


Special Issue Article

Using randomized controlled trials to ask questions regarding developmental psychopathology: A tribute to Dante Cicchetti

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Abstract

Dante Cicchetti, the architect of developmental psychopathology, has influenced so many of us in profound ways. One of his many contributions was in demonstrating the power of randomized controlled trials (RCTs) to study the effects of Child–Parent Psychotherapy (CPP). These RCTs have shed light on causal mechanisms in development. Following Cicchetti and colleagues' work, we designed a brief home visiting program, Attachment and Biobehavioral Catch-up (ABC), to help parents respond in sensitive, nurturing ways, so as to enhance children's attachment and self-regulatory capabilities. In the current study, we assessed adolescents' reports of the closeness of their relationships with their mothers 12 years after their mothers completed the intervention. A total of 142 adolescents participated (47 randomized to ABC, 45 randomized to a control intervention, and 50 from a low-risk comparison group). Adolescents whose mothers had been randomized to ABC reported closer relationships with their mothers than adolescents randomized to the control condition, with significant differences seen on approval, support, companionship, and emotional support subscales. Consistent with Cicchetti et al.'s work, these results provide powerful evidence of the long-term effects of an early parenting intervention.

Keywords: Attachment; prevention; randomized controlled trial; adolescence; parenting

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Introduction

Dante Cicchetti, the luminary who defined the field of developmental psychopathology, made so many key contributions to the way we think about development. Among his many contributions, Cicchetti emphasized the power of randomized controlled trials to further our understanding of the effects of early experience on developmental outcomes (Cicchetti & Hinshaw, 2002; Cicchetti et al., 2000; Toth et al., 2002). As he and his colleagues have argued and as they have demonstrated through empirical work (e.g., Cicchetti et al., 1999, 2000, 2006; Toth et al., 2002), the randomized controlled trial allows causal inferences about the effects of parenting on children's outcomes that are otherwise not possible. In this paper, we discuss the value of randomized controlled trials in studying developmental psychopathology, highlight Cicchetti and colleagues' (Cicchetti et al., 2000, 2006, Toth et al., 2002, 2006) randomized controlled trials of Child–Parent Psychotherapy (CPP: Lieberman & van Horn, 2008; Lieberman, 1992), and present an example from our lab of the effects of an early intervention on adolescent development.

Randomized controlled trials

The randomized controlled trial randomly assigns participants (e.g., children, parents) to intervention condition. Randomization minimizes the effects of confounds (e.g., socioeconomic effects, motivation, etc.) because potential confounding factors are distributed randomly in the two or more groups (Hinshaw, 2002). Because the intervention condition is experimentally manipulated, causal claims can be made regarding intervention effects. If the intervention directly targets a parenting behavior such as responsiveness, differences in child outcomes that are observed between the groups can be attributed to the parenting behavior targeted (if that behavior has been defined and targeted well). Even when socioeconomic status, neighborhood, and other factors are statistically controlled in an observational (or non-experimental) design, one cannot be certain that all relevant factors are being considered.

Intervention active ingredients

The active ingredient of an intervention (sometimes referred to as intervention element [e.g., Hoffmann et al., 2014]) is the technique or process that leads to change in the intervention mechanism (Institute of Medicine, 2015). Interventions vary in how precisely they have specified active ingredients and the extent to which empirical evidence exists to support the specified or inferred active ingredients. Clearly identifying an intervention's active ingredient (or ingredients) represents a critical step in disseminating the program with fidelity. When the active ingredient is identified, focus can be placed upon developing a fidelity assessment to ensure

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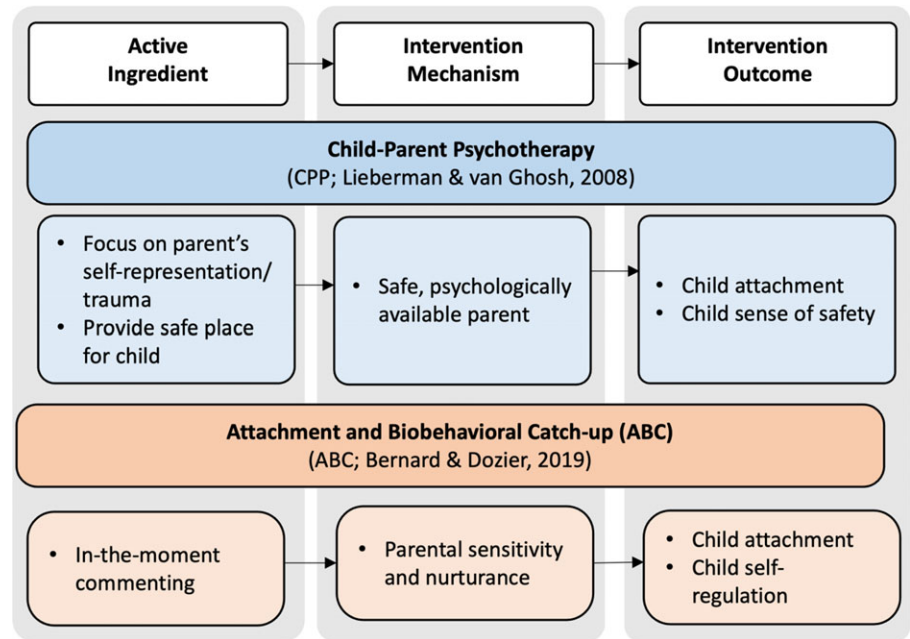


Figure 1. Active ingredients, intervention mechanisms, and outcomes for attachment and biobehavioral catch-up and Child-Parent Psychotherapy.

that the intervention active ingredient is being implemented as intended. Active ingredients of parent–infant interventions range from helping parents resolve experiences of trauma to viewing and discussing videos to directly observing and changing parents' behavior.

