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Peer contagion dynamics in the friendships of children with ADHD

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Background: Friendships in middle childhood carry high developmental significance. The majority of children with attention-deficit/hyperactivity disorder (ADHD) have few friendships, unstable friendships, or poor relationship quality in any friendships they have. The current study used time-window sequential analysis to map the dynamics within the friendships of children with ADHD, specifically the peer contagion processes of dyadic mutuality and coercive joining. **Methods:** Participants were 164 dyads consisting of a target child with ADHD and peer problems (age 6–11 years; 68% male; and 73% white) and a reciprocated friend. Dyads were observed in the lab during a cooperative task eliciting verbal negotiation processes to decide how to share a limited resource and during a fast-paced, engrossing, and competitive task. Both tasks were designed to mirror the real-world interactions of friends. 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) between target children and friends were coded. **Results:** Regarding dyadic mutuality, target children reciprocated their friends' positive affect in both tasks. They also reciprocated their friends' positive behaviors but only in the cooperative task. In contrast, they only reciprocated their friends' coercive joining behaviors in the competitive task. Medium to large reciprocity effects was found for 36%–53% (dyadic mutuality) and 38%–55% (coercive joining) of target children. **Conclusions:** These results extend findings of peer contagion processes to the friendships of children with ADHD and suggest that contagion may vary according to interaction context (i.e., competition vs. cooperation). Understanding the spread of peer contagion may illuminate how children with ADHD and their friends influence each other's adjustment over time and may guide friendship-focused psychosocial interventions for this population. **Keywords:** Attention-deficit/hyperactivity disorder; peer contagion; dyadic mutuality; coercive joining; sequential analysis.

Introduction

Friendships are voluntary and mutual relationships between two children. They carry high developmental significance, as the presence, stability, and quality of friendships predict children's subsequent psychological adjustment in both positive and negative ways (Bagwell & Bukowski, 2018; Hartup & Stevens, 1997). Significantly, impairing friendship problems are documented in the clinical population of children with attention-deficit/hyperactivity disorder (ADHD). However, extremely little is known about the transactional, reciprocal influence processes, referred to as peer contagion (Dishion & Tipsord, 2011; Piehler, 2016), that may occur in the friendships of children with ADHD. Peer contagion unfolds over time, meaning that it is ideally studied using time-window sequential analysis, to permit granular assessments of contingent behavior chains and the extent to which friends reciprocate one another's behaviors within a temporal window (Bakeman & Quera, 2011). The current study applied time-window sequential analysis to assess whether children with ADHD show reciprocity in two peer contagion processes within their friendships: dyadic mutuality and coercive joining.

Dyadic mutuality and coercive joining in friendships

Middle childhood is an important time for friendship development. Dyadic friendships during this age stabilize and deepen. They also represent a context where children learn and practice key social skills that carry over into intimate relationships in adolescence and adulthood (Bagwell & Bukowski, 2018; Hartup & Stevens, 1997). Crucially, 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 (Gottman & Graziano, 1983). This reciprocity, known as peer contagion, could lead to escalating positive behaviors, or conversely, escalating negative behaviors, in interactions between dyad members over time (Dishion & Tipsord, 2011). Nonetheless, the majority of studies about reciprocal behaviors within dyads have been conducted between parents and children, or between adolescents and their

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peers, despite the potential importance of these processes in friendships during middle childhood.

Dyadic mutuality is a positive contagion process that includes two related, but distinct components: reciprocity of positive affect and of positive behaviors (Harrist & Waugh, 2002). Although primarily studied in parent–child relationships, dyadic mutuality is reflected in theoretical writings on children's friendships. Friends are expected to mutually like and support each other, express affective reciprocity, and balance giving and taking (Hartup & Stevens, 1997). Providing initial evidence of such processes, Newcomb and Brady (1982) examined behaviors in school-aged, typically developing boys paired with a friend or an acquaintance in a problem-solving task. Interactions between friends were characterized by greater dyadic mutuality than interactions between acquaintances. Similarly, Piehler and Dishion (2007) found that dyadic mutuality levels differentiated the friendships of persistently antisocial adolescents from those of late-onset antisocial or typically developing adolescents. Dyadic mutuality was also associated with more selfreported positive friendship features.

