intervention or control group. Randomization relied on a computer-generated sequence and was also balanced by child gender to assign an equal number of girls and boys in each condition. To guarantee blindness, the examiner learned about the family's intervention status only after the completion of the age-2 assessment and shared this information with the family. Examiners conducting follow-up assessments were not aware of the family's assigned condition.

Intervention Protocol: the Family Check-up (FCU)—The FCU is an annual brief program (typically 3 sessions) that offers individually tailored parenting-focused intervention based on a comprehensive assessment of the child and family ecology. Upon completion of each annual assessment (first session), families in the intervention group were invited for two or more sessions with a parent consultant. The families who agreed then engaged in a "get to know you" (GTKY) session in which parent concerns were explored with a focus on family issues more pertinent to the child's functioning. In the third meeting, the parent consultant utilized motivational interviewing techniques to provide feedback on the family's current levels of functioning, highlighting areas of the family's strength as well as possible areas of change. Lastly, the families were offered follow-up sessions that were tailored to address their specific needs. The sessions were based on the Everyday Parenting Curriculum, an empirically validated parent management program to strengthen three dimensions of positive parenting (i.e., healthy limit setting, positive behavior support, and communication and problem-solving skills; Dishion et al. 2011). The control families completed annual assessments with research staff but had no contact with clinical staff (i.e., parent consultants) for GTKY, feedback, or follow-up sessions.

Although our sample represented at risk families in the community not requesting clinical services, many of them chose to take part in the FCU (i.e., at least a GTKY and feedback

session), and of those who did, a majority also participated in follow-up sessions. Overall, of the 367 intervention families, a total of 343 (93.5 %) engaged in the FCU at least once between the ages of 2 and 9.5 years. Specifically, the following are the proportion of families who had an assessment at each year and (a) received a feedback session, (b) participated in follow-up sessions, and (c) in parentheses, the average number of follow-up sessions, respectively: age 2: 76 %, 72 % (3.4, range = 0–32); age 3: 69 %, 70 % (3.1, range 0–48); age 4: 70 %, 74 % (3.5, range = 0–41); age 5: 66 %, 68 % (3.6, range = 0–77); age 7.5: 64 %, 65 % (2.4, range = 0–35); age 8.5: 71 %, 72 % (2.6, range = 0–33); age 9.5: 69 %, 71 % (2.3, range = 0–29). An intention-to-treat (ITT) design was used in analyses, including 6.5 % of the intervention families who did not engage in the FCU at any time.

Measures

As described below, constructs pertaining to early pathways to social preference (i.e., positive dyadic interaction, child effortful control) were observed in the toddler and preschool periods (i.e., ages 2 to 5 years). Consistent with our focus on understanding how early experiences at home might translate to later child outcomes in school, social preference (i.e., peer acceptance and rejection) was evaluated during the school-age period (i.e., 7.5 to 10.5 years).

Parent-Child Dyadic Interaction—At 2, 3, 4, and 5 years, child and caregiver behaviors during interactive tasks at the home assessment were coded using the Relationship Affect Coding System (RACS; Peterson et al. 2008), a micro-social coding system of relational behavior and affect within dyadic interactions. As described below, we derived data on qualities of dyadic relationship in three steps (i.e., individual RACS codes for each member of the dyad → summary codes for each member → dyadic states codes for the entire dyad).

At any given moment during an interaction, the child and caregiver were given one individual code from each of the three dimensions of behavior: a) verbal: general conversation (positive, negative, or neutral) and verbal attempts at behavior change of the partner (directives, negative directives, and positive structure); b) physical: physical interaction (positive physical contact, negative physical contact, and neutral physical contact); c) affect: general emotional display (or lack of) in an interaction (positive affect, validation, anger/disgust, distress, ignore).

We then created six behavior clusters to summarize the three data streams (i.e., verbal, physical, and affect) for each person in the interaction: positive, neutral, directive, negative, no talk, and ignore. For example, the positive cluster included behaviors such as positive verbal statement, positive physical contact, positive structure, or positive affect, as well as validation. The negative cluster included anger and disgust, and negative verbal and physical interaction (also see Sitnick et al. 2015). When the three codes did not converge (e.g., a parent could say something mean and then laugh), the priority was given to codes that captured behavior or affect that we thought were more salient to the relationship. Thus, the order of trumping was as follows: Ignore, negative, positive, directive, no talk, and lastly neutral behavior.

Once behavior clusters for each dyadic member were coded, we derived data on dyadic states by combining the behavior cluster of the child and that of the caregiver at each time point (see Dishion et al. 2012). The total duration that each dyad was observed in particular dyadic state was calculated as a proportion score in relation to the overall session time. The dyadic states that were formulated were: positive engagement, neutral engagement, coercive engagement, and non-interactive. Of those, we were primarily interested in dyadic states that involved both participants mutually engaged in particular sets of interactive behavior. Specifically, a summary score of dyadic positive engagement reflected the duration of time that the child or caregiver engaged in positive or neutral behavior while the other member of the dyad also displayed positive or neutral engagement. Likewise, a summary score of *dyadic coercive engagement* encompassed interactions in which either participant was negatively engaged or directive, and the partner responding by negative engagement, directive, ignoring, or not talking. The coding was recorded using Noldus Observer XT, Version 11.0 (Noldus Information Technology 2012) which enables continuous coding of an interaction of caregivers and children simultaneously. Inter-rater reliability was based on 20 % of the sample: overall $\kappa = .93$ at each age; agreement = 93 %, 94 %, 93 %, and 94 % at ages 2, 3, 4, and 5, respectively.