Intervention mechanisms

Hinshaw (2002), in a special issue of *Development and Psychopathology*, proposed that prevention scientists examine *how* interventions worked, rather than only *whether* they were effective. As Hinshaw pointed out, the question of how can be addressed by examining factors that mediate intervention effects on outcomes. The National Institute of Mental Health came to embrace this concept, emphasizing the importance of examining whether an intervention “engages the treatment mechanism” through its experimental therapeutics approach (e.g., Insel & Gogtay, 2014; Raghavan et al., 2019). The intervention mechanism is defined as the means by which the intervention has its effects on outcomes of primary interest through a proximal outcome (Institute of Medicine, 2015). Whereas assessing effects on long-term outcomes can take years, evaluating whether the intervention engages the intervention mechanism can be efficient and expedient. Therefore, the active ingredient (e.g., discussing videos) is expected to engage the intervention mechanism (e.g., parent responsiveness), which then affects child outcomes (e.g., child behavior regulation). As with active ingredients, intervention mechanisms are defined and tested to varying degrees by different models. Among the purported intervention mechanisms are changes in parents' behavior (e.g., responsiveness, management of child behavior), internal representations (e.g., representations of attachment experiences, mentalizing), and capacities (e.g., executive functioning, emotion regulation).

Expected intervention outcomes

Interventions targeting parenting are typically expected to enhance child outcomes. Such outcomes range from attachment to self-regulatory capabilities to brain development (e.g., Cicchetti et al., 2000, 2006; Valadez et al., 2020). Although some studies rely on parent-report of child functioning, differential expectations of

parents could lead to apparent intervention effects when such effects would not be seen using more objective measures (e.g., Hughes & Gullone, 2010). Relying on observational data or self-reports or reports from neutral parties (e.g., teachers, friends) rather than parent-report data obviates this problem.

RCT of child–parent psychotherapy

When Cicchetti and colleagues began their study of Child-Parent Psychotherapy, the program was then referred to as Infant-Parent Psychotherapy and Toddler-Parent Psychotherapy. Here we use the current term, Child-Parent Psychotherapy (CPP). Cicchetti and colleagues have conducted several randomized controlled trials of CPP that have yielded important results regarding CPP's effects on child outcomes (e.g., Cicchetti et al., 1999, 2000; Toth et al., 2006). Some of these results allow causal inferences regarding the effects of early experience.

CPP's active ingredient. Language regarding intervention active ingredients and mechanisms was not being used widely at the time Cicchetti et al. (1999) began their RCTs of CPP, and, as would be expected, these processes were not described fully in the original work. On the basis of personal communication with the intervention developer Alicia Lieberman (January, 2023) and the writing of Lieberman (Lieberman & Van Horn, 2008; Lieberman et al., 2005) and Cicchetti and colleagues (Cicchetti et al., 2000, 2006; Guild et al., 2017), we describe the active ingredients. In general, CPP's active ingredients can be seen as focusing on problematic representations the mother may have of herself or of her child, and providing a safe place for the child (Guild et al., 2017), as depicted in Figure 1. More specifically, when CPP is used with parents with a trauma history, active ingredients include helping the parent talk openly about her own or the child's traumatic experiences, and relatedly providing the child with a safe environment in which to process trauma experienced. The active ingredients when working with depressed parents include a focus on modifying mothers' distorted self-representations as well as enhancing parent-child communication.

CPP's intervention mechanism. On the basis of Cicchetti et al., (2000, 2006) and Toth et al., (2002, 2006), the intervention mechanism can be seen as the parent becoming a safe, available caregiver. In the case of trauma, parents effectively serving as trusted and safe caregivers (who would protect and provide a safe place for processing trauma) can be seen as the intervention mechanism. When CPP is used with depressed mothers and their young children, the alleviation of depression such that parents have the psychological resources needed to be available to their young children's needs is identified as an intervention mechanism (Cicchetti et al., 2000).

CPP with maltreated children. Given that maltreatment is often associated with a host of other risk factors (e.g., poverty, parental mental health problems, low resources), observational or non-experimental studies leave questions of causal inference largely unanswered. Cicchetti et al. (2006) conducted an RCT with maltreating parents examining intervention effects on child attachment disorganization which helped to disentangle parenting effects from other potential confounding factors. Participants were randomized to three conditions: CPP, a version of home visiting based on Nurse Family Partnership (Olds, 2006), and a no-treatment control. Intervention effects emerged in analyses in which only completers were included. (Intent-to-treat analyses, with participants considered regardless of whether they completed the intervention, did not yield significant treatment effects.) In the completers analyses, both the CPP and Nurse Family Partnership-type intervention showed lower rates of disorganized attachment than the no-treatment control. Mediation analyses did not provide support for engagement of an intervention mechanism, but it is important to stress that the study was under-powered for such analyses.