Coercive joining has also been studied as an important negative contagion process in the development of problem behaviors in childhood and adolescence (Dishion & van Ryzin, 2011; van Ryzin & Dishion, 2013). This often presents as aggressive or aversive behavior used to obtain something desirable from a friend, demonstrate power, or avoid an unpleasant experience such as conflict (Piehler, 2016). Within the dyadic friendships of high-risk adolescents, Dishion and Van Ryzin identified a reciprocal process they defined as coercive joining (Dishion & van Ryzin, 2011; van Ryzin & Dishion, 2013). Specifically, when one youth uses coercive behavior to demonstrate dominance over a friend to attain a specific goal, often an escalation of coercive behavior among friends to control the interaction ensues. When one of the friends backs down to end the aversive conflict, coercive behavior is reinforced through escape conditioning. Although potentially an effective short-term strategy to obtain the desired goal, coercive behaviors are often reciprocated, maintained, and even amplified over time, thereby reducing opportunities for friends to learn alternative, prosocial interaction styles. A coercive interaction style between friends was found to predict more serious conduct problems later in adulthood and was related to more antisocial behavior and to less selfreported positive friendship quality (Dishion & van Ryzin, 2011; van Ryzin & Dishion, 2013).

Certain dyadic interaction contexts may foster positive versus negative contagion. Contagion of positive affect and prosocial behaviors (i.e., dyadic mutuality) may be more likely when friends cooperate than when they compete, as the latter is more conducive to producing conflict. Conversely, negative peer contagion (through coercive joining) is probably more likely during competition than during cooperation, because the competition implies an inherent power struggle between friends.

Friendship challenges in children with ADHD

The majority of children with ADHD experience significant friendship problems, including being more often friendless, forming lower-quality and shorter friendships, and befriending peers with more behavioral problems than do typically developing children (see Gardner & Gerdes, 2015, for a review). These friendship problems often remain stable over time and are resistant to treatments currently available (Gardner & Gerdes, 2015; Mikami et al., 2020). Observational studies using macrolevel analyses (i.e., global ratings) or behavioral frequencies/proportions suggest that children with ADHD are less sensitive to their friends' needs and preferences, and tend to act more based on their own interests, to be more controlling, and to violate game rules more often than typically developing children (Normand et al., 2011). These behaviors do not appear to improve over time; instead, children with ADHD tend to engage in more rule-breaking and to become increasingly insensitive toward their friends, in contrast to typically developing children (Normand et al., 2013).

The friendship challenges of children with ADHD are well-documented via studies comparing group means of the number of friends, friendship quality, and problem behaviors of children with ADHD and their friends, to these constructs in typically developing children. To the best of our knowledge, however, no study has conducted fined-grained analyses to understand the peer contagion processes in the interactions of children with ADHD and their friends. This type of question requires the study of the *transactional sequences* of behavior within dyads, which unfold over time (Bakeman & Quera, 2011). That is, as opposed to a study that examines the average level (or frequency count) of problem behaviors in children with ADHD when with their friends, research about peer contagion processes requires understanding the reciprocal or contingent behaviors that the child and friend display, in response to one another. Such questions are most suited to sequential analyses, which consider these contingencies between children and friends over time.

The current study

We used time-window sequential analyses to examine whether children with ADHD show reciprocity in dyadic mutuality and coercive joining within their interactions with a reciprocated friend, and whether peer contagion varied according to the context of the interaction (i.e., competitive versus cooperative). We hypothesized that, when their friends exhibited dyadic mutuality (i.e., positive affect and positive

behavior) during cooperation, children with ADHD would tend to reciprocate these behaviors. Similarly, we hypothesized that children with ADHD would tend to reciprocate their friends' coercive joining (i.e., controlling, aggressive, or rule-breaking behavior) during competition.

