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ATTENTION-DEFICIT/HYPERACTIVITY DISORDER



# Targeting Peer Contagion Dynamics in Children with ADHD: Effects from a Two-Site Randomized Controlled Trial

Sébastien Normand [a,b], Maude Lambert [c], Roger Bakeman [d], Joanna Guiet [a], Mara Brendgen [e,f], and Amori Yee Mikami [g]

[a]Département de Psychoéducation et de Psychologie, Université du Québec en Outaouais; [b]Institut du Savoir Montfort, Hôpital Montfort; [c]Development & Rehabilitation, Children's Hospital of Eastern Ontario; [d]Department of Psychology, Georgia State University; [e]Department of Psychology, Université du Québec à Montréal; [f]CHU Sainte-Justine Research Center; [g]Department of Psychology, University of British Columbia

**ABSTRACT**

**Objective:** Parental Friendship Coaching (PFC) teaches parents to coach their children in friendship skills. This paper examines whether PFC fosters positive peer contagion processes (i.e. dyadic mutuality) and reduces negative peer contagion processes (i.e. coercive joining) within the friendships of children with attention-deficit/hyperactivity disorder (ADHD).

**Method:** Participants were 134 families of children with ADHD and peer problems (age 6–11 years; 69% male; 72% white) at two Canadian sites, randomized to PFC or CARE (an active comparison intervention). Children were observed in the lab at baseline, post-treatment, and at 8-month follow-up during cooperation and competition tasks with a real-life friend. Amount and reciprocity of dyadic mutuality indicators (i.e. positive affect and positive behaviors) and coercive joining indicators (i.e. aggressive, controlling, and rule-breaking behaviors) between friends were coded.

**Results:** Across treatment conditions, children showed an increase in the amount of dyadic mutuality during cooperation and a decrease in the amount of coercive joining during competition over time. Relative to CARE, PFC induced a reduced amount of coercive joining behaviors during cooperation at post-treatment and follow-up. However, PFC led to decreases in the reciprocity of positive affect during cooperation at post-treatment and to increases in the reciprocity of coercive joining during competition at follow-up relative to CARE. Moderation analyses suggest PFC was associated with better outcomes for children with externalizing comorbidity, and for those with a stable or a best friend.

**Conclusions:** Findings highlight the importance of transactional processes, contextual differences, externalizing comorbidities, and friendship status when assessing the efficacy of PFC.

Friendships are significant dyadic relationships that contribute to children's social, emotional, and psychological functioning (Bagwell et al., 2021). The majority of children with attention-deficit/hyperactivity disorder (ADHD) experience friendship problems, including being friendless, forming low-quality and short friendships, and befriending peers with behavioral problems (Spender et al., 2023). Observational studies also indicate children with ADHD interact poorly with their friends, often adopting an insensitive and self-centered approach to negotiations and breaking rules during games (Normand et al., 2013; Spender et al., 2023).

Peer problems in ADHD may worsen over time and are often resistant to treatment, especially when outcomes are assessed by informants unaware of treatment (Mikami, Owens, et al., 2022; Normand et al., 2013). Reviewing the scientific literature from the last 60 years, evidence-based treatment reviews for ADHD have classified social skills training as "having limited evidence of clinical efficacy" and "not an evidence-based intervention" for addressing peer problems in children with ADHD (Evans et al., 2018). The Parental Friendship Coaching (PFC) intervention is a promising approach teaching parents to coach their elementary school-aged children in targeted friendship behaviors that are suggested to help children develop good friendship quality and that are lacking in children with ADHD (Mikami & Normand, 2022). This paper examines whether PFC influences the transactional, reciprocal influence processes (i.e., peer contagion) within the friendships of children with ADHD.

## *Parental Friendship Coaching*

PFC consists of parent-only groups, with no child treatment component, because parents are uniquely positioned to facilitate their children's friendships during

**CONTACT** Sébastien Normand sebastien.normand@uqo.ca Département de Psychoéducation et de Psychologie, Université du Québec en Outaouais, 283 Alexandre Taché Boulevard, Gatineau, QC J8X 3X7, Canada

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the elementary school years (Mikami & Normand, 2022). Parents are involved in organizing and supervising playdates, which are the real-world contexts in which friendships develop, at least in Western societies (Mikami & Normand, 2022). Parents can give in vivo reminders and reinforcements to encourage children's good friendship behaviors in the heat of the moment when the child and peer are playing. Involving parents as friendship coaches may therefore address barriers found in clinic-based social skills training where children with ADHD fail to generalize learned skills outside of sessions (Evans et al., 2018). PFC encourages parents to (a) establish a positive parent – child relationship so that children are receptive to parental feedback; (b) coach children to display skilled friendship behaviors (e.g., game-playing skills, conversation skills, emotion regulation skills); and (c) facilitate opportunities for children to demonstrate and practice good friendship behaviors by networking with other parents and arranging playdates.

In a pilot study involving 62 families of children with ADHD (ages 6–10) randomized to PFC versus no treatment, parents in PFC reported their children to show better friendship behaviors at post-treatment (Mikami, Lerner, et al., 2010). Specifically, parents reported that children had less aggressive and argumentative behavior during playdates, and higher social skills. Child demographics or comorbidities did not moderate these treatment effects. Recently, our team tested the relative efficacy of PFC versus an active comparison treatment, a psychoeducational/parent support intervention (Coping with ADHD through Relationships and Education; CARE), in 172 elementary school-aged children with ADHD (ages 6–11; Mikami et al., 2020). In contrast to CARE, PFC was associated with more positive and less negative friendship behaviors on some questionnaires and observations at post-treatment and 8-month follow-up, but these changes did not translate into better overall friendship quality (i.e., the amount of positive and negative features of a friendship; Bagwell et al., 2021). However, PFC improved friendship quality on questionnaires and observations at post-treatment and follow-up for children with ADHD and a comorbid externalizing disorder. Many children with ADHD, and especially those with comorbid externalizing problems, tend to overestimate their social competencies, making them an especially resistant group to behavioral treatment (Mikami, Calhoun, et al., 2010). Because PFC is a parent-only treatment (with no child component) that focuses on increasing child receptivity to parent coaching and on parents changing the social context in a way to facilitate friendship, it may have helped to bypass some of the defensiveness in children with ADHD and externalizing comorbidity.

However, Mikami et al. (2020) examined friendship outcomes in a fairly global way using macrolevel analyses (e.g., global ratings of closeness), frequencies of broad behaviors (e.g., prosocial behavior, aggressive behavior) or overall composites (e.g., positive and negative friendship quality). Although this approach was decided a priori to limit the number of analyses, it misses key nuances of friendships (and friendship difficulties) of children with ADHD. First, Mikami et al. (2020) considered friendship behaviors at the dyadic level, using the combined scores of the child and friend. This neglects the reciprocal or contingent behaviors that children and their friends display in response to one another over time. Second, Mikami et al. (2020) combined the observational data from a competitive and a cooperative task, but these tasks have different purposes. Whereas cooperation refers to acting together for a common goal in a coordinated way, competition implies a strive to outperform the other. Studies have historically examined them separately (Fonzi et al., 1997) and competent friendship requires the ability to adapt to both contexts (Fülöp, 2022). Third, Mikami et al. (2020) did not consider potentially important friendship behaviors (i.e., preference sharing, controlling behavior, rule-breaking behavior) that distinguish children with ADHD from their typically developing peers (Normand et al., 2013). Overall, the approach used by Mikami et al. (2020) did not consider reciprocal/transactional processes inherent in children's friendships, did not examine whether outcomes varied according to the context of the interaction, and missed important friendship behaviors. The current paper thus examined potential treatment effects when using more nuanced, dynamic friendship outcomes.