For the purposes of this study, scores of dyadic positive engagement and dyadic coercive engagement were used to construct a latent factor of *positive dyadic interaction* at the ages of 2, 3, 4 and 5 years. Dyadic positive engagement and dyadic coercive engagement scores were significantly correlated within each time (r s ranged from $-.61$ to -0.47 , all p -s < 0.01) and also across the four waves ($-.61$ to -0.22 , all p s < 0.01). As our goal was to investigate if the promotion of early parent-child interaction might underlie the FCU's ability to improve child behavior in middle childhood, a second-order latent factor was created based on latent factors of positive dyadic interaction at 3, 4, and 5 years. The latent factor of age-2 positive dyadic interaction was kept separate as it captured variability in relational qualities that existed prior to the FCU (i.e., the intervention group was offered the FCU upon completion of the age-2 assessment).

Child Effortful Control—At age 5 years, children were administered the Tower, Wrapped gift, and Draw-a-star tasks from Kochanska's behavioral battery of effortful control (Kochanska et al. 2000). The Tower and Wrapped gift tasks were videotaped and coded by a group of undergraduate coders who were not aware of the study's hypothesis and each other's coding. Inter-rater reliability based on 16 % of the subjects ranged from .97 to 1.00. The Draw-a-star task was coded by the examiner at the time of the administration. In the *Tower* task, the child was asked to build a tower using 20 blocks taking turns with the examiner who was intentionally slow in responding to his or her turns. Coding reflected the number of blocks placed by the child divided by the total number of blocks placed by the dyad. The mean score was computed across 3 trials ($\alpha = .60$). In the *Wrapped gift* task, the child was instructed to not look at the examiner who made noise wrapping up a gift for the child (60s). Then the examiner left the room to get a bow and the child again was asked to wait without peeking (120 s). The child received the gift when the examiner returned. Coding included the latency to first peek (in seconds), the frequency of peeking, and the extent of touching or opening the gift (0 = *does not touch*; 1 = *touches but does not open*

gift; 2 = *touches and opens gift*). The extent of touching or opening the gift and the frequency of peeking codes were reversed so that higher scores reflected more advanced effortful control. A single index for the Wrapped gift was calculated by standardizing and compositing individual codes ($\alpha = .88$). In the *Draw-a-star* task, the child was asked to draw a star on a picture of a star, staying between the lines. The task involved three trials: baseline, slow (i.e., the child was instructed to draw as slowly as possible), and fast (i.e., the child was instructed to draw as fast as possible). Each trial was coded for the number of seconds to completion and the number of errors that occurred (i.e., the child crossed borders in drawing the star). The difference in time in seconds between the slow trial and the fast trial, and the average number of errors (reversed) were standardized and aggregated ($\alpha = 0.42$).¹ Scores for the Tower, Wrapped gift, and Draw-a-star were used to construct a latent factor of child effortful control.

Child Inhibitory Control—At the age of 2 years, primary caregivers completed the Inhibitory Control subscale of the Children's Behavior Questionnaire (CBQ; Rothbart et al. 1994). Each of the 13 items was rated on a 7-point scale (1 = *extremely untrue of child*; 7 = *extremely true of child*) and asked about the child's capacity to suppress immediate responses (e.g., "can easily stop an activity when s/he is told 'no.'"; $\alpha = .66$). Inhibitory control was incorporated in the model to account for early variations in child self-regulation.

Peer Social Preference—At 7.5, 8.5, 9.5, and 10.5 years, teachers completed the Teacher Ratings of Peers and Social Skills (TPRSK; Dishion and Kavanagh 2003), a 14-item measure that assesses teachers' knowledge of children's peer relations and antisocial activities within the past month in the school setting. Two items that evaluate peer acceptance ("What percentage of this student's peers like and accept him/her?") and peer rejection ("What percentage of this student's peers dislike or reject him/her?") were used in this study. Each item was rated on a scale of 1 (*very few; less than 25 %*) to 5 (*almost all; more than 75 %*). For analysis, latent factors of *peer preference* were created based on peer acceptance and peer rejection scores the four assessments in middle childhood (i.e., 7.5 to 10.5 years), which were significantly correlated within each wave (r s ranged from $-.73$ to $-.65$, all p s < 0.01). Between the ages of 7.5 and 10.5 years, a total of 646 children (88 % of the sample) had some teacher data available. Since we aimed to examine early pathways to peer functioning in middle childhood more broadly than any particular age during this period, a second-order latent factor was created based on latent factors of peer preference at 7.5, 8.5, 9.5, and 10.5 years.

Demographic Questionnaire—Primary caregivers responded to questions about child ethnicity, parental education and income, and family structure. Parental education was rated on a scale of 1 (*no formal schooling*) to 9 (*graduate degree*).

¹The relatively low alpha may be because of a modest degree of association between the difference in time between the trials and the average number of errors ($r = -.26$, $p < .01$). Although previous studies have generally used the time difference only (e.g., Kochanska et al. 2000), we decided to composite *accuracy* and *time* for two reasons: a) the child was instructed to pay attention to both dimensions (i.e., draw a star as fast vs. slow as possible, and *without crossing the borders*), and b) there may be children who sacrifice accuracy for the sake of time, or vice versa. We sought to derive a more comprehensive measure of effortful control in the draw-a-star task by considering both aspects of child behavior during the task.

Analysis Plan

Following preliminary analyses (Tables 1 and 2), the proposed model was tested in a structural equation modeling (SEM) framework which was advantageous for addressing our research questions. First, the use of latent variables in SEM leads to more reliable constructs and greater model specificity. Additionally, SEM is apt for studying complex relationships between constructs simultaneously. In this study, we could examine the roles of sequential mediators that served as both independent and dependent variables in the model. Temporal stability of those factors could also be controlled within the same model for a more conservative test of direct and indirect effects of the FCU. Lastly, SEM packages generally offer more advanced methods of handling missing data, such as full-information maximum likelihood estimation (FIML) that has been found to be superior than other methods (Enders and Bandalos 2001).