Methods

Participants

Participants were 164 children with ADHD (referred to as 'target children'), all of whom were taking part in a clinical trial evaluating interventions for friendship problems (see Mikami et al., 2020, for more details). Data in the present study were collected before participants' randomization to intervention conditions and receipt of treatment. Each target child participated with a real-life friend they invited to the lab. Target children were on average 8.58 years old (*SD* = 1.48; range 6–11; 32% girls) and 72% were white, while friends were on average 8.53 years old (*SD* = 1.57; range 5–13; 41% girls) and 72% were white. Target children's total average inattentive and hyperactive symptoms, respectively, ranged from 5.9 to 7.5, and from 4.3 to 6.0, whereas they ranged from 2.0 to 2.1, and from 1.0 to 1.5 for friends, respectively, based on parent and teacher reports on the Child Symptom Inventory (score range = 0–9; CSI-IV; Gadow & Sprafkin, 2002). ADHD presentations of target children were 69% combined, 27% inattentive, and 4% hyperactive-impulsive. Target children were recruited from hospitals, clinics, and schools in Vancouver and Ottawa/Gatineau, Canada.

All target children were diagnosed with ADHD based on DSM-5 criteria assessed with a parent semistructured diagnostic interview (Kiddie Schedule for Affective Disorders and Schizophrenia [K-SADS]; Axelson, Birmaher, Zelazny, Kaufman, & Gill, 2009) in combination with a teacher-rated ADHD scale (CSI-IV; Gadow & Sprafkin, 2002). Children also needed to show peer problems (>1 *SD* above the mean on the parent- and/or teacher-rated Strengths and Difficulties Questionnaire Peer Problems subscale [SDQ]; Goodman, 1997). Average scores on the SDQ peer problems subscale ranged from 4.8 to 5.4 for target children, whereas they ranged from 1.6 to 1.7 for friends (score range = 0–10).

Medication for ADHD (taken by 59% of target children) or prevalent comorbidities with ADHD (31% had an externalizing disorder and 29% had an internalizing disorder) were not exclusionary. Medicated target children had been on a stable dose leading up to the study and remained on this dose during the observational tasks (as per parent reports). Exclusion criteria for the larger trial were: Full-Scale IQ <75, autism spectrum disorder, or severe condition requiring immediate intervention (e.g., suicidality and psychosis).

Procedure

See Mikami et al. (2020) for full details. This study was approved by the institutional review boards at both sites. Parents and teachers provided consent and children assented to all procedures. Parents and teachers completed the CSI-IV and the SDQ-Peer Problems scale on target children over the phone or by email. If children had elevated symptom ratings, families were invited to the lab, where we administered the K-SADS to parents and a short form of the Wechsler Intelligence Scale for Children-IV (Wechsler, 2003) or Wechsler Abbreviated Scale of Intelligence (Wechsler, 2011) to children to ensure that inclusion criteria were met. Children and teachers completed rating scales to indicate comorbidities.

There were 213 children who met full inclusion criteria for the larger investigation. We asked these families to return with the child's closest friend; 167 did so. The child and friend each reported whether they were 'best friends', 'close friends', 'just ok friends', 'occasional companions', or 'strangers' during private, individual interviews. As recommended in the literature (Berndt & McCandless, 2009), we included the 165 dyads where both children reciprocally endorsed each other as being at least 'just ok friends'. A technical problem prevented us from filming one dyad, making our final $n = 164$.

Measures

We filmed the dyads in two tasks, counterbalanced for order, designed to mirror friends' real-world interactions and used previously to measure friendship patterns of children with and without ADHD (Normand et al., 2011, 2013).

Car-race task. The car-race task simulated a fast-paced, engrossing, and competitive game. Dyads were told that the goal was for each child to be quicker than the other in transporting five blocks across a game table, one at a time in the trunk of a toy truck. The truck needed to travel down a runway from a starting mark to a finish line and back. The runway could not accommodate both trucks side by side and the rules prohibited children from lifting their wheels from the runway.