### *Peer Contagion Dynamics within the Friendships of Children with ADHD*

Some scholars argue it is important to consider the transactional, reciprocal influence processes (referred to as peer contagion) and contextual influences when assessing intervention effects on peer relationships (Bagwell et al., 2021; Dishion & Tipsord, 2011; Piehler, 2016). This might be especially important during middle childhood, when friendships represent a context where children learn and practice key social skills that carry over into intimate relationships in adolescence and adulthood. Over the course of middle childhood, children are increasingly able to engage in communication patterns where they reciprocate the affect and behaviors of their friends (Bagwell et al., 2021). Peer contagion could lead to escalating positive behaviors (e.g., dyadic mutuality) or escalating negative behaviors

(e.g., coercive joining) in interactions between friends over time (Dishion & Tipsord, 2011).

Dyadic mutuality is a positive contagion process that includes two related, but distinct components: reciprocity of positive affect and reciprocity of positive behaviors (Harrist & Waugh, 2002). Coercive joining is a negative contagion process that occurs when one youth uses coercive behavior to demonstrate dominance over a friend to attain a specific goal, often leading to an escalation of coercive behavior among friends to control the interaction. When one friend backs down to avoid the aversive behavior, coercive behavior in the other is reinforced through escape conditioning (Dishion & Van Ryzin, 2011; van Ryzin & Dishion, 2013). Both peer contagion processes relate to friendship quality. Piehler and Dishion (2007) found that dyadic mutuality in adolescent-friend interactions was associated with self-reported positive friendship features, including satisfaction and intimacy in the friendship. Dishion and Van Ryzin (2011) found that friendship quality as reported by adolescents and their friends was negatively related to observed coercive joining. Nonetheless, it is unknown whether dyadic mutuality or coercive joining can be affected by intervention.

Emerging evidence suggests that children with ADHD show reciprocity in both dyadic mutuality and coercive joining indicators within their friendships (Normand et al., 2022). At the baseline (pre-treatment) timepoint for the participants in the current study, 164 dyads (consisting of a target child with ADHD and their real-life friend) were observed in the lab during a cooperative task to decide how to share a limited resource and during a fast-paced, engrossing, competitive task. Sequences of dyadic mutuality (i.e., reciprocity of positive affect and positive behaviors) and coercive joining (i.e., reciprocity of aggressive, controlling, and rule-breaking behaviors) were coded. Target children reciprocated their friends' positive affect in both tasks. They reciprocated their friends' positive behaviors only in the cooperative task and reciprocated their friends' coercive behaviors only in the competitive task. Across tasks, medium to large reciprocity effects (i.e., odds ratio values of 2.00 or above) were found for 36–53% (dyadic mutuality) and 38–55% (coercive joining) of target children (see Normand et al., 2022).

These results extended findings of peer contagion processes to the friendships of children with ADHD and suggest that contagion may depend on the interaction context. The current study builds on Normand et al. (2022) to examine whether PFC influences the tendency of children with ADHD (whose parents received treatment) to show reciprocity in peer contagion processes within their friendships according to the context of the interaction (i.e., cooperation versus competition), and whether these treatment effects varied based on child characteristics such as comorbid externalizing disorders (found to moderate treatment effects of PFC on friendship quality; Mikami et al., 2020).

## The Current Study

Following the recommendation in a recent review on children's friendships to investigate positive and negative dynamic processes within friendships over time (see Bagwell et al., 2021), we used a randomized controlled trial and time-window sequential analyses to examine treatment effects on positive peer contagion (i.e., dyadic mutuality) processes and negative peer contagion (coercive joining) processes. We assessed both the *amount* (i.e., the probabilities or percentages) and the *reciprocity* (i.e., peer contagion) of the indicators of dyadic mutuality and coercive joining. Whereas the analyses of amount allow examining static treatment effects on the prevalence of dyadic mutuality and coercive joining, the analyses of reciprocity permit granular assessments of contingent behavior chains between friends (i.e., peer contagion).

### Research Question 1: Effects of Treatment Condition

Our primary research question tested the effects of PFC versus CARE on peer contagion processes at post-treatment and at 8-month follow-up, as a reanalysis of Mikami et al. (2020). As an initial step, we explored general trends over time in amount and reciprocity of dyadic mutuality and coercive joining indicators when collapsing across treatment conditions. In their naturalistic study, Normand et al. (2013) found that children with ADHD exhibited more insensitive behaviors toward their friends during cooperation and displayed more rule-breaking behaviors during competition over 6 months (ESs were medium). Dyadic mutuality may similarly decline and coercive joining increase over time in the current sample. However, all children in the current sample were receiving treatment, whereas those in Normand et al. (2013) were not.

As the next step, we compared children randomized to PFC relative to those randomized to CARE on the indicators of peer contagion processes. Maintained treatment effects would be evidenced by PFC effects occurring both at post-treatment and follow-up, whereas sleeper effects would be evidenced by PFC effects appearing at follow-up for the first time. We expected that children in the PFC condition would exhibit a higher amount and reciprocity of dyadic mutuality indicators and a lower amount and reciprocity of coercive joining

indicators at post-treatment and follow-up (i.e., immediate and maintained effects) compared to children in CARE.

### Research Question 2: Moderators of Treatment Effects

In line with the findings in Mikami et al. (2020), we expected children with ADHD and a comorbid externalizing disorder to show a better treatment response to PFC than children with ADHD without a comorbid externalizing disorder at post-treatment and follow-up.

## Method

### Participants

Participants in the current study were 134 children with ADHD and peer impairment (referred to as "target children"), all of whom were taking part in a randomized controlled trial evaluating interventions for friendship problems (described in Mikami et al., 2020). Each target child participated with one parent (mostly mothers; 91%). Participants were recruited from hospitals, clinics, and schools in Vancouver and Ottawa/Gatineau, Canada. Each family was also asked to bring a real-life friend of the target child to the lab for child–friend interaction observations. As detailed in the Procedure, the current sample of 134 represents the families in the trial who attended baseline and post-treatment visits (of these, $n = 100$ also completed follow-up visits) with a friend where the friendship was reciprocated.

See Supplementary Table S1 for target children's baseline demographic and clinical characteristics; there were no group differences between PFC and CARE conditions. Friends were on average 8.52 years old ($SD = 1.65$; range 5–13; 39.6% girls), and 71.6% were White. Based on parent and teacher reports on the Child Symptom Inventory (CSI; score range = 0–9; CSI-IV; Gadow & Sprafkin, 2002), friends' total average inattentive and hyperactive symptoms fell in the normative range (from 1.4 to 1.9, and from 1.0 to 2.1, respectively). Average friends' scores on the Strengths and Difficulties Questionnaire Peer Problems subscale (SDQ; Goodman, 1997; score range: 0–10) according to parents and teachers also fell in the normative range (from 1.6 to 1.8).