As shown in Fig. 1, associations between latent factors of positive dyadic interaction at 2 years (i.e., pre-FCU), positive dyadic interaction at 3 to 5 years (i.e., post-FCU), effortful control at 5 years, and peer preference at 7.5 to 10.5 years were investigated as well as the effects of the FCU on those factors (except for age-2 variables). Age-2 inhibitory control was also incorporated in the model to account for earlier variability in child self-regulation and child effects on qualities of dyadic interaction between parents and children. In addition, constructs were allowed to covary if they were assessed at the same time (i.e., child inhibitory control and positive dyadic interaction at 2 years; latent factors of peer acceptance and peer rejection at 7.5 to 10.5 years; indicators of peer acceptance and peer rejection at 7.5, 8.5, 9.5, and 10.5 years) or if they measured the same construct at different ages (i.e., indicators of positive engagement at 2, 3, 4, and 5 years; indicators of coercion at 2, 3, 4, and 5 years). Lastly, child sex, ethnicity, and parent education were included in the model as covariates, a decision that was supported by the literature (e.g., child gender: Rose and Rudolph 2006; ethnicity: Wilson et al. 2009; parental education: Lunkenheimer et al. 2008), as well as observed correlations between variables in the current dataset (Table 2). For example, girls have been shown to demonstrate better effortful control skills than boys (e.g., Chang et al. 2011), and child sex in this study also is significantly correlated with indicators of effortful control and maternal ratings of inhibitory control, both favoring girls. Thus, while the roles of sociodemographic factors on early pathways to social preference may be an interesting research question by itself, for the purposes of this study, we thought it would be important to account for these effects before attributing relations between our primary independent variables and indices of social preference.

Mplus 7 was used for analysis with the FIML employed to accommodate missing data (Muthén and Muthén 2012). Traditionally, nonsignificant chi-squares indicate good-fitting models. However, for larger samples, the chi-square ratio (χ^2/df) may offer a better assessment ($\chi^2/\text{df} < 2$ for acceptable fit; Tabachnick and Fidell 2007). Additional indices that were considered include the Root Mean Square Error of Approximation (RMSEA; < 0.08) and the Comparative Fit Index (CFI; $> .90$; McDonald and Ho 2002).

Results

Sequential Mediation Model

The proposed model demonstrated good fit, $\chi^2(226) = 311.278$, $p < 0.05$, $\chi^2/df = 1.38$, RMSEA = 0.02, CFI = .97. As presented in Fig. 1, higher levels of positive dyadic interaction at 3 to 5 years predicted higher levels of child effortful control at 5 years, $\beta = 0.42$, $p < 0.001$, which, in turn, was associated with higher levels of peer preference, $\beta = 0.34$, $p < 0.01$, at 7.5 to 10.5 years. The FCU predicted higher levels of positive dyadic interaction at 3 to 5 years, $\beta = 0.14$, $p < 0.01$, but was not directly related to any other variable in the model. Those associations were significant controlling for the temporal stability of the sequential mediators (positive dyadic interaction: 2 years $\rightarrow$ 3 to 5 years, $\beta = .56$, $p < 0.001$; child self-regulation: inhibitory control at 2 years $\rightarrow$ effortful control at 5 years, $\beta = 0.18$, $p < 0.01$) as well as possible child effects on dyadic interaction between parents and children, $\beta = -0.04$, *ns*. Overall, this model explained 27 % and 23 % of variance in child effortful control and peer preference, respectively.

Potential indirect effects were tested using the Sobel test. The indirect effect of the FCU on child effortful control at 5 years via positive dyadic interaction at 3 to 5 years was significant, $\beta = 0.14$, $p < 0.05$. Additionally, the indirect effect of positive dyadic interaction at 3 to 5 years on peer preference at 7.5 to 10.5 years via effortful control at 5 years was also significant, $\beta = 0.06$, $p < 0.05$. Together, the indirect effect of the FCU on social preference at 7.5 to 10.5 years, with positive dyadic interaction at 3 to 5 years and child effortful control at 5 years as sequential mediators, was significant, $\beta = 0.02$, $p < 0.05$.

Discussion

The main goals of this study were to examine pathways from early childhood leading to peer functioning in middle childhood, and to explore the long-term effects of the FCU on peer social preference at school-age by sequentially promoting parent-child interaction and child effortful control in early childhood within a sample of multi-risk, low-income families. The results indicated that positive dyadic interaction (i.e., higher positive engagement, lower coercive engagement) at 3 to 5 years led to improvements in child effortful control at 5 years, which in turn contributed to higher levels of peer preference (i.e., higher acceptance and lower rejection by peers) at 7.5 to 10.5 years. Additionally, this indirect pathway to peer functioning was malleable to early intervention as indicated by significant effects of the FCU on parent-child dynamics, which was subsequently associated with higher child effortful control and then higher social preference. The findings were still evident after accounting for early individual differences in the sequential mediators (i.e., positive dyadic interaction and child effortful control), child effects on dyadic interaction, and possible influences of sociodemographic covariates.

