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Associations Between Subtypes of Empathy and Aggression in High-Risk Adolescents

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Abstract

Aggression in youth is a transdiagnostic indicator and associated with a variety of serious, maladaptive outcomes. Theoretically, aggression is linked to individual differences in empathy (i.e., the capacity to understand, resonate with, and experience others' emotions); yet the empirical research is mixed. To clarify this literature, this pre-registered study examined unique associations between subtypes of empathy (cognitive, affective, somatic, positive, and negative) and aggression (reactive, proactive) among a diverse sample of high-risk adolescents ($N = 103$; M_{age}=16.1 years, 53% female; 60% racial/ethnic minoritized groups). Empathy was assessed via youth-report at baseline and aggression was assessed at baseline and 9-month follow-up across multiple informants (youth-, parent-, and teacher). Associations were examined simultaneously while controlling for theoretically relevant covariates (age, sex, minoritized status, receipt of public assistance) and emotional reactivity. Somatic empathy was the most consistent predictor of aggression. Specifically, youth reporting *higher* somatic empathy had *lower* levels of youth- and teacher-reported reactive and proactive aggression at baseline and 9-month follow-up. Additionally, youth who endorsed higher affective empathy also reported more reactive aggression at baseline and at follow-up after accounting for individual differences in emotional reactivity. Results highlight the importance of considering subtypes of both empathy and aggression when examining risk and resilience pathways and point to the potential role of somatic empathy as a protective factor. Taken together, findings enhance our understanding of etiological mechanisms for aggression and suggest that interventions that encourage youth to upregulate their emotional sensitivity or interoceptive awareness may reduce aggression.

Keywords Reactive aggression · Proactive aggression · Longitudinal · Multiple informants · Youth

Introduction

Aggression refers to a heterogeneous set of behaviors that cause harm to others (Anderson & Bushman, 2002). Importantly, aggression is a transdiagnostic indicator that permeates nearly all psychiatric disorders in youth (Kazdin, 2003) and is associated with a diverse range of maladaptive outcomes including lower academic achievement, unemployment, chronic delinquency, substance use problems, and suicide (Farrington, 1991; Huesmann et al., 2009). Theoretically, the development and persistence of aggression is linked to individual differences in empathy (Jolliffe & Farrington, 2004; Parke & Slaby, 1983), or the capacity to understand, resonate with, and experience others' thoughts, perspectives, and emotions (Bernhardt & Singer, 2012). Empathy is a multifaceted and foundational skill that has cascading effects on socioemotional development and is a necessary precursor to positive interpersonal bonds, relationships, and prosocial behavior (Decety & Meyer, 2008; Stern & Cassidy, 2018). Unsurprisingly, low empathy is a diagnostic marker of aggression-related psychopathologies (American Psychiatric Association, 2013), and empathy-boosting interventions are a common feature of treatment for aggression (Vachon et al., 2014). However, empirical work exploring associations between individual differences in empathy and aggression tells a less consistent

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story. Further research is needed to better understand the role of empathy as a risk and resilience factor for aggression, especially among high-risk youth.

Meta-analytic work quantifying the link between empathy and aggression has shown a small and negative association (*average r* = -0.07, Miller & Eisenberg, 1988; *r* = -0.11, Vachon et al., 2014), with studies reporting effects ranging from positive to negative depending on constructs and operational definitions (see Miller & Eisenberg, 1988 and Vachon et al., 2014). A recent meta-analysis reported a null relationship between empathy and aggression in 86 studies (total $N = 17{,}354$), finding that only 1% of the variance in aggression was explained by empathy (Vachon et al., 2014). There is some suggestion that this small effect may be related to a failure to consider subtypes of empathy (e.g., *cognitive empathy*, or *understanding* how someone else is feeling, versus *affective empathy*, or *resonating with* that feeling), which have shown differential associations with aggression (e.g., Palumbo & Latzman, 2021). However, results from the same meta-analysis found that separating cognitive versus affective empathy did not yield further explanatory power when examining links with aggression, broadly defined (Vachon et al., 2014).