### Study Eligibility

See Mikami et al. (2020) for full details. The inclusion criteria for target children were: (a) a diagnosis of ADHD based on the DSM-5 criteria assessed with a parent semi-structured diagnostic interview (Kiddie Schedule for Affective Disorders and Schizophrenia [K-SADS]; Axelson et al., 2009) and on a teacher-rated ADHD scale (CSI-IV); and (b) evidence of peer problems as indexed by a score of $\geq$1 SD above US age and sex norms (see https://www.sdqinfo.org) on the parent- and/or teacher-rated SDQ Peer Problems subscale. Exclusion criteria for the larger trial included a Full Scale IQ of <75 on the Wechsler Abbreviated Scale of Intelligence II (Wechsler, 2011), autism spectrum disorder, psychosis, active suicidality, or participation in concurrent behavioral treatment or interventions for child social difficulties. Children with a stable dose of medication for ADHD, as well as those with comorbid diagnoses of externalizing and/or internalizing disorders were eligible. There were no eligibility criteria for the friends above being invited to the study by the target children's family.

### Procedure

Procedures were approved by the institutional review boards at both sites. Parents and teachers provided active written consent and children provided verbal assent to participate. See Mikami et al. (2020) for the Consolidated Standards of Reporting Trials (CONSORT) diagram.

### Baseline Assessments

At the initial lab visit, parents completed the K-SADS (Axelson et al., 2009) and children completed intelligence testing. Parents, teachers, and children completed questionnaires about the child's behavior (Mikami et al., 2020). Families eligible for participation in the trial ($n = 172$) were asked to return to the lab with the target child's closest friend for a second baseline visit. The child and friend independently reported whether they were "best friends," "close friends," "just ok friends," "occasional companions," or "strangers." Because scholars have argued that friendship is too often considered dichotomously ("best friends" versus "not friends at all"), we increased representativeness and limited ceiling effects by including the dyads where both children mutually endorsed being at least "just ok friends" (Berndt & McCandless, 2009). This resulted in 148 children with reciprocated friends at baseline (87% of the initial 172) who engaged in two tasks (described in Measures).

### Intervention Provision

The 172 families in the trial were randomized to one of the two treatment conditions (PFC or CARE) using computerized software independent from the study team. The trial included a total of 28 groups (14 PFC and 14 CARE), equally distributed across sites, with approximately six to seven families in each group. Both PFC and CARE consisted of 10, weekly 90-minute

parent group sessions. Each program followed an associated manual providing details regarding each session's content. Group sessions were led by a clinician with a PhD in clinical psychology, assisted by a graduate student in clinical psychology, who were part of the study team. To control for therapist effects, the same lead clinician always conducted both the PFC and the CARE group within a cohort and co-clinicians helped with both PFC and CARE whenever feasible. Attendance, satisfaction, and treatment fidelity were acceptable (see Mikami et al., 2020).

PFC followed a behavioral parent training model, encouraging parents to establish a positive relationship with their child, coach their children in positive friendship behaviors, and arrange playdates to practice these behaviors. Sessions consisted of teaching parents the skills, allowing parents to personalize the skills to their family's situation, role playing the skills, and creating plans to use the skills at home through weekly homework assignments. All content was clinician-driven and clinicians provided directive suggestions to parents (Mikami & Normand, 2022). CARE provided education about ADHD, including friendship issues, and encouraged parents to support and share strategies with one another (Power et al., 2012). CARE clinicians provided some information and encouraged parents to discuss difficulties they have faced and share recommendations and resources with each other. However, unlike PFC, CARE clinicians did not provide skill training around strategies to improve children's friendship behaviors.

### Post-Treatment and Follow-Up Assessments

All 172 families in the trial were asked to return to the laboratory at post-treatment and follow-up (8 months after post-treatment) with their child and the child's current closest friend. Of the 149 who had brought a reciprocated friend at baseline, 134 of them brought a reciprocated friend at post-treatment (90% of the 149) and completed the two tasks. They constitute our post-treatment sample. The friend could be the same friend who had come for the baseline assessment ($n = 97$; 72%) or a new friend ($n = 37$; 28%). At follow-up, 100 brought a reciprocated friend and completed the two tasks (75% of the 134). They constitute our follow-up sample. At follow-up, 64 (64%) target children brought a friend who had come to baseline or post treatment, whereas 36 (36%) brought a new friend. There were no significant differences in terms of ADHD symptom severity and externalizing disorders in target children who brought the same versus new friend at post-treatment and follow-up. An additional four dyads of reciprocated friends were seen only at baseline and follow-up and were not included in the analyses. Children who remained in the study did not differ from those who dropped out at follow-up in child demographics, parent/family variables, and child clinical variables (see Supplementary Table S2).

## Measures

We video recorded the dyads in two tasks, counterbalanced for order, designed to mirror the real-world interactions of friends (Fonzi et al., 1997). These tasks, originally developed to measure friendship patterns in typically developing children (Fonzi et al., 1997), have since been adapted for children with ADHD (Normand et al., 2013).

### Competitive Task: Car Race

In the car-race task (Fonzi et al., 1997), which simulated a fast-paced and competitive game, dyads were told that the goal was to be quicker than their opponent in transporting five blocks across a game table. Blocks could only be transported one at a time in the trunk of a toy truck. The truck needed to travel down a runway and back. The runway could not accommodate both trucks side by side and the rules prohibited children from lifting their wheels from the runway.

### Cooperative Task: Toy Sharing

In the toy-sharing task (Fonzi et al., 1997), which was a cooperative task eliciting negotiation processes on how to share a limited resource, dyads were presented with 15 toys appealing to both genders and different ages (e.g., Legos®, Trash Pack® figurines, Silly Bandz® bracelets). The dyad was asked to select five toys that they both liked from the initial 15 and then to come to an agreement about how they would share the toys. Dyads were allowed to take these five toys home.

### Dyadic Mutuality and Coercive Joining Indicators

Thirteen undergraduate students, kept unaware of other study information, coded the recordings of the two tasks based on previously developed coding manuals (Normand et al., 2013). A random sample of 20% of tasks was recoded to establish inter-rater reliability. Behaviors were coded for the target child and the friend separately. Except for positive affect, all behaviors were coded using continuous coding with 1-second precision. Positive affect was coded using interval coding with 5-second intervals, whole-interval sampling, predominant activity sampling variant (Bakeman & Quera, 2011). In line with previous work by our team (Normand et al., 2022), indicators of *dyadic mutuality* were: (a) Prosocial behavior (i.e., altruistic behavior that considers the friend's well-being, $\kappa = .73–.74$); (b)

Preference sharing (i.e., communication of personal and subjective preferences [likes, dislikes, opinions] to the friend, κ = .81); (c) and Positive affect (i.e., expression of affection, laughter, smiles, or jokes during 5-second intervals, κ = .81 for both tasks). Indicators of *coercive joining* were: (a) Aggressive behavior (i.e., verbal and physical aggressive behaviors that are hurtful and directed toward the friend, κ = .81–.83); (b) Controlling behavior (i.e., behavior in which the child clearly tries to have verbal/physical control over the friend's behavior, κ = .74–.80); (c) Rule-breaking behavior (i.e., violation of the game rules such as transporting more than one block at a time, lifting one's car in the air, κ = .78). Given the specific nature of each task, preference sharing was only coded in the toy-sharing task, and rule-breaking behavior only coded in the car-race task.

### Moderators

Children had an externalizing disorder if the parent endorsed ODD or CD on the K-SADS and teacher ratings corresponded to a T score ≥60 on the Oppositional Defiant and/or Conduct Problems DSM scales on the Teacher Report Form (Achenbach & Rescorla, 2001).