Toy-sharing task. The toy-sharing task was a cooperative task eliciting negotiation processes used by friends in deciding how they 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. We assessed dyadic mutuality with two variables: reciprocated *positive affect* and *positive behavior,* computed separately for the car-race and toy-sharing tasks (see Appendix S1 for rationale). Positive affect occurred when laughter, warmth, or smiling was displayed by a dyad member. Positive behavior occurred when prosocial behavior or preference sharing was observed. Coercive joining behavior occurred when controlling, aggressive, or rule-breaking behavior was evidenced.

A team of 13 undergraduates, unaware of study hypotheses and which member was the target child versus the friend, coded the recordings of the two tasks based on previously developed coding manuals (e.g., Normand et al., 2011). Each coder received a minimum of 120 hr of training, which included a review of the coding rules, reliability checks, and feedback on accuracy. Once a criterion of 80% agreement was reached, formal coding started using Noldus Observer XT (Version 11.5). A random sample of 20% of tasks was recoded to establish interrater reliability. To minimize drift, ongoing monthly meetings occurred and interrater reliability was checked weekly. 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).

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. Behavioral indicators of *dyadic mutuality* were (a) prosocial behavior (i.e., altruistic behavior that considers the friend's well-being, = .73–.74); (b) preference sharing (i.e., communication of personal and subjective preferences [likes, dislikes, and opinions] to the friend, = .81); (c) and positive affect (i.e., expression of affection, laughter, smiles, or jokes during 5-second intervals, = .81, for both tasks). Behavioral indicators of *coercive joining* were (a)

aggressive behavior (i.e., verbal and physically aggressive behaviors that are hurtful and directed toward the friend, = .81–.83); (b) controlling behavior (i.e., behavior in which the child clearly tries to have verbal/physical control over the friend's behavior, = .74–.80); and (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, = .78). Because percentages for positive behavior during the car-race task were zero for 24% of target children and for 32% of friends, we recoded this variable before analysis to 0 if 0%, 1 otherwise. For additional descriptive details see Table S1.

Analyses

The Generalized Sequential Querier (GSEQ) 5.1.11 software (Bakeman & Quera, 2011) and the Statistical Package for the Social Sciences (SPSS) version 28.0 (SPSS Inc, Chicago, IL, USA) were used. To examine differences between tasks and between target children and friends, we employed repeated-measures *t*-tests. We characterized effect sizes with Cohen's d_z for related samples, using thresholds of 0.20, 0.50, and 0.80 for small, medium, and large effects, respectively (Cohen, 1988).

Reciprocity of dyadic mutuality and coercive joining – whether target children reciprocated their friends' similar behavior (or affect) – was assessed with time-window sequential analysis (Bakeman & Quera, 2011). This analysis asks: were the odds that the target child's behavior began during a time window defined by the friend's behavior greater than the odds that the target child's behavior began at other times? To conduct this analysis, we tallied successive seconds of the observation into 2 2 tables. Rows defined the friend's behavior; seconds were tallied in Row 1 if they occurred in a window beginning in the second after the onset of the friend's behavior and extending 5 seconds after its offset and in Row 2 otherwise. Five seconds is arbitrary, but preliminary analyses suggested that other values yielded essentially similar results. Columns defined the target child's behavior; seconds were tallied in Column 1 if they contained an onset of the target child's corresponding behavior and in Column 2 otherwise. This lets us compute the odds ratio (OR), the statistic we used to gauge reciprocity. Values of 1.25, 2.00, and 3.00 or above for increased odds (and 0.80, 0.50, 0.33, or below for reduced odds) represent small, medium, and large effect sizes, respectively (Bakeman & Quera, 2011).

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. This represents a trade-off with less restrictive criteria, statistics are based on more dyads. As would be expected, the percentage of dyads for whom an odds ratio could be computed declined with more restrictive criteria. Yet, as described subsequently, the results with different criteria were markedly consistent.