An Integrative Model of Peer Relations

The findings add to the basic literature on peer relations by unveiling an early pathway to children's social preference at school-age in which early individual and interpersonal factors conjointly play roles. Most previous studies have examined associations between parenting,

child effortful control, and peer relations in pairs (e.g., Chang et al. 2011; McDowell and Parke 2009; Riggs et al. 2006), with the few existing comparable studies including important limitations (e.g., use of short-term designs, low risk samples; Eisenberg et al. 2001; Eisenberg et al. 2003; Spinrad et al. 2007). We tried to conduct a more rigorous test of a mediational model by using a large sample of children living in poverty and followed from toddlerhood to middle childhood using multiple methods and informants across contexts.

Specifically, this study suggests that positive parent-child interaction during the toddler period leads to higher levels of child effortful control in the preschool period, which in turn places children in optimal position to be accepted by peers throughout the school-age period. The indirect and longer-term effects of parent-child relations on child social preference is especially intriguing in that peers are not yet a central part of child development in the early years. Relatedly, parent-child interactive contexts in this study did not involve peers in any way, minimizing the possibility of direct effects (e.g., advice giving) of parents on children's social behavior. Thus, the current findings highlight early parent-child interaction as a critical context in which children learn to regulate impulses and behavior, which in turn may have long lasting impact on diverse areas of their adjustment.

For a more conservative test of the direction of influence hypothesized in this study, we accounted for the stability of sequential mediators and possible child effects on parent-child interaction. With respect to these findings, a modest degree of stability for effortful control is probably due to the fact that inhibitory control was used as a covariate rather than effortful control, and the two constructs were evaluated via different methods (i.e., maternal ratings vs. behavioral tasks). Although it would have been preferable to have equivalent measures of effortful control at both assessments, including age-2 inhibitory control in the analysis led to at least partial control of stability of a critical aspect of effortful control.

Additionally, the lack of significant finding regarding child effects on dyadic engagement might seem peculiar based on theoretical and empirical evidence for transactional patterns of parent-child interaction over time (Sameroff 2009). However, this may be attributed to child effects already being accounted for in our measure of parent-child interaction. This is actually a unique aspect of this study, as most prior research has observed parental behavior toward children rather than how parents and children relate to each other in complex dynamics. We thought that it is important to more directly evaluate qualities of a primary context for socialization and thus attempted to capture relational states for each pair of parents and children acknowledging that both parties contribute to dyadic exchanges (Sitnick et al. 2015).

Furthermore, our specific focus on parent-child interaction allowed us to more directly test one of many proposed pathways from parent behavior to child social preference (McDowell and Parke 2009). Specifically, it has been suggested that parents may affect peer relations via direct interaction with children, advice giving, and provision of social opportunities (McDowell and Parke 2009). Of many possible pathways, we tried to more closely examine mechanisms involved in how parents might promote their child's peer preferences in school through direct parent-child interaction in the preschool years by deriving dyadic engagement

variables. Based on the current pattern of findings, child self-regulation may be an additional mediator by which early parent-child relations become manifest in later peer relations.

The Long-Term Efficacy of the FCU on children's Peer Social Preference

To the best of our knowledge, this is the first study to demonstrate that an early pathway to child peer relations may be shifted in a parenting program that begins even before children are actively involved with peers (i.e., toddlerhood). Thus, in addition to its contribution to the basic literature, this study reveals early processes that could be a target of early intervention. Although the FCU did not directly predict levels of social preference for children, it did so indirectly by facilitating positive dyadic interaction, and, subsequently, child effortful control abilities. This makes sense in that the FCU involves direct work with parents and not children, focusing on parenting issues. This study highlights the value of promoting positive changes within the primary agent of socialization early in life for long-lasting effects on child adjustment across relational contexts. We also speculate that the effects may have been particularly salient in the preschool years when children are fast developing and more malleable, and parents are motivated to improve their parenting skills.

Methodologically, a major strength of this study is that, unlike many other studies involving parent and child data, parent ratings were not used at all. Although parents may have access to rich information about child and parent behavior, in a prevention trial, the fact that parents are aware of their group assignment (i.e., intervention vs. control) may seriously compromise the validity of their reports. Relatedly, to minimize similar bias in assessment, examiners and coders of parent-child interaction and child effortful control, and teachers who rated peer relations were all unaware of each child's intervention status. We believe that this led to a more conservative test of intervention effects in this study.

Our study also expands the scope of the FCU in that, in addition to child problem behavior spanning preschool (Dishion et al. 2008; Shaw et al. 2009) and early school-age (Dishion et al. 2014), verbal skills (Lunkenheimer et al. 2008), inhibitory control (Chang et al. 2014), behavioral regulation (Shelleby et al. 2013), and academic achievement (Brennan et al. 2013), we now know that the FCU may promote children's social preference. Compared to prior studies that have tested the effects of the FCU on parenting (e.g., Dishion et al. 2008) and child outcomes (e.g., Chang et al. 2014), this study is unique in that we focused on a relatively unexplored child outcome (i.e., peer context) using this dataset as well as psychological processes that might underlie such treatment effects. Together, the existing body of research suggests that the FCU may be an effective and efficient program to promote healthy adjustment of impoverished children across many domains and developmental transitions.

Limitations

Although this study has several methodological strengths, including the long-term follow-up of a randomized controlled trial of the FCU, the use of a large sample of multi-risk, low-income families, and the adoption of multiple methods, informants, and contexts for assessment (e.g., observation of parent-child dyads, behavioral tasks for child effortful

control, and teacher reports of social preference), it also has a few limitations meriting discussion.