CPP with depressed mothers. In a large early clinical trial of CPP's effectiveness, Cicchetti et al., (1999, 2000; Guild et al., 2017; Toth et al., 2006) studied intervention effects among depressed mothers. Mothers and infants were randomized to either CPP or a control group receiving no intervention. As predicted, children in the CPP group showed secure attachments more often than children in the control group and greater change toward security from pre- to post-intervention (Cicchetti et al., 2006). Children in the CPP group also showed more normative cognitive development at age 3 than control group children (Cicchetti et al., 2000). The results provide support for the hypothesis that working to change mothers' internal representations and enhance mother-infant communication (i.e., active ingredients) leads to change in children's attachment and cognitive development (i.e., outcomes). Support was not provided for the engagement of the intervention mechanism (reducing maternal depression) driving the effects, but the study was under-powered for such analyses. Intent-to-treat analyses including all children yielded significant effects on attachment quality. This RCT is impressive in randomizing to condition and following dyads well beyond the intervention.

Overview of CPP studies. RCTs with high-risk families (e.g., maltreating parents, depressed parents) are extremely difficult to conduct. Recruitment and retention are often challenging, making intent-to-treat analyses under-powered. These early RCTs by Cicchetti and colleagues examining the efficacy of parent-infant interventions forged a path for the rest of us. Between the time these early studies were conducted and the present, the field of prevention science has evolved and the National Institute of Mental Health has

laid out guidelines for experimental therapeutics that have helped refine the study of RCTs (e.g., Insel & Gogtay, 2014; Raghavan et al., 2019).

RCTs of attachment and biobehavioral catch-up

Following in the footsteps of Cicchetti and colleagues, we have tested the parenting program we developed (Attachment and Biobehavioral Catch-up, or ABC; Dozier & the ABC Lab, 2023) through multiple randomized controlled trials. In our lab, ABC has been examined through RCTs with high-risk birth parents involved in the child welfare system (e.g., Bernard et al., 2012), with foster parents of preschoolers (e.g., Raby et al., 2019), with parents adopting internationally (e.g., Lind et al., 2021), and with parents using substances identified prenatally (e.g., Tabachnick et al., 2022). Three different developmental models of ABC have been developed, with all sharing an emphasis on nurturing the distressed child, following the child's lead, and avoiding behaving in frightening ways. The infant version is the standard version without adaptations, and is intended for parents of infants between 3 and 24 months). The neonatal version (starting prenatally to 2–3 months of age) is adapted to help parents recognize subtle cues for engagement and disengagement of the young infant while focusing on nurturing the distressed infant and following the infant's lead. The early childhood version adds a focus on calming the dysregulated child to the standard ABC targets of nurturance and following the lead (starting 24–48 months of age). ABC for Early Childhood differs from other well-established early childhood interventions (e.g., Video-feedback Intervention to Promote Positive Parenting and Sensitive Discipline: VIPP-SD; Juffer et al., 2012, and Parent-Child Interaction Therapy: PCIT; Eyberg & Funderburk, 2010) in emphasizing the importance of the parent remaining psychologically and physically available to the dysregulated child rather than relying on time-out or other related strategies.

In our RCTs, we have randomized participants to ABC or to a control intervention that targets cognitive and motor development (Developmental Education for Families: DEF), and have used intent-to-treat analyses. Berlin and colleagues and Bernard and colleagues have also conducted RCTs of ABC (e.g., Hepworth et al., 2021), using active control conditions as well.

ABC's active ingredient. The active ingredient of ABC has been identified as "in-the-moment" comments made by parent coaches (Dozier & Bernard, 2019). These in-the-moment comments are made at a very high rate (i.e., at least once per minute) and bring attention to intervention targets. Comments are expected to have one or more of the following three components: 1) describe behavior (e.g., "he held up his toy, and you said, 'you've got your truck!'", 2) relate behavior to intervention target (e.g., "that's such a great example of following his lead."), and 3) relate behavior to child outcome (e.g., "that helps him know he has an effect on the world."). The frequency of in-the-moment comments and the average number of components included in comments predict change in the intervention mechanism, parental sensitivity (Caron et al., 2018).

ABC's intervention mechanism. Parental sensitivity is identified as ABC's intervention mechanism. Changes in child outcomes are expected to occur as the result of changes in parental sensitivity. Sensitivity is assessed through observations of children and parents engaged in free play. Changes in parental sensitivity have been shown to mediate intervention effects on a host of intervention outcomes, including inhibitory control (Lind et al., 2021), language

development (Raby *et al.*, 2019), and diurnal cortisol production (Garnett *et al.*, 2020). We acknowledge that, while the precision in specifying, testing, and having evidence for the intervention mechanism represents a strength, our assessment of sensitivity has focused on sensitivity under positive affect conditions (which is referred to as “following the child’s lead”) rather than nurturance of the distressed child. Opportunities for nurturing the distressed child are seen much less frequently than opportunities for following the lead, making it difficult to assess in brief observations.

ABC’s RCT outcomes. Across the RCTs of ABC in our lab, parents (typically mothers) and their infants have been randomized to ABC or the control intervention, Developmental Education for Families (DEF). DEF is of the same duration, frequency, and setting as ABC. Our primary early outcomes were attachment and physiological regulation (i.e., diurnal cortisol production). In infancy, intervention effects emerged for attachment quality, with ABC children showing secure attachments more often and disorganized attachments less often than children in the DEF condition (Bernard *et al.*, 2012). Diurnal cortisol production was more normative (i.e., a steeper wake-up to bedtime slope) in the ABC condition than in the DEF condition (Bernard *et al.*, 2015a), with these effects sustained over time (Bernard *et al.*, 2015b; Garnett *et al.*, 2020). Other differences in infancy/early childhood include better receptive vocabulary (Raby *et al.*, 2019), executive functioning (Lind *et al.*, 2017), inhibitory control (Lind *et al.*, 2021), autonomic nervous system regulation (Tabachnick *et al.*, 2022), and more optimal DNA methylation profiles (Hoye *et al.*, 2019) among ABC relative to DEF children.