Emerging research suggests that examining other fundamental, albeit less studied, subtypes of empathy such as somatic empathy or positive versus negative empathy may further clarify associations with aggression. For example, somatic empathy, defined as experiencing another person's emotions via visceral, shared physiological or bodily responses, has been identified as a central component of the empathic response (Van der Graaff et al., 2016) and has shown both positive and negative associations with aggression in youth and adult samples (Raine et al., 2022; Raine & Chen, 2018). Additionally, nascent work suggests that positive and negative empathy, which differentiate between empathy for others' positively-valanced versus negatively-valanced emotions (Morelli et al., 2015), may show distinct associations with aggression (Raine et al., 2022). However, these subtypes have not been captured by traditional empathy measures and have only recently been examined in conjunction with aggression (Raine & Chen, 2018). Better understanding how these multiple subtypes of empathy are related to aggression in high-risk adolescents could elucidate important etiological pathways and potential targets for intervention.

Alongside efforts to parse empathy into more specific subtypes, a growing body of literature suggests that expanding this work to delineate meaningful subtypes of aggression may also be important for clarifying this muddled literature. Specifically, theory and research suggest that *reactive aggression*, an impulsive, "hot," and emotionally driven form of aggression, may show distinct associations with empathy relative to *proactive aggression*, a more "cold" and calculated form of aggression. For example, several studies have shown opposite associations with empathy broadly defined (i.e., "total empathy", Fig. 1), such that *higher* levels of empathy are often associated with reactive aggression, while *lower* levels of empathy have been consistently associated with proactive aggression (Chen et al., 2021; Raine et al., 2022; Raine & Chen, 2018).

Importantly, an examination of cognitive and affective subtypes of empathy and reactive and proactive aggression has shown a similar pattern of findings (Fig. 1). *Higher* levels of cognitive and affective empathy have been linked to reactive aggression (Palumbo & Latzman, 2021; Raine et al., 2022; Raine & Chen, 2018) and *lower* levels of cognitive and affective empathy have been linked to proactive aggression (e.g., Chen et al., 2021; Raine et al., 2022; for exceptions, see Austin et al., 2017 and Deschamps et al., 2018). Notably, negative associations with proactive aggression

	Total Empathy			Affective Empathy			Cognitive Empathy		
	(+)	(-)	ns	(+)	(-)	ns	(+)	(-)	ns
Reactive Aggression	*Raine et al., 2022*, Chen et al., 2021 (PR), Raine et al., 2018*	**Mayberry et al., 2007**, Chen et al., 2021	Deschamps et al., 2018* (PR & TR only)	*Raine et al., 2022*, *Palumbo et al., 2021*, Chen et al., 2021 (PR)	**Mayberry et al., 2007**, Pouw et al., 2013, Austin et al., 2017* (TR)	**Euler et al., 2017**, Chen et al., 2021 (PR), Tampke et al., 2020* (TR)	*Raine et al., 2022*, Chen et al., 2021 (PR)	*Palumbo et al., 2021*, **Mayberry et al., 2007**, Pouw et al., 2013, Chen et al., 2021 (PR)	**Euler et al., 2017**, **Fung et al., 2015**
Proactive Aggression		*Raine et al., 2022*, **Mayberry et al., 2007**, Chen et al., 2021 (PR), Katsuma et al., 2008, Deschamps et al., 2018* (PR & TR only), Raine et al., 2018*	Deschamps et al., 2018* (PR & TR only), Raine et al., 2018*		*Raine et al., 2022*, *Palumbo et al., 2021*, **Euler et al., 2017**, **Fung et al., 2015**, **Mayberry et al., 2007**, Chen et al., 2021 (PR), Austin et al., 2017* (TR), Tampke et al., 2020 (TR)*			*Raine et al., 2022*, *Palumbo et al., 2021*, Chen et al., 2021 (PR), **Mayberry et al., 2007**	**Euler et al., 2017**, **Fung et al., 2015**, Pouw et al., 2013, Austin et al., 2017* (TR)

Fig. 1 Associations between subtypes of empathy and aggression. Research finding a positive association are listed in the (+) columns, research finding negative associations are listed in the (-) columns, and research finding non-significant associations are listed in the "ns" (non-significant) columns. Studies involving adult populations are italicized, adolescent populations (13-17 years of age) are bolded, and child populations (less than 13 years of age) are underlined. Studies are a cross-sectional design unless denoted with an asterisk, indicating a longitudinal design. All studies included youth- or self-report unless otherwise specified, and studies that included additional informants are denoted with (PR) or (TR) indicating parent-report or teacher-report. Studies that examined associations between multiple subtypes of empathy and/or aggression are listed more than once. Studies that reported differing associations between empathy and aggression based on informant are also listed more than once

appear to be particularly robust while associations with reactive aggression appear more tenuous, as inverse or non-significant associations have also been found (see Austin et al., 2017; Chen et al., 2021; Mayberry & Espelage, 2007). These inconsistencies may be related to several factors, including variation in study samples or design (i.e., community vs. clinical samples), variability in assessment (i.e., use of non-traditional measures), and/or a failure to examine subtypes of empathy and aggression simultaneously within the same model.