Results

Dyadic mutuality and coercive joining

As detailed in Table 1, ordering results from strongest to weakest effects, target children, on average, engaged in the following

Table 1 Mean percentages of dyadic mutuality and coercive joining

	Car-race task		Toy-sharing task		Task difference	
Variable	*M*	(*SD*)	*M*	(*SD*)	d_z	*p*
Target child						
Positive affect	30	(23)	26	(21)	0.17	.031
Positive behavior	2.3	(2.4)	12	(7.2)	1.45	<.001
Coercive joining behavior	24	(10)	10	(6.5)	1.25	<.001
Friend						
Positive affect	31	(24)	23	(22)	0.32	<.001
Positive behavior	1.9	(2.3)	13	(7.8)	1.37	<.001
Coercive joining behavior	20	(9.3)	8.7	(5.7)	1.13	<.001
Target child–friend difference						
	d_z	*p*	d_z	*p*		
Positive affect	0.07	.39	0.12	.12		
Positive behavior	0.13	.11	0.01	.90		
Coercive joining behavior	0.36	<.001	0.18	.019		

N = 164. Task comparisons are across columns; target child–friend comparisons are down rows. Dyadic mutuality behaviors include positive affect and positive behavior. Coercive joining behaviors are controlling, aggressive, and rule-breaking (see *Measures*). d_z is the standardized difference between means for related samples (Cohen, 1988); *p* values are from a *t*-test for related samples. A positive d_z indicates a higher mean for the car race than the toy-sharing task and for the target child than the friend.

1. Less positive behavior during the car-race task than during the toy-sharing task, a large difference (d_z = 1.45, p < .001).
2. More coercive joining behavior during the car-race task than during the toy-sharing task, again a large difference (d_z = 1.25, p < .001).
3. More positive affect during the car-race task than during the toy-sharing task, a difference that, although statistically significant, did not meet the threshold for a small effect (d_z = 0.17, p = .031).

Table 1 also shows that target children and their friends did not significantly differ in terms of positive affect and positive behavior in either task. However, target children, on average, were more likely than their friends to engage in coercive joining behavior in both the car-race (d_z = 0.36, p < .001) and toy-sharing (d_z = 0.18, p = .019) tasks. See Table S1 for additional descriptive statistics for dyadic mutuality and coercive joining; see Appendix S2 and Figure S1 for preliminary analyses of distributions of these variables.

Target children's reciprocity

The potential to assess reciprocity exists only when both children engage in the specific behavior at least once. As detailed in Table S2, for positive affect this characterized 90% and 88% of the dyads, and for coercive joining 99% and 95% of the dyads during the car-race and toy-sharing tasks, respectively, and for positive behavior 96% of the dyads during the toy-sharing task. However – reflecting the low average reported in Table 1 – only 55% of the dyads displayed positive behavior during the car-race task (Table S2). Thus, reciprocity in this competitive context could be assessed for, at most, about half the children.

To assess reciprocity for each of the various behaviors of interest, we computed five odds ratios – reflecting minimum tallies of 1 through 5 (see Analyses section). To gauge their significance, we categorized the odds ratios as exhibiting at least a weak effect (i.e., 1.25) or not (i.e., <1.25) and then, assuming that the probability of a weak effect is just 50%, we computed binomial test *z*-scores. We regard *z*-scores of 1.96 or greater as indicating probabilities of at least a weak effect significantly greater than the 50% expected by chance (see Table S2 for details).

Ordered from largest average odds ratios (most evidence of reciprocity) to least, results were as follows:

1. Coercive joining behavior during car-race task (% OR 1.25 = 84%–85%, z = 8.70–8.85).
2. Positive affect during toy-sharing task (% OR 1.25 = 66%–82%, z = 3.90–5.58).
3. Positive behavior during toy-sharing task (% OR 1.25 = 59%–61%, z = 2.32–2.74).
4. Positive affect during car-race task (% OR 1.25 = 54%–64%, z = 1.07–2.83).
5. Coercive joining behavior during toy-sharing task (% OR 1.25 = 52%–58%, z = 0.48–1.90).
6. Positive behavior during car-race task (% OR 1.25 = 22%–41%, z = 5.27 to 0.93).