First, the participants were mostly European American and African American children of economically disadvantaged families, with a small percentage of biracial children (13 %). Thus, there is a possibility that the current findings may not generalize to other samples, particularly those with different racial, ethnic, or economic characteristics. For example, we have yet to confirm that the indirect pathway to social preference and its modifiability within children who are raised in middle-income families that are more resourceful in many ways. Additionally, attrition analyses revealed that families with lower parental educational attainment were more likely to drop out of the study over time, which could pose a further threat to the generalizability of our findings. However, we attempted to address this issue by including parental education as a covariate and also adopting the full-maximum likelihood estimation (FIML), which is known to produce less biased estimates in the presence of missing data (Enders and Bandalos 2001).

Secondly, because of issues in obtaining cooperation from school districts, only 56 % to 66 % of the sample retained at 7.5 to 10.5 years had teacher ratings of social preference. We tried to solve this problem partly by aggregating the four waves of school data (i.e., latent variables), which resulted in a total of 88 % of the original sample having some teacher data available for analysis. However, it was not possible to address questions about timing (e.g., Is there a specific period during the school years at which early risk factors are most influential to peer relationship?) or cumulative risk (e.g., Do repeated peer relationship difficulties lead to worse child outcomes?). Relatedly, one could also argue that the use of teacher ratings itself is a limitation that needs corroborating evidence, such as sociometric status based on peer nominations. Indeed, it has been suggested that adults and peers may observe a child's behavior in different peer contexts and also base their decisions on different norms (Newcomb et al. 1993). Thus, future research might benefit from an integration of multiple sources of information.

Thirdly, there was a large variation in terms of treatment dosage (i.e., number of FCU sessions) across families in the intervention condition. Moreover, even among families who received same treatment dosage, they could have engaged in the same number of sessions at different periods, as the FCU was offered nearly each year (i.e., except at age 6). Thus, a line of future research would be to explore effects of treatment dosage and timing on child outcomes. Furthermore, based on a recent finding that families reporting high levels of caregiving stress were more likely to engage in the FCU over time (Smith et al. 2016), dosage effects should be investigated in the context of pre-intervention family characteristics as well.

Lastly, although the main focus of this study was investigating dyadic parent-child interaction and child effortful control as underlying processes that were thought to underlie the long-term efficacy of the FCU on peer functioning, it is possible that other factors may play roles in pathways to social preference, some of which may also be responsive to prevention efforts. Specifically, other individual (e.g., disruptive behavior; Pederson et al., 2007) and family risks (e.g., interparental conflict; David and Murphy 2007), as well as

teacher- or school-related contextual risks (e.g., classroom climate; Mikami et al. 2010) may be pertinent to children's peer functioning.

Conclusions

With these caveats, the current findings suggest that the FCU, a home-based, parenting program beginning as early as the toddler period, may have long-term effects in promoting children's peer social preference in the school context. More importantly, this study revealed one mechanism by which such effects may occur, involving sequential improvements in dyadic interaction between parent and child and child effortful control. As child self-regulation and parent-child relational context have been highlighted as early foundations for positive functioning, it is quite possible that the promotion of these two critical aspects of child development in the FCU may contribute to other areas of child functioning as well. We look forward to expanding our exploration of long-term outcomes of the FCU and also testing whether such positive effects continue to be evident in the adolescent period.

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References

- Brennan LM, Shelleby EC, Shaw DS, Gardner F, Dishion TJ, Wilson MN. Indirect effects of the family check-up on school-age academic achievement through improvements in parenting in early childhood. *Journal of Educational Psychology*. 2013; 105:762–773.
- Buhs ES, Ladd GW, Herald SL. Peer exclusion and victimization: processes that mediate the relation between peer group rejection and children's classroom engagement and achievement? *Journal of Educational Psychology*. 2006; 98:1–13.
- Chang H, Olson SL, Sameroff AJ, Sexton HR. Child effortful control as a mediator of parenting practices on externalizing behavior: evidence for a sex-differentiated pathway across the transition from preschool to school. *Journal of Abnormal Child Psychology*. 2011; 39:71–81. [PubMed: 20632205]
- Chang H, Shaw DS, Dishion TJ, Gardner F, Wilson MN. Direct and indirect effects of the family check-up on self-regulation from toddlerhood to early school-age. *Journal of Abnormal Child Psychology*. 2014; 42:1117–1128. [PubMed: 24599383]
- Chang H, Shaw DS, Dishion TJ, Gardner F, Wilson MN. Proactive parenting and children's effortful control: mediating role of language and indirect intervention effects. *Social Development*. 2015; 24:206–223.
- Clark KE, Ladd GW. Connectedness and autonomy support in parent-child relationships: links to children's socio-emotional orientation and peer relationships. *Developmental Psychology*. 2000; 36:485–498. [PubMed: 10902700]
- Connell A, Bullock BM, Dishion TJ, Shaw D, Wilson M, Gardner F. Family intervention effects on co-occurring behavior and emotional problems in early childhood: A latent transition analysis approach. *Journal of Abnormal Child Psychology*. 2008; 36:1211–1225. [PubMed: 18473160]
- David KM, Murphy BC. Intergenerational parental conflict and preschoolers' peer relations: the moderating roles of temperament and gender. *Social Development*. 2007; 16:1–23.
- Dishion TJ. The family ecology of boys' peer relations in middle childhood. *Child Development*. 1990; 61:874–892. [PubMed: 2364761]