Additionally, key to these efforts is considering associations with aggression across time, as most of the existing literature examines these connections cross-sectionally (Fig. 1**).** Longitudinal studies are needed to better understand how various subtypes of empathy impact aggression over time and across contexts. Along these lines, a preponderance of empirical work examining associations between empathy and aggression has focused on either youth- *or* parent-reported aggression (Fig. 1), with few studies including multiple perspectives (for exception see Deschamps et al., 2018; Chen et al., 2021; Tampke et al., 2020) and even less considering aggression in the school context via teacher report of aggression (for exception see Austin et al., 2017).

Relatedly, open questions remain concerning the consistency of these associations across developmental stage, with much of the existing research focusing on younger children (i.e., 12 years of age or younger) or adults (Fig. 1). Examining connections between subtypes of empathy and aggression during the adolescent period may be particularly important as adolescence is a sensitive developmental window characterized by notable neurobiological and hormonal changes underlying socioemotional development (Dahl et al., 2018; National Academies of Sciences et al., 2019). Critically, this developmental period is marked by the emergence of severe mental illness (Casey et al., 2008; Steinberg, 2005), and increased aggression across adolescence signals heightened risk for severe and intractable forms of psychopathology (Byrd et al., 2012; Card et al., 2008). This underscores the heightened vulnerability of the adolescent period and suggests that further elucidating associations between empathy and aggression during this developmental window has the potential to enhance interventions targeting aggression.

The current pre-registered study (https://osf.io/zbpt5/) seeks to build on prior work and address the aforementioned limitations by examining unique associations between subtypes of empathy and aggression in a diverse sample of high-risk youth during the sensitive adolescent period. This study applies a newly developed and well-validated measure of empathy that includes assessments of cognitive and affective empathy as well as somatic, positive, and negative empathy in line with emerging work showing the importance of these subtypes (Raine et al., 2022; Raine & Chen, 2018). Additionally, subtypes of aggression (i.e., reactive and proactive aggression) were assessed at baseline and 9-month follow-up, across multiple informants (i.e., youth, parent, and teacher). Analyses first focused on associations between youth-reported empathy and aggression subtypes, assessed cross-sectionally and longitudinally. We next examined associations between empathy and aggression as reported across multiple informants (i.e., parent, teacher). Finally, in addition to the inclusion of theoretically relevant demographic covariates, we assessed the impact of individual differences in emotional reactivity, a defining feature of sample recruitment, on the association between empathy and aggression. This is in line with prior work linking emotional reactivity to both empathy (Schipper & Petermann, 2013; Thompson et al., 2019) and aggression (Byrd et al., 2022b; Garofalo & Velotti, 2017).

Based on previous research, we hypothesized that reactive aggression would be positively associated with cognitive, affective, and somatic empathy subtypes, while proactive aggression would be negatively associated with these empathy subtypes. Building on recent work suggesting that reactive aggression may be more strongly related to negative empathy, while proactive aggression is more strongly associated with positive empathy (Raine et al., 2022), we hypothesized that reactive aggression would be significantly associated with negative empathy while proactive aggression would be associated with positive empathy. We expected similar associations to emerge when examining parent- and teacher-reported aggression. Further, we expected that emotional reactivity would be related to both empathy and aggression, and that connections between empathy and aggression in youth would remain even after accounting for such individual differences in emotional reactivity. Additional details about pre-registered hypotheses can be found on the Open Science Foundation (https://osf.io/zbpt5/).