These results suggest significant evidence of target child reciprocity for coercive joining behavior during the car-race task, and for positive affect and positive behavior during the toy-sharing task, no matter the criterion. There was significant evidence of target child reciprocity for positive affect during the car-race task when criteria were more restrictive (3–5 minimum tallies) and based on fewer dyads (64%–75%). By contrast, no significant evidence was found for target child reciprocity for coercive joining behavior during the toy-sharing task (z = 0.48–1.90). Finally, there was a significant lack of target child reciprocity (i.e., negative *z*-scores) for positive behavior during the car-race task when criteria were less restrictive (1–2 minimum tallies) and based on more dyads (38%–55%).

It is informative descriptively to classify positive odds ratios (OR 1.25) by effect size, thus differentiating into small, medium, and large positive effects (i.e., those with thresholds of 1.25, 2.00, and 3.00), respectively. Figures showing this breakdown for criteria with a minimum of 1 through 5 tallies were relatively similar (see Figure 1). Depending on the criterion, across both tasks and both dyadic mutuality and coercive joining behaviors, reciprocity effects were large for 19%–40% of the target children. Similarly, reciprocity effects were medium for 12%–25% of the target children – with the exception of positive behavior during the car-race task. This was the only circumstance that showed a lack of reciprocity, with 59%–78% of the odds ratios showing no or negative effect.

Discussion

We used time-window sequential analysis to assess whether children with ADHD show reciprocity in two peer contagion processes within their friendships (dyadic mutuality and coercive joining) during a cooperative task and a competitive task designed to mirror friends' real-world interactions. In line with the developmental psychopathology literature suggesting that friendships can represent both a protective factor and a risk factor (Bagwell & Bukowski, 2018), our findings show evidence of reciprocity in both dyadic mutuality and coercive joining.

Target children reciprocated their friends' positive affect in both tasks. Most friendships include shared laughter, and children often seek fun peers who enjoy the same activities as they do. The friendships of children with ADHD are not substantially different in this regard, similar to what has been found for the friendships of aggressive children (Dishion, Spracklen, Andrews, & Patterson, 1996). Overall, our findings support a possible contagion of positive emotional experiences in friendships (Dishion & Tipsord, 2011) among children with ADHD, regardless of the context (i.e., cooperative vs. competitive). Target children also reciprocated their friends' positive behaviors, but only in the cooperative context. Most children with ADHD showed *a lack of reciprocity* of such behaviors in the competitive context. It is essential to consider that positive behavior did not occur frequently in the competitive context in the first place, thereby making reciprocity less likely to occur. However, the robustness of our findings using more or less restrictive criteria (see Table S2 and Figure 1) allows us to speculate that, unlike peer contagion of positive emotions, peer contagion of positive behaviors may predominantly occur in situations that do not elicit rivalry between friends. Indeed, target children *only* reciprocated their friends' coercive joining behaviors in the fast-paced, engrossing, and competitive task. Because self-regulation abilities have been identified as an important risk factor for peer influences (Dishion & Tipsord,