In middle childhood, children in the ABC condition reported higher ratings of trust in their mothers than reported by children in the DEF condition (Zajac *et al.*, 2020). They also showed greater maternal cue-related activation than DEF children in clusters of brain regions including the precuneus, cingulate gyrus, and hippocampus, regions associated with social cognition (Valadez *et al.*, 2020). Other middle childhood effects have included better autonomic nervous system regulation (Tabachnick *et al.*, 2019), enhanced inhibitory control (Korom *et al.*, 2021), and more mature patterns of amygdala-prefrontal cortex connectivity (Valadez *et al.*, 2024) among ABC relative to DEF children.

The current study

The current study examined ABC intervention effects on adolescent reports of closeness with their mothers, specifically asking about the emotional support and approval they felt they received from their mothers, and the companionship and closeness they felt with them, using the Network of Relationships Inventory-Relationships Quality Version (referred to subsequently as Network of Relationships Inventory: Buhrmester & Furman, 2008). Participants were referred to the study in infancy from a diversion from foster care program within the child welfare system and were randomized to receive the ABC or DEF intervention. Children were assessed annually in infancy and early childhood, in middle childhood (ages 8, 9, and 10) and in adolescence (ages 13, 14, and 15). A low-risk comparison group was added during middle childhood. Given intervention effects on attachment in infancy and (self-reports of attachment in) middle childhood, we predicted that children in the ABC group would report closer relationships with their mothers than children in the DEF group during adolescence.

Methods

Participants

Data for this project were collected in the context of a longitudinal study designed to test the efficacy of the ABC intervention. The sample size was determined by the number of adolescents who completed questionnaires regarding their relationship with their mothers at age 14. The intervention sample was enrolled when children were infants. At the time of enrollment of the intervention sample, 212 families consented to participate and were randomized into one of the two intervention conditions. A low-risk comparison sample who had no CPS involvement was enrolled during middle childhood through local community centers and schools.

The study sample consisted of 142 adolescents. A total of 152 participants completed questionnaires, but 8 participants were removed from analyses because they either reported they did not have a mother figure in their life or selected “other” for mother figure on Network of Relationships Inventory (Buhrmester & Furman, 2008), and two additional participants were removed due to implausible data. There were no significant differences between the participants removed from the sample and the final analytic sample. Table 1 provides demographic data for the full sample and for each of the three groups.

Procedure

Parents were recruited and referred to the original RCT during a three-year period. During children’s infancy, parent and child dyads were randomly assigned to either ABC or the control intervention (DEF). At age 14, adolescents completed the Network of Relationships Inventory (Buhrmester & Furman, 2008). Parents of participating adolescents gave informed consent for their child’s participation and adolescents assented. The study’s research protocol was approved by the Institutional Review Board at the University of Delaware.

Experimental intervention: Attachment and biobehavioral catch-up (ABC) intervention

The ABC intervention was developed with the goal of enhancing attachment quality and self-regulation for infants who experienced early adversity. Target behaviors of ABC focus on parents nurturing their distressed child, following the child’s lead when the child is not distressed, and avoiding frightening behaviors (Dozier & Bernard, 2019). The intervention is implemented weekly in the families’ homes, with 10 sessions each lasting about one hour. Trained parent coaches deliver the intervention, focusing on specific content that relates to the target behaviors.

Control Intervention: Developmental education for families (DEF)

DEF was designed to be similar to ABC in frequency, duration, and setting. The intervention was based loosely on the Abecedarian Program (Ramey, 2019), but omitted elements related to parental responsiveness to ensure that ABC and DEF were sufficiently distinct. Parent coaches provided educational information about developmental milestones for children and helped children engage in activities with their parents designed to enhance their cognitive and motor development.

Table 1. Demographic characteristics by intervention group

	Overall (N = 142)	ABC (N = 47)	DEF (N = 45)	Low-risk Group (N = 50)
Average Child Age at 14 (SD)	14.34 (0.36)	14.37 (0.39)	14.29 (0.34)	14.36 (0.34)
Child Sex – n male (%)	72 (50.70%)	26 (55.32%)	19 (42.22%)	27 (54.00%)
Child Race – n (%)				
Black/African American	70 (49.30%)	26 (55.32%)	27 (60.00%)	17 (34.00%)
White	11 (7.75%)	3 (6.38%)	0 (0.00%)	8 (16.00%)
Biracial	41 (28.87%)	13 (27.66%)	12 (26.67%)	16 (32.00%)
Other	16 (11.27%)	3 (6.38%)	5 (11.11%)	8 (16.00%)
Unknown/Refused to answer	4 (2.82%)	2 (4.26%)	1 (2.22%)	1 (2.00%)
Child Ethnicity – n (%)				
Non-Hispanic or Latino	103 (72.54%)	35 (74.47%)	30 (66.67%)	38 (76.00%)
Hispanic or Latino	35 (24.65%)	10 (21.28%)	14 (31.11%)	11 (22.00%)
Unknown/Refused to Answer	4 (2.82%)	2 (4.26%)	1 (2.22%)	1 (2.00%)
Average Parent Age (SD)	39.59 (5.66)	39.34 (6.02)	38.06 (5.35)	41.21 (5.25)
Parent Employment Status – n (%)				
Employed	95 (66.90%)	27 (57.45%)	23 (51.11%)	45 (90.00%)
Unemployed	43 (30.28%)	18 >(38.30%)	21 (46.67%)	4 (8.00%)
Unknown/Refused to Answer	4 (2.82%)	2 (4.26%)	1 (2.22%)	1 (2.00%)
Parental Education – n (%)				
Less than High School Degree	21 (14.79%)	14 (29.79%)	6 (13.33%)	1 (2.00%)
High School Degree or GED	62 (43.66%)	21 (44.68%)	28 (62.22%)	13 (26.00%)
Some College	38 (26.76%)	10 (21.28%)	8 (17.78%)	20 (40.00%)
Bachelor's Degree or higher	16 (11.27%)	0 (0.00%)	1 (2.22%)	15 (30.00%)
Unknown/Refused to Answer	5 (3.52%)	2 (4.26%)	2 (4.44%)	1 (2.00%)
Average Household Income (SD)	45548.68 (41412.32)	27717.93 (23471.75)	26686.43 (19148.70)	70607.32 (48798.95)