### Data Analytic Plan

We assessed the amount of dyadic mutuality and coercive joining using the Generalized Sequential Querier (Bakeman & Quera, 2011) to compute proportions of time (expressed as percentages) children engaged in indicators of dyadic mutuality (separately for positive affect and positive behavior) and indicators of coercive joining. As in Normand et al. (2022), reciprocity of dyadic mutuality and coercive joining indicators – whether target children with ADHD reciprocated their friends' similar behavior (or affect) – was assessed with time-window sequential analysis. We used the Generalized Sequential Querier (Bakeman & Quera, 2011) to tally successive seconds of the observations into 2 × 2 tables. The odds ratios computed from these tables allowed us to determine whether the odds that the target child's behavior (tallied in columns) began during a time window defined by the friend's behavior (tallied in rows) was greater than the odds that the target child's behavior began at other times.

For positive behavior and coercive joining indicators – whose onset and duration were coded with 1-second precision – seconds were tallied in Column 1 if coded for a target child's onset, in Column 2 otherwise; and in Row 1 if coded for a friend's window, in Row 2 otherwise. We defined this window as beginning in the second after the onset of the friend's behavior and extending 5 seconds after its offset. Five seconds is arbitrary, but preliminary analyses suggested that other values yielded essentially similar results – and 5 seconds was the width of the interval used to code affect. For positive affect – which was coded yes or no for 5-second intervals – seconds were tallied in Column 1 if the interval was coded for a target child's positive affect, in Column 2 otherwise; and in Row 1 if the previous interval was coded for a friend's positive affect, in Row 2 otherwise. Thus, the window was the previous interval. Dividing these by-second tallies by five gives the number of friends' intervals coded for positive affect that were followed by an interval coded for target children's positive affect. Since tallies are proportionate, odds ratios based on by-second or by-interval tallies are identical.

As expected, the odds ratios were all quite positively skewed. We recoded odds ratios using terms and criteria recommended by Bakeman and Quera (2011): 1 = *negative effect* (odds ratios 0–0.79), 2 = *negligible effect* (odds ratios 0.80–1.24), 3 = *small effect* (odds ratios 1.25–1.99), 4 = *medium effect* (odds ratios 2.00–2.99), and 5 = *large effect* (odds ratios ≥ 3.00).

The number of dyads with sufficient data to compute an odds ratio can be problematic. Reciprocity can only be assessed when both target child *and* friend engage in the specified behavior at least once. If any row or column of the 2 × 2 odds ratio table sums to zero – that is, if there is no friend's window or target child's onset for a specified behavior – no odds ratio can be computed and the contingency index is treated as missing. Bakeman and Quera (2011) recommend that a contingency index should be treated as missing if any row or column sum is less than 5. When potential contingency events are relatively rare, as is the case here, this criterion may be too conservative. Our solution was to compute odds ratios (our index of reciprocity) applying progressively more restrictive criteria (i.e., from 1 to 5 tallies) and compare results (see Normand et al., 2022). This represents a trade-off: with less restrictive criteria, statistics are based on more dyads. For the current study, we again computed odds ratios with minimum criteria varying from 1 to 5 tallies and found that results were similar no matter the criterion for all three behaviors in both tasks. Hence, we report results for the three tallies minimum criteria.

We employed mixed-design analyses of variance using the General Linear Model Procedure, Statistical Package for the Social Sciences (SPSS) version 28.0 (SPSS Inc, Chicago, IL). Between-subject variables

were treatment condition (PFC versus CARE), comorbid externalizing disorders (ODD/CD versus not), target child's gender (girl versus boy), ADHD medication status (medicated versus not), same friend status (same versus new), and best friend status (best friend versus not). Time was the repeated measure (baseline to post-treatment, baseline to follow-up). Main effects for time indicated post-treatment and follow-up differences, time by treatment interactions indicated treatment effects, and time by treatment by moderator interactions indicated moderation effects. We assessed effect sizes with generalized eta squared ($\eta_G^2$), as is appropriate for effects that include repeated measures, and characterized the magnitude of the effects using Cohen's thresholds for small, medium, and large of .01, .06, and .14, respectively (Cohen, 1988). Generally, we regard as worthy of presentation and interpretation effect sizes that are at least small and $p$ values of .05 or smaller.

## Results

### Research Question 1: Effects of Treatment Condition

Our exploration of general trends over time (when collapsing across treatment conditions) can be seen under the *Time* column in Table 1 (post-treatment sample) and in Table 2 (follow-up subsample). Two baseline to post-treatment main effects of time seem noteworthy. First, during the car-race task, the average amount of coercive joining decreased from 23.8% to 21.9% ($\eta_G^2 = .010$, $p = .042$). Second, during the toy-sharing task, the average amount of positive affect increased from 25.0% to 28.8% ($\eta_G^2 = .007$, $p = .037$; a less than small but statistically significant effect). Regarding baseline to follow-up time effects, first, during the car-race task, the average amount of coercive joining decreased from 23.9% to 18.5% ($\eta_G^2 = .082$, $p = < .001$). Second, during the toy-sharing task, the average amount of positive behavior increased from 12.3% to 15.2% ($\eta_G^2 = .035$, $p = .002$). Figure 1 (top) illustrates that, overall across treatment conditions, the amount of coercive joining during the car-race task decreased and the amount of positive affect and positive behavior during the toy-sharing task increased over time.

Results testing treatment effects of PFC relative to CARE are displayed in the *Time* × *Treat* column in Table 1 (post-treatment sample) and in Table 2 (follow-up subsample). There were two effects from baseline to post-treatment, both occurring during the toy-sharing task. First, the amount of coercive joining decreased from 11.0% to 10.0% for the PFC group but increased from 9.37% to 11.5% for the CARE group ($\eta_G^2 = .013$, $p = .034$). Second, the reciprocity of positive affect decreased from 3.74 to 2.85 for the PFC group but increased from 3.23 to 3.51 for the CARE group ($\eta_G^2 = .038$, $p = .007$). Also, two baseline to follow-up treatment effects are noteworthy. First, during the toy-sharing task, the amount of coercive joining decreased from 10.5% to 8.94% for the PFC group but increased from 9.18% to 10.6% for the CARE group ($\eta_G^2 = .014$, $p = .038$). Second, during the car-race task, the reciprocity of coercive joining increased from 3.47 to 3.69 for the PFC group but decreased from 3.86 to 3.18 for the CARE group ($\eta_G^2 = .036$, $p = .002$). Figure 1 (bottom) illustrates that both the amount of coercive joining and the reciprocity of positive affect during the toy-sharing task decreased from baseline to post-treatment for the PFC group but increased for the CARE group (in both post-treatment sample and follow-up subsample). However, from post-treatment to follow-up, the amount of coercive joining decreased in both groups (continuing its decrease in the PFC group), whereas the reciprocity of positive affect increased in the PFC group and remained steady in the CARE group. In contrast, the reciprocity of coercive joining during the car-race task was evident only at follow-up, where it increased for the PFC group but decreased for the CARE group.