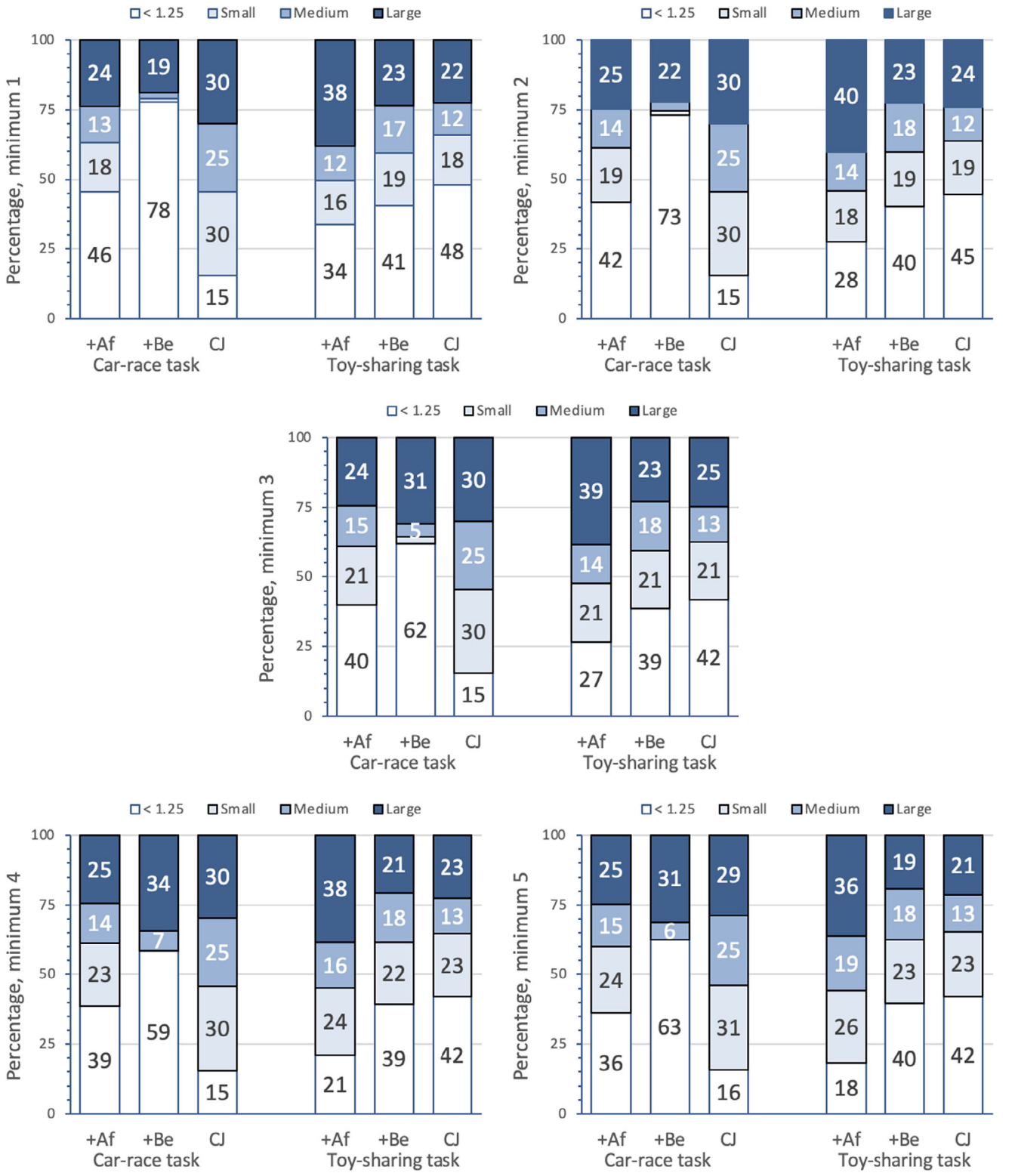

Figure 1 Percentages of odds ratios by effect-size category for 1, 2, 3, 4, and 5 minimum tallies criteria. *Note*. For the number of dyads for each minimum, see Table S2. Dyadic mutuality behaviors are positive affect and positive behavior. Coercive joining behaviors are controlling, aggressive, and rule-breaking (see *Measures* in the main article). When actual percentages are not noted on the figure (because of space limitations), percentages are 3%. Overall, the pattern of results appears very similar using criteria 1 through 5

2011), it is not surprising that children with ADHD may be negatively influenced by friends, especially during competitive interactions that are likely to dysregulate their behavior. Children with ADHD, who are more vulnerable to rewards (such as the attraction of winning races, Luman, Tripp, & Scheres, 2010), may be less likely to inhibit coercive behaviors (or to reciprocate prosocial behaviors) in such settings, possibly leading to negative peer contagion over time.

Strengths and limitations

To the best of our knowledge, the current investigation is the first to examine dynamic, microsocial peer contagion processes within the dyadic friendships of children with ADHD. To this end, we used well-defined and operationalized transactional process constructs of dyadic mutuality and coercive joining and conducted time-window sequential analysis (Bakeman & Quera, 2011). We included a broad range of friendships instead of only considering best friendships (Berndt & McCandless, 2009). We examined how peer contagion influences varied by interaction context (competitive vs. cooperative), which may guide future research and clinical directions. Our relatively large sample of clinically diagnosed children with ADHD is another strength.