Method

Participants were drawn from an ongoing longitudinal study of 103 adolescents between the ages of 14 and 17 years (M_{age}=16.1 years, SD = 1.1 years, 53% female; 60% racial/ethnic minoritized groups) and their caregivers (M_{age}=45.2; SD = 7.6; 94% female; 48% racial/ethnic minoritized groups). Adolescents and their primary caregivers (89% biological mothers, hereafter referred to as "parent") were recruited from a large, Mid-Atlantic, urban geographic region using two recruitment streams designed to obtain a sample with a range of emotional reactivity. Two-thirds of the sample (n = 69) were recruited from a recently completed longitudinal

study of clinically referred youth with moderate-to-high levels of emotional reactivity[1] and one-third of the sample (n = 35) was recruited from the community via a university-based research recruitment program designed to target youth with low levels of emotional reactivity. Emotional reactivity was assessed during phone screening using the Affective Instability subscale from the Personality Assessment Inventory-Adolescent Version (PAI-AI; Morey, 2007; scores > 11 indicating clinical significance). Youth recruited for moderate-to-high emotional reactivity had higher levels of emotional reactivity (M = 9.57; SD = 3.85; range = 3–17) relative to those youth recruited for low emotional reactivity (M = 3.49; SD = 2.09; range = 0–7), with the full sample showing a wide range of emotional reactivity (see **Figure S1**).

Youth were excluded if they were less than 14 or older than 17 years of age (n = 3), had a history of a neurological medical condition (n = 2), had irremovable metal (e.g., braces; n = 4), were no longer living with their parent (n = 2), or were not within driving distance (n = 3). Additionally, those recruited from the community with high levels of emotional reactivity (n = 6) were also excluded. All parents had legal custody and primary physical custody (> 50% of the time). Parents reported having M = 2.27 children (S.D. = 1.44) and 58% reported living with their romantic partners. While over half of parents reported full-time or part-time employment (44% and 17%, respectively), 15% reported an annual household income between $20,000 and $39,000 and 22% reported annual income <$20,000. Additional demographic information is available upon request.

Procedure

Eligible adolescents and their parents were asked to complete three study assessments, each of which were 9 months apart (i.e., baseline, 9-, and 18-month follow-ups). The baseline assessment was in-person and included a neuroimaging scan, neuropsychological and behavioral assessments, and youth- and parent-reported questionnaires assessing emotions and behaviors. At each assessment, adolescents and their parents were also asked to provide contact information for a current teacher. Following the assessment, teachers were contacted and asked to complete an online questionnaire assessing emotions and behaviors observed in the school setting.[2] Follow-up assessments were completed virtually and included youth-, parent-, and teacher-reported questionnaires. The current study focuses on the baseline and 9-month follow-up,[3] specifically questionnaire assessments of youth-reported empathy and aggression, as assessed via youth-, parent-, and teacher-report. All study procedures were approved by the Human Research Protection Office (HRPO) and the Clinical and Translational Science Institute (CTSI) pediatric practice-based research network. Youth and their parents provided written informed consent and were compensated for their time.

Measures

Empathy. Empathy was assessed using youth-report on the Cognitive, Affective, & Somatic Empathy Scale (CASES) (Raine & Chen, 2018). The CASES is a 30-item questionnaire that asks about one's ability to empathize across three domains. Ten cognitive items assess perspective taking or understanding another's emotional experience (e.g., "*I know when someone is unhappy even before they say why*"), 10 affective items reflect resonating with the emotion of another's emotion (e.g., "*Seeing people sad at a funeral would make me feel sad too*"), and 10 somatic items reflect a mirroring (e.g., "*Seeing others laugh makes me laugh too*"), or bodily experience of others' emotion (e.g. "*I cringe when I see someone cut or bleeding*"). Within each of these domains, items assessed empathy in response to both positive (e.g., "*I know why my friends are cheerful even when they don't say why*") and negative (e.g., "*I can tell when someone is feeling guilty*") emotional situations. All items are rated on a 3-point Likert scale (*0 = rarely, 1 = sometimes, 2 = often)*, and summed to create the following subscales: cognitive empathy, affective empathy, somatic empathy, positive empathy, and negative empathy. The CASES empathy subscales had good reliability (cognitive empathy α = 0.89; affective empathy α = 0.83; somatic empathy α = 0.85, positive empathy α = 0.91; negative empathy α = 0.88).

Aggression. Aggression was assessed using youth-, parent-, and teacher-report on the Reactive-Proactive Aggression Questionnaire (Raine et al., 2006). The RPQ

[1] At the time of initial recruitment, these participants were between the ages of 11–13 years (M_{age} = 12.03 years, *S.D.* = 0.92 years; 47% female; 60% racial/ethnic minority). These youth had elevated scores on the PAI-AI (M = 13.05, S.D. = 2.90; scores > 11 indicating clinical significance; Morey, 2007) and were receiving psychiatric treatment for a mood or behavior problem. For additional information about this sample see Byrd et al., 2022a, b.