Measures

Parental sensitivity in infancy

Parental sensitivity was assessed for families in the ABC and DEF groups at one month post-intervention, and when the children were 12 months and 24 months old. If children's post-intervention assessment was within several months of their 12 or 24 month assessment, only one assessment was conducted. Videos of parent and children interaction were coded for sensitivity to non-distress as described in previously published protocols (Bernard et al., 2015a; Bick & Dozier, 2013). Forty percent of the videos were double coded (ICC = .70), with scores averaged across double coders for analyses. If multiple assessments of sensitivity were available (e.g., post-intervention, 12 months, and 24 months), scores were averaged across assessments.

Network of relationships inventory

When participants were 14 years old, they completed the Network of Relationships Inventory (Buhrmester & Furman, 2008). The Network of Relationships Inventory is a validated, self-report questionnaire used to assess the child's perception of relationship qualities with several members of the participant's social network, including mother, father, sibling, friend, romantic partner, and teacher (Buhrmester & Furman, 2008). The Network of

Relationships Inventory consists of 30 questions and uses a five-point Likert-scale response format which asks how often the participants experience each circumstance or emotion. For example, an item from the Emotional Support subscale reads "How much do you seek out your mother when you're upset?"

The inventory consists of two composite scale scores. The first, Closeness, is a composite of the positive subscales, Companionship, Intimate Disclosure, Emotional Support, Approval, and Satisfaction. The second, Discord, is a composite of the negative subscales, Conflict, Criticism, Pressure, Exclusion, and Dominance. Internal reliability of the subscales ranged from good to excellent ($\alpha = .78-.93$) in the current study.

Statistical methods

Data were analyzed using the statistical software R, version 3.63 (R Core Team, 2021). Data were visualized with histograms and q-q plots and checked for normality using the Anderson-Darling test of Normality. The data were deemed non-normal based on the visuals and the results of the tests for normality ($p = .002$); therefore, nonparametric analyses were used. Kruskal-Wallis tests were used as a nonparametric alternative to one-way ANOVA to assess the impact of group (ABC, DEF, Low-Risk comparison) on parent-adolescent relationship quality. Significant effects were

further investigated for pairwise comparisons using the “nparcomp” package. This method has been shown to be a robust methodology for nonparametric multiple comparisons using Tukey’s method (Konietschke et al., 2015). For preliminary analyses, continuous variables were summarized with means (standard deviations) and differences were tested with Student’s *t*-test; categorical variables were summarized with frequencies (percentages) and differences were tested with Fisher’s exact tests, Pearson’s Chi-Square or analyses of variance (ANOVA). Analyses used *p* values <.05 to evaluate significance.

Results

Preliminary analyses

Adolescents in the ABC, DEF, and Low-Risk comparison conditions (referred to as Intervention Groups) did not differ on child age, $F(2, 140) = 0.66, p = .523$, or sex at birth, $\chi^2(2, 142) = 1.91, p = .384$. Race differed by Intervention Group $\chi^2(6, 138) = 13.93, p = .030$. Specifically, the Low-Risk sample differed from the ABC and DEF groups, with more children identifying as Black/African American in the ABC and DEF groups than in the Low-Risk group. Children in the ABC and DEF groups did not differ significantly from one another in terms of race. The three groups did not differ in ethnicity (i.e., identifying as Hispanic/Latino), $\chi^2(2, 138) = 1.42, p = .491$. There was a significant difference in parental age across groups, $F(2, 140) = 4.24, p = .017$, with Low-Risk mothers significantly older than the mothers in the DEF group ($p = .019$). ABC and DEF mothers did not significantly differ in age. The Low-Risk group had significantly higher income than the ABC and DEF groups (p values <.001), but the ABC and DEF groups did not differ significantly from one another. Parents in the Low-Risk group were more often employed than parents in the ABC and DEF groups (p values <.001), but there were no significant differences between the ABC and DEF groups. Parents in the Low-Risk group had more education than parents in the ABC and DEF group (p values <.001), but the ABC and DEF groups did not differ significantly from one another. For descriptive statistics by Intervention Group, see Table 1.