Limitations include the contrived nature of the closed-field observational tasks, although studying friendship processes using naturalistic observation has its own challenges. Second, we were only able to assess reciprocity when both target child and friend engaged in the specified behavior at least once. This resulted in missing scores when assessing reciprocity of positive behavior (but not positive affect) during the car-race task. This is not surprising given the competitive nature of the task, but caution is nonetheless needed when interpreting these results. Third, our cross-sectional design precluded conclusions about the developmental significance of the contagion processes. Future studies should examine the interrelation of both processes over time and their unique and combined contributions to longer-term outcomes. Instances of reciprocity, if repeated consistently over months or years in a friendship, could potentially lead to snowballing effects on friendship quality and adjustment. Finally, reciprocity effects for dyadic mutuality and coercive joining were medium or large for around a third to half of target children, respectively, highlighting individual differences. Potential moderators include demographic characteristics (e.g., gender, age, and culture), clinical characteristics (e.g., ADHD presentation, symptom severity, externalizing problems, and medication status), social characteristics (e.g., social status and social competence), and contextual demands (e.g., adult monitoring and supervision; Dishion & Tipsord, 2011). Lastly, future studies should examine whether other peer contagion processes occur in the friendship interactions of children with ADHD, such as deviancy training (Piehler, 2016).

Clinical implications

The present findings suggest that children with ADHD reciprocate their friends' positive affect, but reciprocate their friends' positive behaviors (i.e., prosocial/intimate) only when the context is cooperative. In light of the well-known generalization challenges of traditional social skills training for children with ADHD (Gardner & Gerdes, 2015), these findings may help optimize intervention efforts. First, they underscore the potential utility of helping children with ADHD to select prosocial friends. Consistent with this idea, a previous study found that children with ADHD paired with prosocial friends were rated as having higher quality friendships and as more normalized following a friendship intervention implemented within an intensive behavioral treatment program (Hoza, Mrug, Pelham, Greiner, & Gnagy, 2003). Second, our findings suggest that parents of children with ADHD might encourage, or organize playdates around, cooperative tasks or games, to facilitate dyadic mutuality (Mikami et al., 2020). In contrast, competitive contexts may encourage friends to negatively influence each other in coercive joining. Although friendly competition is considered part of the cement that holds together children's friendships, our findings suggest that competitive situations may facilitate the spread of coercive behavior between friends in this clinical population. Parents of children with ADHD might monitor and minimize coercive influences during playdates between friends and show their child how to be a 'good sport' during competitive games (Mikami et al., 2020). Whether interventions lead to increases in dyadic mutuality and reductions in coercive joining can also be assessed. It will also be important to examine whether coercive joining undermines or reduces intervention effects (Dodge, Dishion, & Lansford, 2006).

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Appendix S1. Rationale for examining dyadic mutuality and coercive joining behaviors separately by task.
Appendix S2. Preliminary analyses of distributions of the dyadic mutuality and coercive joining variables.
Table S1. Additional descriptive statistics for dyadic mutuality and coercive joining.
Figure S1. Box-and-Whisker plots for positive affect, positive behavior, and coercive joining during the car-race and toy-sharing tasks for the target child and a friend.

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Key points

- Persistent and treatment-resistant friendship difficulties are a significant area of impairment for many children with ADHD.
- However, little is known about reciprocal peer influence dynamics within these children's friendships.
- Using observational methods and time-window sequential analysis, results suggest that mutual peer influences vary according to interaction context (i.e., cooperation vs. competition).
- Children with ADHD reciprocate their friends' positive affect in both contexts. However, they only reciprocate their friends' positive behavior (i.e., prosocial/intimate) in cooperative situations and only reciprocate their friends' coercive behaviors in competitive situations.
- Targeting the interaction context – and considering friends' potential positive and negative contagion influences – may help optimize interventions to improve friendships in children with ADHD.

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