### Research Question 2: Moderators of Treatment Effects

Externalizing disorder moderation results are in the *Time* × *Treat* × *Extern* columns in Table 1 (post-treatment sample) and in Table 2 (follow-up subsample). Although no baseline to post-treatment moderation of treatment effects seems noteworthy, one baseline to follow-up moderation was found. Specifically, the presence of comorbid externalizing disorders moderated the effect of treatment on the reciprocity of positive behavior during the toy-sharing task. The treatment effect was of medium size for children with comorbidity ($\eta_G^2 = .11$, $p = .034$) but negligible for children without ($\eta_G^2 = .002$, $p = .70$). Further probing revealed that for children with ADHD and externalizing comorbidity, reciprocity of positive behavior increased from 2.20 to 3.40 for the PFC group, but decreased from 2.73 to 2.20 for the CARE group. In contrast, reciprocity of positive behavior decreased somewhat in both conditions for children without externalizing comorbidity, from 3.19 to 2.88 for the PFC group and from 3.00 to 1.91 for the CARE group (see Supplementary Figure S1).

**Table 1.** Means and ANOVA statistics for changes from baseline to post-treatment.

| | | | | | | $\eta_G^2$ | | | | $p$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Behavior | $N$ | $M_{BL}$ | $M_{PT}$ | Time | Time × Treat | Time × Treat × Extern | Time × Treat × Gender | Time | Time × Treat | Time × Treat × Extern | Time × Treat × Gender |
| Car-race task (Competition) | Amount (%) | Positive affect | 130 | 30.3 | 28.9 | .001 | <.001 | .001 | <.001 | .43 | .75 | .41 | .87 |
| | | Positive behavior | 130 | 2.46 | 3.05 | .011 | .003 | .003 | .003 | .065 | .31 | .34 | .32 |
| | | Coercive joining | 130 | **23.8** | **21.9** | **.010** | .001 | .001 | .006 | **.042** | .58 | .64 | .11 |
| | Reciprocity | Positive affect | 82 | 3.01 | 3.44 | .021 | <.001 | .005 | <.001 | .057 | .88 | .37 | .83 |
| | | Positive behavior | 20 | 2.65 | 2.45 | – | – | – | – | – | – | – | – |
| | | Coercive joining | 128 | 3.70 | 3.48 | .009 | .005 | .002 | <.001 | .11 | .21 | .47 | .87 |
| Toy-sharing task (Cooperation) | Amount (%) | Positive affect | 133 | **25.0** | **28.8** | **.007** | <.001 | .003 | .002 | **.037** | .71 | .18 | .24 |
| | | Positive behavior | 133 | 12.3 | 13.4 | .006 | .003 | .006 | .003 | .11 | .24 | .10 | .29 |
| | | Coercive joining | 133 | 10.2 | 10.8 | .002 | **.013** | .001 | .003 | .38 | **.034** | .57 | .31 |
| | Reciprocity | Positive affect | 70 | 3.43 | 3.26 | .004 | **.037** | .003 | .016 | .41 | **.007** | .48 | .08 |
| | | Positive behavior | 106 | 2.95 | 3.03 | .001 | .002 | .002 | .001 | .68 | .54 | .53 | .74 |
| | | Coercive joining | 111 | 2.82 | 2.58 | .006 | .009 | <.001 | .001 | .21 | .13 | .79 | .55 |

Effect size ($\eta_G^2$) and $p$ value are from repeated measures analyses of variance, baseline (BL) to post-treatment (PT, post-treatment sample). Bolding indicates effects that we regard as noteworthy defined as $\eta_G^2 \geq .010$ and $p$ values ≤ .05 or, in one case near small but $p = .037$. Statistics for the reciprocity of positive behavior during car-race task are not given; the number of dyads meeting criterion to compute reciprocity were too few to have confidence in the results. Extern = externalizing comorbidity (ODD/CD versus not) and Gender = girls versus boys.

**Table 2.** Means and ANOVA statistics for changes from baseline to follow-up.

| | | | | | | $\eta_G^2$ | | | | $p$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Behavior | *N* | $M_{BL}$ | $M_{FU}$ | Time | Time × Treat | Time × Treat × Extern | Time × Treat × Gender | Time | Time × Treat | Time × Treat × Extern | Time × Treat × Gender |
| Car-race task (Competition) | Amount (%) | Positive affect | 97 | 29.8 | 32.5 | .004 | <.001 | .002 | <.001 | .19 | .98 | .29 | .72 |
| | | Positive behavior | 97 | 2.51 | 2.81 | .002 | .004 | .002 | <.001 | .46 | .34 | .48 | .97 |
| | | Coercive joining | 97 | **23.9** | **18.5** | **.082** | .009 | <.001 | .004 | **<.001** | .13 | .97 | .33 |
| | Reciprocity | Positive affect | 56 | 3.02 | 3.32 | .011 | .005 | .006 | .001 | .21 | .40 | .36 | .74 |
| | | Positive behavior | 7 | 2.71 | 2.71 | – | – | – | – | – | – | – | – |
| | | Coercive joining | 95 | 3.67 | 3.42 | .012 | **.036** | .004 | .002 | .081 | **.002** | .30 | .47 |
| Toy-sharing task (Cooperation) | Amount (%) | Positive affect | 100 | 25.3 | 29.3 | .008 | .003 | .001 | <.001 | .093 | .27 | .61 | .83 |
| | | Positive behavior | 100 | **12.3** | **15.2** | **.035** | <.001 | <.001 | .013 | **.002** | .73 | .84 | .053 |
| | | Coercive joining | 100 | 9.82 | 9.83 | <.001 | **.014** | <.001 | <.001 | .99 | **.038** | .79 | .76 |
| | Reciprocity | Positive affect | 34 | 3.21 | 3.56 | .015 | .017 | .011 | .028 | .32 | .28 | .41 | .19 |
| | | Positive behavior | 74 | 2.91 | 2.82 | .001 | .005 | **.030** | <.001 | .73 | .42 | **.050** | .99 |
| | | Coercive joining | 75 | 2.64 | 2.99 | .012 | <.001 | .002 | .011 | .22 | .83 | .59 | .24 |

Effect size ($\eta_G^2$) and *p* value are from repeated measures analyses of variance, baseline (BL) to follow-up (FU, follow-up subsample). Bolding indicates effects that we regard as noteworthy defined as $\eta_G^2 > .010$) and *p* values ≤ .05. Statistics for the reciprocity of positive behavior during car-race task are not given; the number of dyads meeting criterion to compute reciprocity were too few to have confidence in the results. Extern = externalizing comorbidity (ODD/CD versus not) and Gender = girls versus boys.