Primary analyses

Nonparametric ANOVAs were used to examine Intervention Group (ABC, DEF, and Low-Risk) differences in parent-adolescent relationship quality. The composite subscales, Closeness and Discord, from the Network of Relationships Inventory were examined first. As seen in Figure 2, there were significant Intervention Group differences in Closeness, $\chi^2(2, 142) = 6.95, p = .031$, with pairwise comparisons indicating that ABC adolescents rated their relationships more favorably than DEF adolescents ($p = .037$) and a marginally significant difference between Low-Risk and DEF adolescents ($p = .079$). There were no significant Intervention Group differences for Discord, $\chi^2(2, 142) = 0.50, p = .781$.

Informed by analyses with the composite scales, only the positive subscales were examined for Intervention Group differences. As depicted in Figure 3, there were significant Intervention Group differences on the Approval subscale, $\chi^2(2, 142) = 10.83, p = .004$, with pairwise comparisons indicating that adolescents in the ABC and the Low-Risk groups rated their mothers higher in approval than adolescents in the DEF group ($p = .048$ and $p = .001$, respectively). Adolescents in the ABC and Low-Risk groups did not differ significantly from one another on the Approval subscale.

As depicted in Figure 4, Intervention Groups differed on the Companionship scale, $\chi^2(2, 142) = 7.51, p = .023$, with adolescents

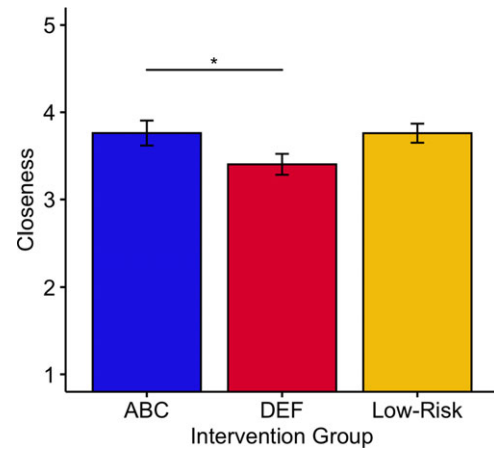


Figure 2. Intervention group effects on closeness.

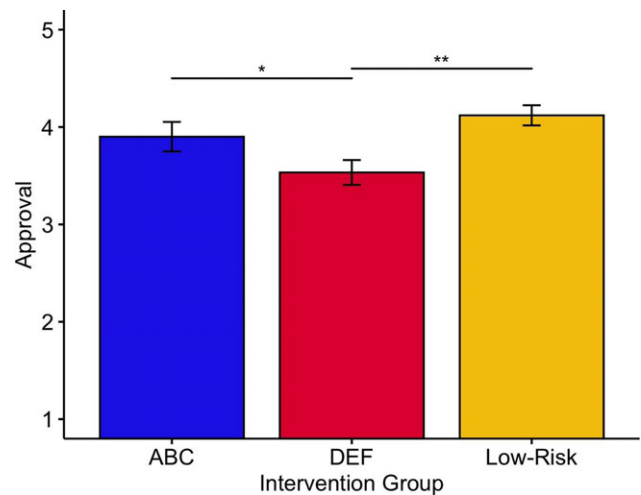


Figure 3. Intervention group effects on approval.

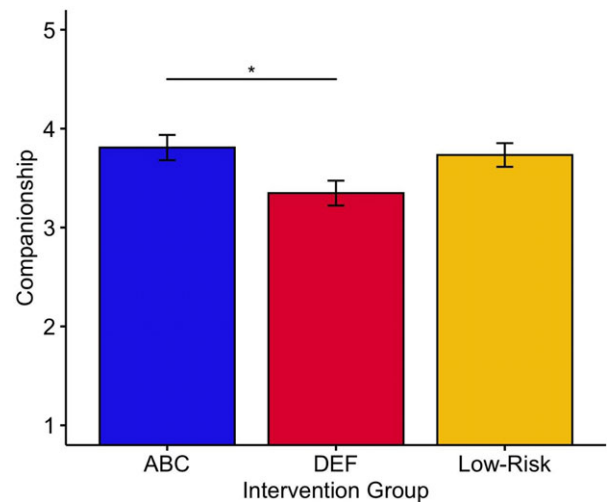


Figure 4. Intervention group effects on companionship.

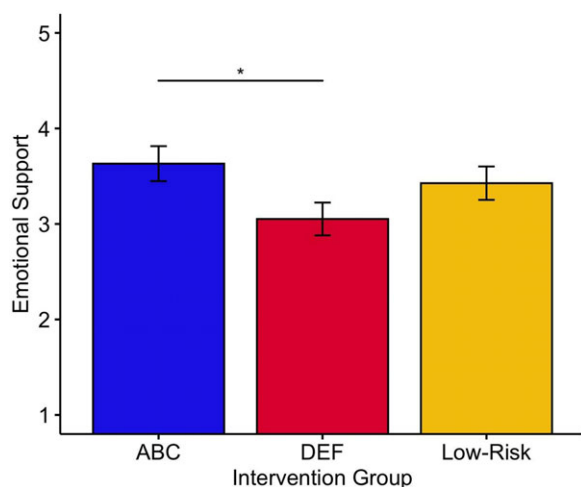


Figure 5. Intervention group effects on emotional support.

in the ABC group rating their companionship with their mothers higher than adolescents in the DEF group ($p = .024$). There was also a marginally significant difference with the Low-Risk group tending to rate companionship with their mothers higher than the DEF group ($p = .076$). The ABC and Low-Risk group did not significantly differ from one another on the Companionship scale.