- Dishion, TJ., Kavanagh, K. Intervening in adolescent problem behavior: a family-centered approach. New York: Guilford; 2003.
- Dishion, TJ., Stormshak, E. Intervening in children's lives: An ecological, family-centered approach to mental health care. Washington, DC: American Psychological Association; 2007.
- Dishion TJ, Shaw DS, Connell A, Wilson MN, Gardner F, Weaver C. The family check up with high-risk families with toddlers: outcomes on positive parenting and early problem behavior. *Child Development*. 2008; 79:1395–1414. [PubMed: 18826532]
- Dishion, TJ., Stormshak, EA., Kavanagh, K. Everyday parenting: a professional's guide to building family management skills. Champaign: Research Press; 2011.
- Dishion TJ, Forgatch MS, Van Ryzin MJ, Winter C. The nonlinear dynamics of family problem solving in adolescence: the predictive validity of a peaceful resolution attractor. *Nonlinear Dynamics, Psychology, and Life Sciences*. 2012; 16:33–1352.
- Dishion TJ, Brennan L, Shaw DS, McEachern A, Wilson M. The prevention of early onset problem behavior through periodic family check-ups in early childhood: a health maintenance model with indigent high risk families. *Journal of Abnormal Child Psychology*. 2014; 42:343–354. [PubMed: 24022677]
- Eisenberg N, Valiente C, Morris AS, Fabes RA, Cumberland A, Reiser M, et al. Longitudinal relations among parental emotional expressivity, children's regulation, and quality of socioemotional functioning. *Developmental Psychology*. 2003; 37:3–19.
- Eisenberg N, Gershoff ET, Fabes RA, Shepard SA, Cumberland AJ, Losoya SH, et al. Mothers' emotional expressivity and children's behavior problems and social competence: mediation through children's regulation. *Developmental Psychology*. 2001; 37:475–490. [PubMed: 11444484]
- Enders CK, Bandalos DL. The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling*. 2001; 8:430–457.
- Evans GW, Kim P. Childhood poverty, chronic stress, self-regulation, and coping. *Child Development Perspectives*. 2013; 7:43–48.
- Kerns, KA., Contreras, JM., Neal-Barnett, AM. Family and peers: linking two social worlds. Westport, CT: Praeger; 2000.
- Kochanska G, Murray KT, Harlan ET. Effortful control in early childhood: continuity and change, antecedents, and implications for social development. *Developmental Psychology*. 2000; 36:220–232. [PubMed: 10749079]
- Ladd GW. Peer relationships and social competence during early and middle childhood. *Annual Review of Psychology*. 1999; 50:333–359.
- Ladd GW. Peer rejection, aggressive or withdrawn behavior, and psychological maladjustment from ages 5 to 12: an examination of four predictive models. *Child Development*. 2006; 77:822–846. [PubMed: 16942492]
- Ladd, GW., Pettit, GS. Parenting and the development of children's peer relationships. In: Borenstein, MH., editor. *Handbook of parenting*. 2nd. Vol. 5. Mahwah, NJ: Erlbaum; 2002. p. 269–310.
- Lengua LJ. Associations among emotionality, self-regulation, adjustment problems, and positive adjustment in middle childhood. *Applied Developmental Psychology*. 2003; 24:595–618.
- Lunkenheimer ES, Dishion TJ, Shaw DS, Connell A, Gardner F, Wilson MN, Skuban EM. Collateral benefits of the family check up on early childhood school readiness: indirect effects of parents' positive behavior support. *Developmental Psychology*. 2008; 44:1737–1752. [PubMed: 18999335]
- McDonald RP, Ho MHR. Principles and practice in reporting structural equation analyses. *Psychological Methods*. 2002; 7:64–82. [PubMed: 11928891]
- McDowell DJ, Parke RD. Parental correlates of children's peer relations: an empirical test of a tripartite model. *Developmental Psychology*. 2009; 45:224–235. [PubMed: 19210004]
- McDowell DJ, Parke RD, Wang SJ. Differences between mothers' and fathers' advice-giving style and content: relations with social competence and psychological functioning in middle childhood. *Merrill-Palmer Quarterly*. 2003; 49:55–76.
- Mikami AY, Lerner MD, Lun J. Social context influences on children's rejection by their peers. *Child Development Perspectives*. 2010; 4:123–130.