[2] Participants with teacher data did not differ from those without any teacher data on age, minority status, or family public assistance. Children with missing teacher data (n = 20) were more likely to be female (t = 2.45, p = 0.02) and from the clinical sample (t = -2.40, p = 0.02).

[3] Participants completing both assessments (n = 98) were compared to those with missing 9-month follow-up data (n = 5) on all demographic covariates (age, sex, minority status, receipt of public assistance, and group). Participants with complete data did not differ from those who only completed the baseline assessment, with the exception of group (i.e., all participants lost to follow-up were from the clinical sample (t = -7.34, p < 0.001).

is a 23-item questionnaire that assesses both reactive (e.g., "*yelled at others when they have annoyed you*") and proactive (e.g., "*had fights with others to show who was on top*") aggression. All items are rated on a 3-point Likert scale (0 = *never*, 1 = *sometimes*, 2 = *often*), and summed to create reactive and proactive aggression subscales. Aggression subscales showed acceptable reliability across timepoints and informants (youth-report baseline: reactive aggression α = 0.85, proactive aggression α = 0.70; and 9-month follow-up: reactive aggression α = 0.86, proactive aggression α = 0.88; parent-report baseline: reactive aggression α = 0.88, proactive aggression α = 0.83; and 9-month follow-up: reactive aggression α = 0.86, proactive aggression α = 0.80; teacher-report baseline: reactive aggression α = 0.93, proactive aggression α = 0.69; and 9-month follow-up: reactive aggression α = 0.91, proactive aggression α = 0.93).

Covariates

Demographics. Child age, racial/ethnic minoritized status (0 = white; 1 = minoritized status), and child sex (0 = male; 1 = female) were obtained via parent report. Family receipt of public assistance was obtained via parent report (e.g., food stamps, welfare, etc.; 0 = no public assistance; 1 = receipt of public assistance).

Emotional Reactivity. Emotional reactivity was assessed using youth-report on the Personality Assessment Inventory – Adolescent (PAI-A). The PAI-A is 264-item youth-report measure that is designed to assess various aspects of adolescent personality (Morey, 1991, 2007). The Affective Instability subscale of the PAI-A uses 6 items to assess intensity and variability of emotion (e.g., "*mood can shift quite suddenly", "has little control over anger"*) on a 4-point scale (0 = *false*, 1 = *slightly true*, 2 = *mainly true*, 3 = *very true*). Responses to each of these 6 questions are summed to create a total Affective Instability score, which showed good reliability in this sample (α = 0.83).

Data Analytic Plan

Preliminary analyses were conducted to examine descriptive statistics and bivariate correlations between study variables using the function "tab_corr" from the R package{sjPlot}, specifying pairwise deletion for missing values, and Pearson's correlation coefficients (Lüdecke, 2022). All hypotheses were tested with structural equation models in MPlus version 8 (Muthén & Muthén, 2017) using full information maximum likelihood estimation with robust standard errors to handle missing data. In the first models (see Fig. 2, **Panel A**), associations between