As seen in Figure 5, there was a significant Intervention Group difference on the Emotional Support scale, $\chi^2(2, 142) = 6.25$, $p = .044$, with adolescents in the ABC group rating the emotional support they received from their mothers higher than rated by adolescents in the DEF group ($p = .030$). The Low-Risk group did not significantly differ from the ABC and DEF groups.

The Intervention Groups did not differ significantly on the Satisfaction subscale or the Intimate Disclosure subscale (p values $> .05$).

Maternal sensitivity as mediator of intervention effects on adolescent relationship with mother

Maternal sensitivity data during infancy were available for families in the ABC and DEF groups. The Low-Risk comparison parents did not have sensitivity data in infancy as they were recruited when children were in middle childhood. A nonparametric mediation analysis was conducted to determine if maternal sensitivity during infancy mediated intervention effects on adolescents' ratings of their relationships with their mothers. The "Rfit" package (Kloke & McKean, 2023) was used to conduct nonparametric regression in order to assess the relationships between Intervention Groups and Sensitivity on the relationship quality subscales. The "mediation" package was used with nonparametric bootstrapping of 5000 simulations (Tingley et al., 2014).

A total of 70 mothers ($n = 34$ and 36 for ABC and DEF, respectively) had Sensitivity data in infancy, with Sensitivity data missing for 22 mothers. As seen in previous studies (e.g., Lind et al., 2020), ABC mothers were rated higher on Sensitivity than DEF mothers ($M = 2.4[1.01]$ and $M = 1.96[.79]$, respectively). Sensitivity in infancy was not significantly associated with adolescent-reported Closeness on the Network of Relationships Inventory ($\beta = .17$, $SE = .13$, $p = .189$). There was no support for Sensitivity mediating the association between Intervention Group and the Network of Relationships Inventory subscales ($p > .05$). Figure 6 depicts the mediational model and path coefficients.

Discussion

Following the example of Dante Cicchetti and colleagues (e.g., Cicchetti et al., 1999, 2000, 2006), we used a randomized controlled trial to assess the efficacy of a parenting program. In this study, we examined the effects of ABC on adolescents' relationships with their parents years after the intervention was implemented. As Cicchetti and colleagues pointed out, the RCT allows us to examine experimentally the effects of early experience. This approach is powerful in allowing causal claims regarding the effects of parenting on children's developmental outcomes.

ABC, a 10-session home visiting program targeting parental sensitivity as the intervention mechanism, had a significant effect on adolescents' report of the closeness and companionship they felt with their mothers, and the emotional support and approval they felt they received from their mothers 12 years after the home visiting program was implemented. This finding demonstrates the power of a brief early intervention to affect adolescents' relationships with their mothers many years after the intervention. The finding is in line with a host of other attachment-related effects of the ABC intervention seen from infancy through middle childhood, extending effects into adolescence. Previous findings have shown that ABC's effects on children's trust in their relationships with their mothers extended from behavioral to representational, with ABC children developing more secure and organized attachments than control children in infancy (Bernard et al., 2012), showing less anger at their mothers in early childhood (Lind et al., 2014), and expressing more trust in their mothers during middle childhood (Zajac et al., 2020) than control group children. Sustained attachment-related effects have also been seen for ABC mothers, with more differentiated neural activity when viewing babies' emotion faces (Bernard et al., 2015c) and more secure attachment script narratives relative to DEF mothers (Raby et al., 2021). The present findings are exciting in providing the first evidence that implementing ABC in infancy has an impact on how children view their own mothers in adolescence. Given that adolescence represents a time of significant risk for emerging psychopathology, supportive relationships with parents can be particularly important in buffering children from risk and enhancing resilience (Cicchetti & Rogosch, 2002; Cicchetti, 2023; Doyle & Cicchetti, 2017).

Previous findings have demonstrated that parental sensitivity is an intervention mechanism of ABC, functioning as a mediator of the association between intervention and various child outcomes, such as inhibitory control (Lind et al., 2017), receptive language (Raby et al., 2019), and diurnal cortisol production (Garnett et al., 2020). Although ABC was associated with enhanced maternal sensitivity and with adolescents' report of closeness with their mothers in the current study, we did not find significant support for sensitivity functioning as the intervention mechanism.

Our findings fit with seminal findings of Cicchetti and colleagues (Cicchetti et al., 1999, 2000, 2006; Toth et al., 2006) that demonstrated to the field that an early intervention (and by extension, changes in parenting) can enhance children's attachment quality. Subsequent to Cicchetti and colleagues, other parent-infant interventions have been developed that have shown striking effects over time. In addition to ABC, van Ijzendoorn et al. (2022) have conducted multiple RCTs of Video-feedback Intervention to Promote Positive Parenting and Sensitive Discipline (VIPP-SD: Juffer et al., 2012), demonstrating strong effects of a brief intervention on children's attachment and other outcomes.