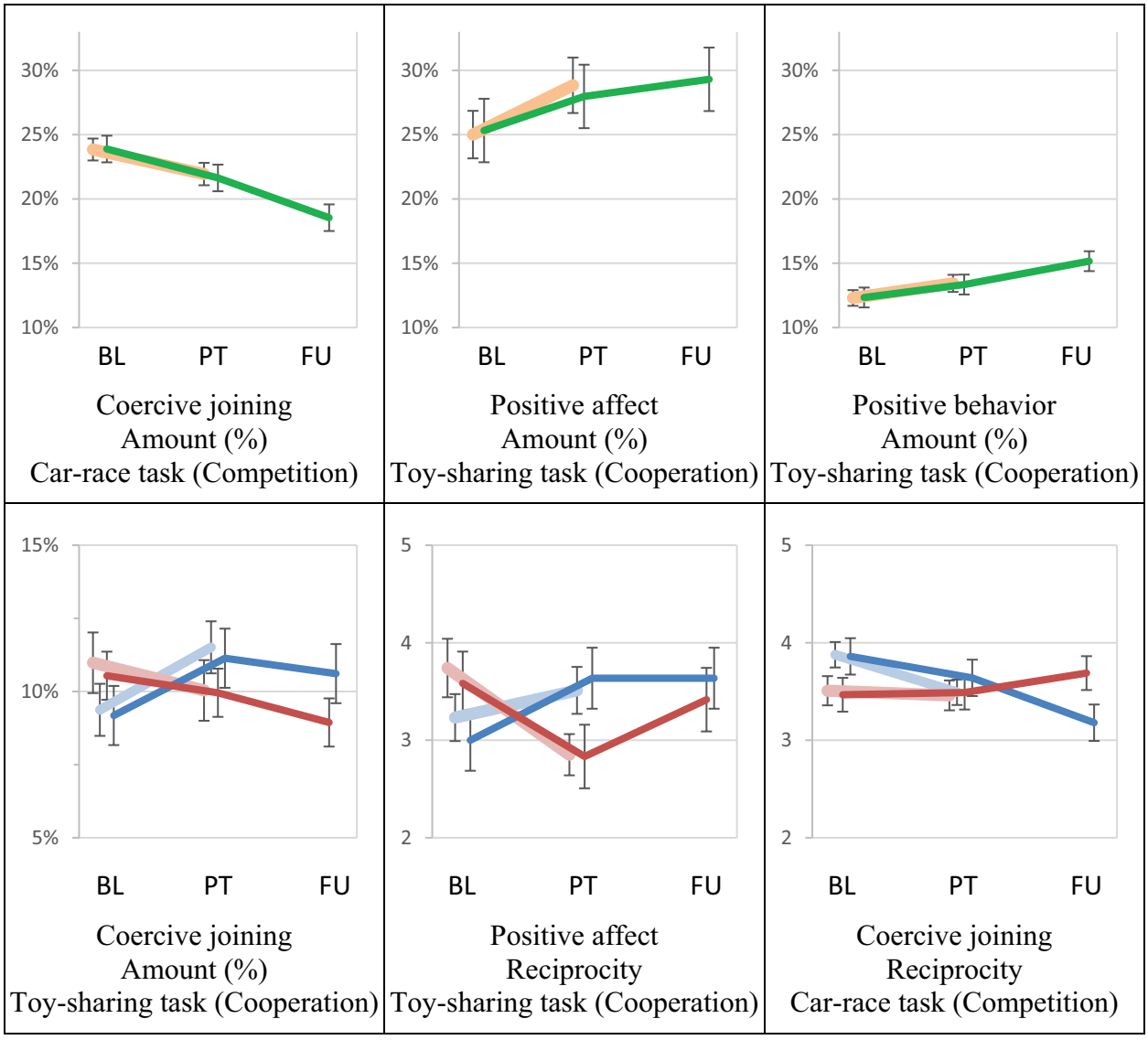


**Figure 1.** Selected graphs for time and treatment effects. Presented are selected graphs illustrating noteworthy time effects (top row) and treatment effects (low row). For time effect, orange lines (lighter) represent the post-treatment sample ($n = 134$), and green lines (darker) represent the follow-up subsample ($n = 100$). For treatment effects, red lines (darkest) represent Parental Friendship Coaching (PFC) and blue lines (next darkest) represent Coping with ADHD through Relationships and Education (CARE) treatments. Lighter red (next lightest) and blue lines (lightest) represent the post-treatment sample ($n = 134$) and darker blue and orange lines represent the follow-up subsample ($n = 100$). For reciprocity, 1 = negative, 2 = *negligible*, 3 = *small*, 4 = *medium*, and 5 = *large effect*. Error bars are standard errors of the mean.

### *Post-Hoc Analyses*[1]

We explored whether treatment effects varied based on target child gender, ADHD medication, same friend versus new, and best friend versus not status. Parents of target children indicated their child's gender (at baseline) and whether their child was taking ADHD medication (at each timepoint). As detailed in the Procedure, target children and potential friends independently rated whether they were "best friends," "close friends," "just ok friends," "occasional companions," or "strangers" at each timepoint. We considered those who mutually rated one another as "best friends" to be best friend dyads; all others were coded as not best friends. At post-treatment and follow-up, research assistants indicated whether friends were the same as previously or new.

Gender moderation results are in the *Time* × *Treat* × *Gender* columns in Table 1 (post-treatment

[1]We are grateful to anonymous reviewers for suggesting these moderator analyses, which we conducted post hoc.

sample) and in Table 2 (follow-up subsample). Gender did not moderate treatment effects. Similarly, treatment effects were not moderated by ADHD medication (Suplementary Table S3). Same versus new friend status generally did not moderate treatment effects. However, see Supplementary Table S4 and Supplementary Figure S2 for one exception, where PFC led to unique decreases in the reciprocity of coercive joining in the toy-sharing task from baseline to follow-up in same-friend dyads, but to increases of coercive joining when the friend was new. Similarly, there were two noteworthy interactions where PFC uniquely resulted in greater decreases in the amount of coercive joining in the car-race task and greater increases in the amount of prosocial behavior in the toy-sharing task from baseline to post-treatment in best-friend dyads versus not best-friend dyads (Supplementary Table S5 and Supplementary Figure S3).

## Discussion

The majority of children with ADHD experience significant and treatment-resistant friendship problems (Mikami, Owens, et al., 2022; Spender et al., 2023). PFC is a promising intervention targeting the friendship problems of children with ADHD (Mikami & Normand, 2022), but to date this has only been examined on broad outcome measures (Mikami, Lerner, et al., 2010; Mikami et al., 2020). Prior evaluations of PFC have not examined nuanced aspects of children's friendships, including reciprocal/transactional processes between friends, whether outcomes differ depending on the interaction context, and potentially important friendship behaviors that have been shown to distinguish the friendship interactions of children with and without ADHD (Mikami et al., 2020; Normand et al., 2013). The current study examined whether PFC, compared to an active control treatment (CARE), might foster positive peer contagion processes (i.e., dyadic mutuality) and reduce negative peer contagion processes (i.e., coercive joining) within the friendships of children with ADHD.

### *Time Trends in Dyadic Mutuality and Coercive Joining*

Collapsed across treatment conditions, children with ADHD increased their amount of dyadic mutuality indicators and reduced their amount of coercive joining indicators over time. This could suggest that children with ADHD may find it easier to be prosocial and to not respond aggressively to a friend's aggression when they are familiar with the tasks/games they are doing. It may be that when these children know what to expect, it is easier for their friendship interactions to go smoothly. However, these changes depended on the context of the friendship interaction. Immediate and maintained changes in the amount of coercive joining indicators over time appeared only in the competitive context, whereas changes in the amount of dyadic mutuality indicators appeared only in the cooperative context. These findings echo the contention of Normand et al. (2022) that certain interaction contexts may foster different friendship behaviors. Dyadic mutuality behaviors may be more likely when the task is cooperative rather than competitive, as the latter is more conducive to producing conflict and providing a stage for coercive joining (Normand et al., 2022). In addition, the current study provides preliminary evidence that short-term changes in the prevalence of coercive joining behaviors may be most observable in a competitive context, whereas short-term changes in the amount of dyadic mutuality behaviors might be best visible in a cooperative context. Examining behavioral versus affective indicators of dyadic mutuality is also informative. Specifically, changes in positive affect were evident at post-treatment only, whereas changes in positive behaviors in the cooperative context only appeared at the 8-month follow-up. This suggests that changes in positive behaviors (e.g., prosocial behaviors) may take more time to be learned than positive affect.