- Muthén, LK., Muthén, BO. Mplus User's Guide. 7th. Los Angeles, CA: Muthén & Muthén; 2012.
- Newcomb AF, Bukowski WM, Pattee L. Children's peer relations: A meta-analytic review of popular, rejected, neglected, controversial, and average sociometric status. *Psychological Bulletin*. 1993; 113:99–128. [PubMed: 8426876]
- Noldus Information Technology. The Observer XT reference manual 11.0. Wageningen, the Netherlands: Author; 2012.
- O'Neil R, Parke RD, McDowell DJ. Objective and subjective features of children's neighborhoods: relations to parental regulatory strategies and children's social competence. *Journal of Applied Developmental Psychology*. 2001; 22:135–155.
- Olson, SL., Lunkenheimer, ES. Expanding concepts of self-regulation to social relationships: transactional processes in the development of early behavioral adjustment. In: Sameroff, AJ., editor. *Transactional processes in development*. Washington, DC: APA Press; 2009. p. 55-76.
- Parker JG, Asher SR. Peer relations and later personal adjustment: are low-accepted children at risk? *Psychological Bulletin*. 1987; 102:357–389. [PubMed: 3317467]
- Pedersen S, Vitaro F, Barker ED, Borge AI. The timing of middle-childhood peer rejection and friendship: linking early behavior to early-adolescent adjustment. *Child Development*. 2007; 78:1037–1051. [PubMed: 17650124]
- Peterson, J., Winter, C., Jabson, J., Dishion, TJ. The relationship affect coding system, Unpublished coding manual. Child and Family Center, University of Oregon. OR: Eugene; 2008.
- Prinstein MJ, La Greca AM. Childhood rejection, aggression, and depression as predictors of adolescent girls' externalizing and health risk behaviors: a six-year longitudinal study. *Journal of Consulting and Clinical Psychology*. 2004; 72:103–112. [PubMed: 14756619]
- Rabiner DL, Coie JD, Miller-Johnson S, Boykin ASM, Lochman JE. Predicting the persistence of aggressive offending of African American males from adolescence into young adulthood: the importance of peer relations, aggressive behavior, and ADHD symptoms. *Journal of Emotional and Behavioral Disorders*. 2005; 13:131–140.
- Reavis R, Keane S, Calkins S. Trajectories of peer victimization the role of multiple relationships. *Merrill-Palmer Quarterly*. 2010; 56:303–332. [PubMed: 20938488]
- Riggs NR, Greenberg MT, Kusché CA, Pentz MA. The mediational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in elementary school students: effects of the PATHS curriculum. *Prevention Science*. 2006; 7:91–102. [PubMed: 16572300]
- Rose AJ, Rudolph KD. A review of sex differences in peer relationship processes: potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin*. 2006; 132:98–131. [PubMed: 16435959]
- Rothbart, MK., Bates, JE. Temperament. In: Damon, W., Lerner, R., Eisenberg, N., editors. *Social, emotional, and personality development*. Vol.3. *Handbook of Child Psychology*. 6th. New York: Wiley; 2006. p. 66-166.
- Rothbart MK, Ahadi S, Hershey KL. Temperament and social behavior in childhood. *Merrill-Palmer Quarterly*. 1994; 40:21–39.
- Rubin, KH., Bukowski, WM., Parker, JG. Peer interactions, relationships, and groups. In: Damon, W., Lerner, R., Eisenberg, N., editors. *Social, emotional, and personality development*: Vol. 3. *Handbook of child psychology*. 6th. New York: Wiley; 2006. p. 571-645.
- Sameroff, AJ., editor. *The transactional model of development: how children and contexts shape each other*. Washington: American Psychological Association; 2009.
- Shaw DS, Dishion TJ, Connell A, Wilson MN, Gardner F. Maternal depression as a mediator of intervention in reducing early child problem behavior. *Development and Psychopathology*. 2009; 21:417–439. [PubMed: 19338691]
- Shelleby EC, Shaw DS, Cheong J, Chang H, Gardner F, Dishion TJ, Wilson MN. Behavioral control in at-risk toddlers: the influence of the family check-up. *Journal of Clinical Child and Adolescent Psychology*. 2013; 41(3):288–301.
- Sitnick SL, Shaw DS, Gill A, Dishion T, Winter C, Waller R, et al. Parenting and the family check-up: developments and changes in observed parent-child interaction during early childhood. *Journal of Clinical Child and Adolescent Psychology*. 2015; 44:970–984. [PubMed: 25133754]

- Smith JD, Berkel C, Hails KA, Dishion TJ, Shaw DS, Wilson MN. Predictors of participation in the family check-up program: a randomized trial of yearly services from age 2 to 10 years. *Prevention Science*. 2016; doi: 10.1007/s11121-016-0679-7
- Spinrad TL, Eisenberg N, Gaertner B, Popp T, Smith CL, Kupfer A, et al. Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. *Developmental Psychology*. 2007; 43:1170–1186. [PubMed: 17723043]
- Tabachnick, BG., Fidell, LS. Using multivariate statistics. 5th. New York: Allyn and Bacon; 2007.
- Vitaro F, Pedersen S, Brendgen M. Children's disruptiveness, peer rejection, friends' deviancy, and delinquent behaviors: a process-oriented approach. *Development and Psychopathology*. 2007; 19:433–453. [PubMed: 17459178]
- Wilson MN, Hurtt CL, Shaw DS, Dishion TJ, Gardner F. Analysis and influence of demographic and risk factors on difficult child behaviors. *Prevention Science*. 2009; 10:353–365. [PubMed: 19475510]

Fig. 1.

Sequential mediation model. *Note.* Standardized estimates are presented. Solid lines represent significant paths. All variables were controlled for child sex, ethnicity, and parent education. Correlations between positive engagement measures across time (i.e., ages 2 to 5), coercion measures across time, and concurrent measures of peer acceptance and peer rejection (e.g., age-7.5 acceptance and age-7.5 rejection) are omitted from the figure. For Intervention, 1 = *intervention*, 0 = *control*. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 1

Descriptive statistics

	M	SD	Range
<i>Variables</i>			
Intervention	–	–	–
Child sex	–	–	–
Parent education	5.19	1.14	2–8
Child inhibitory control, age 2	3.96	0.81	1.33–7.00
<i>Parent-child dyadic interaction</i>			
Positive engagement, age 2	0.33	0.14	0.00–0.78
Coercive engagement, age 2	0.11	0.08	0.00–0.41
Positive engagement, age 3	0.35	0.14	0.02–0.85
Coercive engagement, age 3	0.09	0.06	0.00–0.48
Positive engagement, age 4	0.28	0.13	0.01–0.77
Coercive engagement, age 4	0.09	0.06	0.00–0.39
Positive engagement, age 5	0.37	0.14	0.00–0.73
Coercive engagement, age 5	0.06	0.05	0.00–0.33
<i>Child effortful control</i>			
Tower, age 5	1.92	0.42	1.03–9.00
Gift task, age 5	0.00	0.73	–4.05–0.43
Draw-a-star, age 5	0.00	0.81	–4.13–4.66
<i>Peer competence</i>			
Peer acceptance, age 7.5	4.01	1.17	1–5
Peer rejection, age 7.5	1.43	0.84	1–5
Peer acceptance, age 8.5	3.78	1.20	1–5
Peer rejection, age 8.5	1.56	1.00	1–5
Peer acceptance, age 9.5	3.77	1.19	1–5
Peer rejection, age 9.5	1.52	0.94	1–5
Peer acceptance, age 10.5	3.79	1.22	1–5
Peer rejection, age 10.5	1.56	1.01	1–5