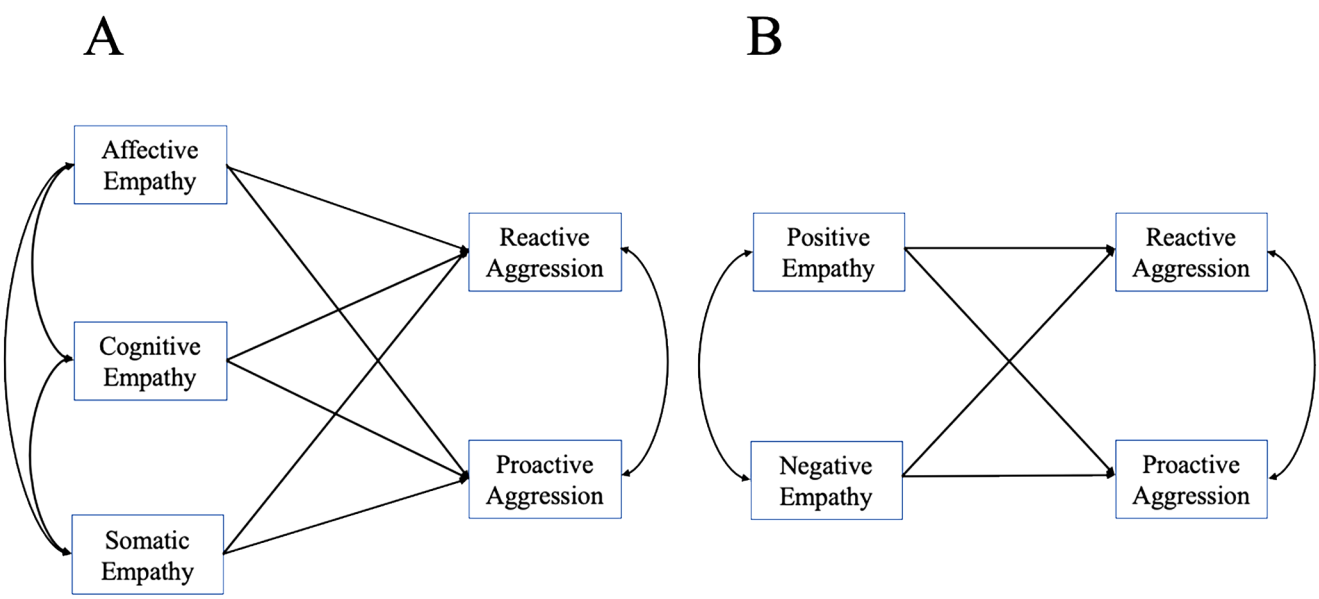

Fig. 2 Structural equation models examining associations between subtypes of empathy and reactive and proactive aggression. **Panel A** depicts the model examining associations between cognitive, affective, and somatic empathy and reactive and proactive aggression. **Panel B** depicts the model examining associations between positive and negative empathy and reactive and proactive aggression. Separate, analogous models were analyzed for subtypes of aggression assessed at baseline and at 9-month follow-up, and via multiple informants (youth-, parent-, and teacher-report). Covariates (age, sex, minoritized status, receipt of public assistance, recruitment group, and emotional reactivity) were also regressed on reactive and proactive aggression, though they are not depicted

youth-reported cognitive, affective, and somatic empathy and youth-reported aggression (i.e., reactive, proactive) at baseline and 9-month follow-up were estimated simultaneously while controlling for theoretically relevant demographic covariates (i.e., child age, sex, minoritized status, family receipt of public assistance) and recruitment group. The second models (see Fig. 2, **Panel B**) examined associations between youth-reported positive and negative empathy and youth-reported aggression (i.e., reactive, proactive) at 1) baseline and 2) 9-month follow-up while accounting for covariates. Analogous analyses examined associations between youth-reported empathy and (1) parent-reported reactive and proactive aggression and (2) teacher-reported reactive and proactive aggression, assessed at baseline and 9-month follow-up. Finally, emotional reactivity, a defining feature of sample recruitment, was included in all models to examine the impact of associations between empathy and aggression. Model fit was evaluated using standard criteria for $\chi 2$, comparative fit index (CFI; Bentler, 1990), and the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993). For CFI, conventional cut-off values of 0.95 or greater indicate good fit (McDonald & Ho, 2002). RMSEA values below 0.05 represent good fit (Kline, 2023; McDonald & Ho, 2002). Standardized effects from the full models are reported.

Results

Table 1 and **Table S1** show descriptive statistics and correlations for all study variables. At the bivariate level, all significant associations between empathy subtypes and reactive and proactive aggression were negative, such that higher levels of empathy were associated with less aggression. Somatic empathy was most consistently correlated with both reactive and proactive aggression across all timepoints and informants. Youth-reported proactive aggression and parent-reported reactive aggression were significantly associated with all empathy subtypes at both timepoints, while teacher-reported aggression was only related to somatic empathy, with one exception; higher levels of cognitive empathy were associated with less teacher-reported reactive aggression at follow-up. Demographic covariates were unrelated to youth-reported aggression; however, boys, youth of a minoritized racial status, and youth receiving public assistance had higher levels of parent- and teacher-reported aggression. Recruitment group and emotional reactivity were also positively associated with reactive and proactive aggression.