Overall, and in line with the initial results from Mikami et al. (2020), these findings could suggest that both PFC and CARE were efficacious. Although it is unclear what would have happened in a no treatment condition, a study on the friendship patterns of school-aged children with ADHD (using the same observational tasks and a similar coding system) showed an increase in their coercive joining behaviors over 6 months, whereas typically developing children showed a reduction in these behaviors over time (Normand et al., 2013). Therefore, both PFC and CARE may have led to improvements in dyadic mutuality and coercive joining behaviors. Interestingly, despite these improvements in the *amount* of dyadic mutuality and coercive joining indicators over time, the current findings did not provide support for parallel improvements in *reciprocity* of dyadic mutuality and coercive joining (i.e., peer contagion) over time. It may take longer than 11–12 months (i.e., the time between baseline and follow-up) to observe changes in children's ability to reciprocate the affect and behaviors of their friends (Bagwell et al., 2021). There is evidence that engaging in such reciprocal communication patterns may be a long-term challenge – not only for children – but also for

adolescents with ADHD, who may need continued treatment throughout development (e.g., Interpersonal Skills Group; Evans et al., 2014).

### Treatment Effects of PFC versus CARE

As hypothesized, PFC led to small reductions in the amount of coercive joining indicators (i.e., observed aggressive, controlling behaviors) at post-treatment and follow-up compared to CARE, but in the cooperative context and not in the competitive context. PFC, relative to CARE, may help children with ADHD negotiate less aggressively and show fewer controlling behaviors when they share a limited resource with a friend. Mikami et al. (2020) found PFC was associated with reduced observed aggressive behaviors at follow-up, but not at post-treatment. The current findings suggest that a more nuanced picture is obtained when analyzing observational data according to the context of the interaction: PFC effects on the amount of coercive joining behaviors appear to be both immediate and maintained, but only during cooperation.

In contrast, and contrary to hypotheses, PFC did not reduce the *amount* of coercive joining indicators during competition more than CARE and in fact led to small increases of *reciprocity* of coercive joining from baseline to follow-up. Since no studies have previously examined similar contextual differences regarding effects of any treatment for children with ADHD (including PFC), we can only speculate about the meaning of these differences. The cooperative task represents a more affectively neutral context (i.e., possibly involving cool executive functioning) where the friends work together toward a common goal. In contrast, the competitive task is a more motivationally and emotionally significant context (i.e., involving hot executive functioning) that pits the two friends against one another. The increased reciprocity of coercive joining behaviors during competition appears to be especially present between post-treatment and follow-up (after PFC is completed; Figure S1, right bottom).

Because low self-regulation abilities have been identified as an important risk factor for peer contagion influences (Dishion & Tipsord, 2011), children with ADHD may be most negatively influenced by friends during competitive interactions that are likely to dysregulate their behavior (Normand et al., 2022). In PFC (and not in CARE), parents are encouraged to organize playdates between the two friends, which could possibly lead to increased exposure and imitation between friends over time. The competitive setting may dysregulate children with ADHD, thereby leading to increased reciprocity of coercive joining behaviors when the friends exhibit such behaviors (see Normand et al., 2022). This negative peer contagion may especially increase when parents are no longer supported by clinicians to monitor and intervene during children's playdates. If replicated, this finding may suggest a potential iatrogenic effect of PFC that could lead to an amplification of coercive joining behaviors between friends during competition over time, and especially after parents have completed PFC.

PFC also appeared to lead to *reduced* reciprocity of positive affect during cooperation at post-treatment (small ES). In other words, children whose parents received PFC were *less* likely to respond with positive affect to the friends' positive affect in the cooperative context. Interestingly, this reduced transactional emotional process between children and their friends in the PFC condition only seemed to occur between baseline to post-treatment, as reciprocity of positive affect then increased from post-treatment to follow-up (see Figure 1, middle bottom). It is possible that PFC children learn to negotiate with their friends, which could lead to target children getting fewer or less desirable toys for themselves given the uneven number of toys to be shared. Speculatively, by letting their friend have a better outcome, this may lead their friend to show positive affect. It is possibly not an automatic reflex for children with ADHD to mirror their friends' positive affect, especially if the transaction left them with a less desirable outcome.

Overall, these results may suggest that PFC has the most relative advantage to CARE in helping children with ADHD reduce the amount of their coercive joining behaviors during negotiation of a limited resource with a friend, with this occurring consistently at post-treatment and follow-up. However, relative to CARE, PFC may potentially lead to poorer reciprocity in positive affect (at post-treatment, in the cooperative task) and more reciprocity in coercive joining (at follow-up, in the competitive task). Nonetheless, these findings comparing PFC to CARE need to be considered within the larger perspective that, overall, children in both conditions increased in dyadic mutuality (in the cooperative task) and reduced in coercive joining (in the competitive task) over time. Post-hoc, this pattern of findings makes sense in that the content of PFC focused on equipping parents with skills to reduce their child's negative friendship behaviors (e.g., poor sportsmanship, whining and complaining, aggression, telling the friend what to do, dictating game rules) and to increase positive friendship behaviors (e.g., sharing, turn-taking, perspective-taking). By contrast, PFC did not contain content to help parents increase their children's positive affect, though lack of positive affect is not usually a problem

for children with ADHD (Okado et al., 2016). Nor did PFC specifically target reciprocity (e.g., when to mirror, versus when to diffuse, a friend's behavior).

### Moderation of Treatment Effects

Our current findings suggest that, for children with a comorbid externalizing disorder versus for those without, PFC resulted in them increasingly reciprocating their friends' positive behaviors during cooperation at follow-up (medium ES). These results echo the initial findings of Mikami et al. (2020) that PFC was associated with better friendship quality among children with ADHD and a comorbid externalizing disorder. Because positive peer contagion in youth's friendships has been associated with better friendship quality (Piehler & Dishion, 2007), treatment effects on friendship quality may lead to increased reciprocity of friends' positive behaviors over time, or vice versa. Alternatively, the current positive results of PFC for children with externalizing disorders may also have been attributable to components from behavioral parent training targeted at increasing child receptivity to parent coaching (Mikami et al., 2020). Children with ADHD and comorbid externalizing disorders who learn to become more receptive to parent feedback may also become increasingly receptive to their friends' positive influence, leading to increased reciprocity of their friends' positive behaviors over time.

Exploratory post-hoc analyses showed that treatment effects were not moderated by child gender and ADHD medication. There were, however, some findings suggesting that PFC led to unique decreases in the reciprocity of coercive joining in the toy-sharing task from baseline to follow-up with same-friend dyads, but to increases of coercive joining when the friend was new. Although this was a new and isolated finding requiring replication, it may suggest that PFC effects could be most evident for dyads who remain stable over time (who perhaps practiced friendship skills during playdates over the course of treatment). Moderation results also suggest PFC uniquely led to greater decreases in the amount of coercive joining in the car-race task and to greater increases in the amount of prosocial behavior in the toy-sharing task from baseline to post-treatment in best-friend dyads, but not in other friendships. Research suggests that best friendships are meaningful relationships for children, offering them more positive experiences than other friendships, and are possibly especially protective against risk factors (Adams et al., 2011). That PFC might be especially useful for dyads where the children consider each other as best friends is a novel finding that requires replication and might have important clinical implications for children with ADHD.