Table 2

Bivariate correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Intervention	–																					
2. Child sex	0.01	–																				
3. Parent education	0.01	–0.03	–																			
4. Inhibitory control, age 2	0.00	0.11 [*]	0.04	–																		
5. Engagement, age 2	–0.01	0.01	0.23 ^{**}	0.05	–																	
6. Coercion, age 2	0.01	0.00	–0.19 ^{**}	–0.06	–0.61 ^{**}	–																
7. Engagement, age 3	0.12 ^{**}	–0.06	0.17 ^{**}	–0.03	0.44 ^{**}	–0.30 ^{**}	–															
8. Coercion, age 3	–0.04	–0.01	–0.11 ^{**}	–0.05	–0.28 ^{**}	0.31 ^{**}	–0.55 ^{**}	–														
9. Engagement, age 4	0.04	–0.03	0.09 [*]	–0.06	0.30 ^{**}	–0.22 ^{**}	0.49 ^{**}	–0.22 ^{**}	–													
10. Coercion, age 4	0.02	–0.06	–0.10 [*]	0.02	–0.22 ^{**}	0.34 ^{**}	–0.28 ^{**}	0.27 ^{**}	–0.47 ^{**}	–												
11. Engagement, age 5	0.09 [*]	0.01	0.16 ^{**}	–0.02	0.36 ^{**}	–0.20 ^{**}	0.41 ^{**}	–0.23 ^{**}	0.40 ^{**}	–0.19 ^{**}	–											
12. Coercion, age 5	–0.06	–0.07	–0.08	–0.06	–0.24 ^{**}	0.25 ^{**}	–0.22 ^{**}	0.29 ^{**}	–0.22 ^{**}	0.24 ^{**}	–0.54 ^{**}	–										
13. Tower, age 5	0.04	0.12 ^{**}	–0.02	–0.01	–0.01	0.01	0.03	–0.12 ^{**}	–0.10 [*]	0.12 ^{**}	–0.07	0.01	–									
14. Gift task, age 5	0.05	0.10 [*]	–0.07	0.04	0.12 ^{**}	–0.10 [*]	0.05	–0.10 [*]	–0.03	–0.06	0.03	–0.17 ^{**}	0.24 ^{**}	–								
15. Draw-a-star, age 5	–0.03	0.03	0.10 [*]	0.08	0.19 ^{**}	–0.16 [*]	0.12 [*]	–0.09 [*]	0.01	–0.14 ^{**}	0.09	–0.06	0.17 ^{**}	0.21 ^{**}	–							
16. Peer acceptance, age 7.5	–0.05	0.25 ^{**}	–0.02	0.10	0.08	–0.16 ^{**}	0.04	–0.07	0.00	–0.13 [*]	0.03	–0.11	0.22 ^{**}	0.15 [*]	0.17 ^{**}	–						
17. Peer rejection, age 7.5	0.05	–0.22 ^{**}	0.00	–0.10	–0.10	0.18 ^{**}	–0.01	0.04	0.02	0.13 [*]	0.01	0.08	–0.11	–0.12 [*]	–0.15 [*]	–0.73 ^{**}	–					
18. Peer acceptance, age 8.5	0.00	0.14 ^{**}	–0.05	0.11	0.04	–0.08	0.04	–0.12 [*]	–0.04	–0.13 [*]	0.02	–0.12 [*]	0.03	0.16 ^{**}	0.10	0.50 ^{**}	–0.39 ^{**}	–				
19. Peer rejection, age 8.5	–0.01	–0.11 [*]	–0.05	–0.05	–0.04	0.13 [*]	0.03	0.12 [*]	0.02	0.12 [*]	0.00	0.15 ^{**}	0.05	–0.04	–0.02	–0.41 ^{**}	0.35 ^{**}	–0.71 ^{**}	–			
20. Peer acceptance, age 9.5	0.04	0.18 ^{**}	0.01	0.12 [*]	0.05	–0.07	0.03	–0.12 [*]	0.00	–0.15 ^{**}	0.02	–0.19 ^{**}	–0.01	0.04	0.00	0.37 ^{**}	–0.37 ^{**}	0.41 ^{**}	–0.45 ^{**}	–		
21. Peer rejection, age 9.5	–0.09	–0.17 ^{**}	–0.01	–0.09	–0.04	0.06	–0.02	0.17 ^{**}	0.06	0.12 [*]	–0.05	0.19 ^{**}	–0.01	–0.09	–0.05	–0.38 ^{**}	0.45 ^{**}	–0.38 ^{**}	0.43 ^{**}	–0.65 ^{**}	–	
22. Peer acceptance, age 10.5	0.06	0.11 [*]	0.01	0.19 ^{**}	–0.03	–0.06	–0.02	–0.08	0.03	–0.09	–0.06	–0.07	0.05	0.08	0.02	0.30 ^{**}	–0.31 ^{**}	0.41 ^{**}	–0.35 ^{**}	0.37 ^{**}	–0.30 ^{**}	–

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23. Peer rejection, age 10,5	-0.07	-0.14*	-0.06	-0.21**	0.00	0.06	-0.04	0.07	-0.03	0.07	-0.02	0.06	0.01	-0.07	0.02	-.23**	.29**	-0.37**	0.40**	-0.36**	0.31**	-0.68**

For Intervention, 0 = control, 1 = intervention; for child sex, 0 = male, 1 = female;

* $p < 0.05$,

** $p < 0.01$