Cicchetti and colleagues have made the case that early experience sets the stage for developmental trajectories, with successful resolution of early developmental tasks having

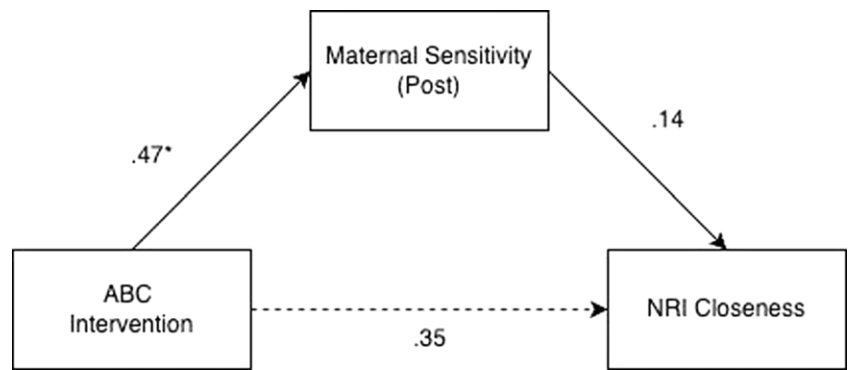


Figure 6. Mediation pathway for ABC predicting closeness via maternal sensitivity (ns).

important, cascading consequences for the resolution of later developmental tasks (Masten & Cicchetti, 2010). The parent serves as a critical co-regulator for the infant, with successful experience in co-regulating allowing the child to gradually take over these regulating functions him or herself. Understanding how an early intervention could affect children's outcomes many years later can best be understood in this context. Parenting interventions that enhance the parent's ability to serve as a successful co-regulator result in children developing better regulated autonomic nervous system functioning (Tabachnick et al., 2022) and better regulated hypothalamus–pituitary–adrenal functioning (Bernard et al., 2015a), both of which support more adequate emotion and behavior regulation. At the level of brain development, effective early interventions can result in more mature amygdala–prefrontal cortex connectivity (Valadez et al., 2024), again supporting emotional and behavioral regulation. At a behavioral level, children whose parents become more responsive as the result of early intervention display less anger toward parents (Lind et al., 2014) and are better able to regulate their emotions and behaviors (Lind et al., 2020) than children whose parents do not receive early intervention. Thus, through early intervention, children are set on trajectories more likely to result in positive mental health outcomes rather than in psychopathological outcomes.

Strengths of the current study include the randomized controlled design, the long follow-up of children from a high-risk sample, and the use of a well-validated measure to assess adolescents' relationships with their mothers. Weaknesses include significant attrition and the related issue of under-powered mediation analyses. In addition, behavioral assessments of adolescents' relationships with their mothers would strengthen the design.

Conclusion

We emphasize several key take-aways of this paper that we hope may be useful for future research directions.

1. Power of RCTs. As Cicchetti et al. (2000; Cicchetti & Hinshaw, 2002) have emphasized, strong causal inferences regarding the effects of early experience and parenting are possible when using RCTs. The impact of a parenting intervention focused on enhancing parental responsiveness can be seen on attachments early (Bernard et al., 2012; Cicchetti et al., 2006) with this impact continuing over time. An example of a powerful RCT is the Bucharest Early Intervention Project (BEIP; Nelson et al., 2014). For decades, problematic effects of orphanage or institutional care had been documented (e.g., Bowlby, 1951; Rutter, 1998; Spitz, 1946). Factors other than the problematic conditions of orphanages were always potential causes of the outcomes, however. The BEIP, in randomizing children to foster families or to

treatment as usual (which was typically continued orphanage placement at least for the short-term), could provide causal evidence that it was the orphanage care itself that led to problematic outcomes (e.g., Fox et al., 2017).

2. Importance of specificity in intervention development. Following the point that RCTs can allow causal inferences, intervention active ingredients (or elements) and intervention mechanisms need to be carefully defined (Hinshaw, 2002; Insel & Gogtay, 2014). Defining these processes is important in understanding how the intervention affects development, and by extension, how environmental factors affect child outcomes. These definitions of intervention active ingredients and mechanisms are also central to knowing what features of the intervention should be preserved such that the intervention is effective when implemented by others.

As discussed, making in-the-moment comments is the active ingredient of ABC. Prior to defining this intervention active ingredient, we had difficulty screening potential parent coaches who would be successful in implementing ABC or in providing clear feedback regarding progress. Defining it gave us the basis for a screening measure and for developing a quantifiable measure that could provide regular assessments of progress toward certification (Caron & Dozier, 2019, 2022).

Defining the intervention mechanism (i.e., parental sensitivity) has also been important for ABC. As we implement ABC nationally and internationally, sites often do not have the resources to assess child outcomes. However, they can (and are required to) assess parental responsiveness at pre- and post-intervention assessments. These assessments can demonstrate whether ABC is effectively engaging the intervention mechanism at implementation sites around the country and around the world. Indeed, when looking at community sites we see moderate to large effect sizes in pre- to post-intervention sensitivity, rivaling what we see in our RCTs (Roben et al., 2017).

As developmental psychopathologists and certainly as prevention scientists, a key aim is developing an intervention that can have an impact on children and families – or adapt an existing intervention to enhance its impact. This paper has only touched on several key issues in implementation – the importance of defining intervention active ingredients and mechanisms. There are many other issues beyond the scope of this paper that are important to consider in implementing an intervention (see Bauer & Kirchner, 2020).

3. Role of early experience. The work of Dante Cicchetti and colleagues (e.g., Cicchetti et al., 2000, 2006; Russotti et al., 2021; Toth et al., 2006) has illuminated the importance of early experience in setting the stage for later developmental outcomes. Early experience is not deterministic but rather sets the young child on a trajectory with subsequent skills and experiences dependent on these early capabilities (Masten & Cicchetti, 2010; Raby et al., 2015). As Masten and Cicchetti (2010) pointed out, well-timed

interventions that address critical targets have the opportunity to alter problematic trajectories. Given that brain and behavioral systems are especially plastic early, intervening early is key. Cicchetti and colleagues' work in assessing effects of Child-Parent Psychotherapy has been seminal in providing empirical evidence in support of these claims.

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