### Strengths, Limitations, and Future Directions

The current study is the first, to our knowledge, to involve longitudinal data in dyadic mutuality and coercive joining of any kind (either as a result of treatment, or naturalistically) to capture moment-to-moment interactions and influences between friends. Most importantly, it is the first known report investigating whether dynamic, microsocial peer contagion processes (i.e., dyadic mutuality and coercive joining) within the friendships of children with ADHD are influenced through intervention. To this end, we used well-operationalized constructs of dyadic mutuality and coercive joining, a large and well-characterized clinical sample, a randomized controlled design with an active comparison group and a 8-month follow-up, observations of children and their friends in two complementary interaction contexts (cooperation and competition), and time-window sequential analysis to assess both on the *amount* (i.e., the probabilities or percentages) and the *reciprocity* (i.e., peer contagion) of the observed indicators of dyadic mutuality and coercive joining (Bakeman & Quera, 2011).

Limitations include that our outcomes for each child were limited to their interactions with the specific friend who participated in the study. Although we included a broad range of real-life friendships (i.e., not just best friendships) to increase ecological validity (Berndt & McCandless, 2009), it is unclear whether our results would generalize to other friendships the target child may have. Second, our findings are limited by the nature of the observational tasks conducted in our lab, although the use of observational methods to study children's friendships in naturalistic settings would be challenging. Nonetheless, it may be hard to observe behavioral changes in such brief observations of behavior during lab tasks. Parent, teacher, or friend reports may offer a complementary – and perhaps more representative – perspective of generalized behavioral change over time. Third, reciprocity could only be analyzed when both the target child *and* friend engaged in the specified behavior at least once (Bakeman & Quera, 2011). This resulted in missing scores when assessing reciprocity of some behaviors (e.g., positive behavior during the car-race task; see Tables 1 and 2). Caution is thus needed when interpreting the reciprocity findings. Fourth, most participants were educated parents of White, middle/high middle SES, elementary school aged children. Future studies should examine how parents with diverse backgrounds foster their children's friendships (age, sex, culture; see Salaam et al., 2022; Tu et al., 2017). Fifth, the follow-up period of 8 months was relatively short to examine treatment effects on peer

contagion dynamics, as such processes may take longer to unfold. Sixth, future studies should examine whether other peer contagion processes, such as deviancy training and co-rumination, occur in the friendship interactions of children with ADHD and whether these can be affected by treatment (Piehler, 2016). Future research would also benefit from focusing on social-cognitive factors (i.e., social goals, attributions about social failures, perspective taking skills, self-efficacy beliefs) that affect how children respond to a wide range of friendship tasks in everyday life (Bagwell et al., 2021). Finally, in PFC, parents were guided to identify relevant scenarios for their children, and both cooperation and competition scenarios were offered as examples among others, but it was left to the parent to select the scenario(s) that they wished to target with their child. Future revisions of the PFC intervention might more explicitly explain to parents that competent friendship interactions require the ability to adapt to both the cooperation and competition scenarios (Fülöp, 2022), and more directly support parents in coaching their child for both cooperative and competitive friendship tasks.

### *Clinical Significance*

PFC led to reductions in the amount of coercive joining behaviors (i.e., aggressive and controlling behaviors) when children negotiated with friends during cooperation, both at post-treatment and at the 8-month follow-up. These findings suggest that parents may play a crucial role in the socialization of children's verbal negotiation with friends, helping children with ADHD to reduce their well-documented tendency of being more controlling, aggressive, insensitive, and of having up to twice more conflicts with their close friends than children without ADHD (Normand et al., 2013). As was done in the PFC intervention, parents could conduct role plays with children around how to effectively solve problems with friends, and arrange structured playdates involving cooperative games where children can practice limiting their aggressive and controlling behaviors toward the friend. However, the finding that PFC led to decreased reciprocity of positive affect during cooperation at post-treatment suggests that children with ADHD might need additional parental emotion socialization. Although previous work indicates that PFC, relative to CARE, leads to parents providing more emotion strategies and praise and more warmth, and to children showing less withdrawn/depressed behavior, PFC has not been associated with observed changes in positive affect (Smit et al., 2022). Parents may benefit from additional guidance to better support their children's reciprocity of their friends' positive affect, especially while solving problems with friends.

Similarly, while it is worrisome that PFC (relative to CARE) did not lead to increased dyadic mutuality during competition but instead to increased reciprocity of coercive joining behaviors during competition at follow-up, these results corroborate previous cross-sectional findings that competitive situations may facilitate the spread of coercive behavior between children with ADHD and their friends (Normand et al., 2022). Parents might benefit from additional scaffolding to continue to monitor and prevent the spread of coercive joining during playdates after the standard PFC program is completed (e.g., adding individual booster sessions, facilitate longer-term parent-to-parent support), especially when their child is in an emotionally dysregulating setting such as during competition with a friend.

Children with comorbid ADHD and externalizing disorders represent a clinically important, at-risk subgroup that has more peer problems and worse long-term adjustment than children with ADHD only (Normand et al., 2020). Our current findings, combined with the results of Mikami et al. (2020), suggest that PFC may have particular benefits for this group, across a variety of indicators of friendship quality and processes.

## Conclusion

This paper examined whether PFC, compared to an active comparison intervention (CARE), affected the peer contagion processes within the real-life friendships of children with ADHD. PFC may be most promising in reducing the amount of aggressive and controlling behaviors in a task where children and friends had to negotiate to share a limited resource – as this finding was consistent at post-treatment and 8-month follow-up. On the other hand, PFC was also associated with some worse outcomes in terms of reciprocity, although in a less consistent pattern. However, moderation analyses suggested that PFC appeared to be most helpful on a variety of peer contagion outcomes for children with ADHD plus externalizing comorbidity, as well as children who had a stable or a best friend.

Treatment effects of PFC were small, in line with the literature finding that benefits of psychosocial treatment tend to have smaller effect sizes when outcome measures are obtained from raters who are unaware of treatment conditions (such as the coders of our lab tasks or peers), as opposed to questionnaires reported by adults involved in

treatment such as parents (Mikami et al., 2022). Nevertheless, even small but reliable treatment effects on peer contagion might trigger positive changes in other important areas of functioning and may therefore be clinically meaningful (Dishion & Van Ryzin, 2011; Piehler & Dishion, 2007). The current findings on peer contagion outcomes add to the previous literature showing some benefits of PFC relative to CARE on questionnaire and observed measures of friendship behaviors and friendship quality (Mikami et al., 2020) and on observed measures of parental emotional-related socialization behaviors (Smit et al., 2022). However, social impairment is persistent and broad in ADHD and no treatment eliminates social impairment in all children, and most may be best served by multimodal treatment that might need to be lifelong.

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## ORCID

Sébastien Normand http://orcid.org/0000-0001-5462-6664
Maude Lambert http://orcid.org/0000-0001-8872-8474
Roger Bakeman http://orcid.org/0000-0001-6517-3111
Joanna Guiet http://orcid.org/0000-0002-4864-4433
Mara Brendgen http://orcid.org/0000-0001-6780-8547
Amori Yee Mikami http://orcid.org/0000-0001-5821-0674

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