Associations Between Subtypes of Empathy and Aggression: Youth-Report

Table 2 depicts the results from analyses examining associations between cognitive, affective, and somatic empathy and youth-reported reactive and proactive aggression at baseline and 9-month follow-up. Consistent with our preregistered hypotheses, affective empathy was positively associated with increased reactive aggression at baseline, such that youth reporting higher levels of affective empathy also reported higher levels of reactive aggression. Also as predicted, somatic empathy was associated with both reactive and proactive aggression at baseline and 9-month follow-up; however, these associations were all negative such that youth reporting higher levels of somatic empathy also reported lower levels of reactive *and* proactive aggression. No associations between cognitive empathy and reactive or proactive aggression were found.

Table 3 depicts the results from analyses examining associations between positive and negative empathy and youth-reported reactive and proactive aggression at baseline and 9-month follow-up. Contrary to hypotheses, no associations between positive and negative empathy and youth-reported reactive or proactive aggression at baseline were found. There was a significant negative association between positive empathy and proactive aggression at follow-up such that youth reporting more positive empathy also reported less proactive aggression 9 months later.

Associations Between Subtypes of Empathy and Aggression: Parent-Report

Table S2 depicts the results from analyses examining associations between cognitive, affective, and somatic empathy and parent-reported reactive and proactive aggression at baseline and 9-month follow-up. The only significant association that emerged was between affective empathy and parent-reported proactive aggression at 9-month follow-up. Specifically, youth reporting higher levels of affective empathy had higher levels of parent-reported proactive aggression. **Table S3** shows results from analyses examining associations between positive and negative empathy and parent-reported reactive and proactive aggression at baseline and 9-month follow-up. Contrary to hypotheses, no associations were found.

Associations Between Subtypes of Empathy and Aggression: Teacher-Report

Table S4 depicts the results from analyses examining associations between cognitive, affective, and somatic empathy and teacher-reported reactive and proactive aggression

Table 1 Descriptive statistics and correlations among key study variables

				Covariates					Empathy					
		Mean/%	*SD*	Age	Sex (Female)	Minoritized Status	Public Assistance	Group	Emotional Reactivity	Cognitive Empathy	Affective Empathy	Somatic Empathy	Positive Empathy	Negative Empathy
	Age	16.15	1.05											
	Sex (Female)	52.88%		-0.10										
	Minoritized Racial Status	59.62%		0.03	-0.04									
	Public Assistance	62.5%		0.13	-0.15	0.28**								
	Group	66.35%		0.33***	-0.09	0.21*	0.47***							
	Emotional Reactivity	24.19	18.70	0.02	0.31**	0.07	0.13	0.23*						
	Cognitive Empathy	12.70	4.71	-0.02	0.18	-0.20*	-0.28**	-0.38***	0.06					
	Affective Empathy	13.58	4.44	0.01	0.26**	-0.20*	-0.39***	-0.34***	0.04	0.75***				
	Somatic Empathy	10.67	4.99	-0.09	0.28**	-0.16	-0.35***	-0.38***	0.04	0.71***	0.82***			
	Positive Empathy	19.08	6.90	0.00	0.12	-0.18	-0.36***	-0.38***	-0.01	0.86***	0.89***	0.88***		
	Negative Empathy	17.88	6.69	-0.07	0.39***	-0.21*	-0.35***	-0.38***	0.11	0.85***	0.89***	0.88***	0.82***	
	Reactive Aggression [Baseline]	6.72	4.34	-0.05	0.03	0.11	0.14	0.33***	0.62***	-0.06	-0.02	-0.19	-0.12	-0.08
Youth-Report	Proactive Aggression [Baseline]	1.29	1.88	-0.01	-0.12	0.06	0.16	0.25*	0.30**	-0.22*	-0.24*	-0.34***	-0.28**	-0.28**
	Reactive Aggression [FU]	6.14	4.32	-0.10	0.03	0.06	0.15	0.27**	0.51***	-0.15	-0.12	-0.21*	-0.21*	-0.12
	Proactive Aggression [FU]	1.52	3.04	-0.12	-0.19	0.08	0.16	0.11	-0.01	-0.30**	-0.30**	-0.36***	-0.35***	-0.33**
	Reactive Aggression [Baseline]	7.61	4.66	0.14	-0.28**	0.23*	0.41***	0.48***	0.16	-0.23*	-0.23*	-0.31**	-0.23*	-0.30**
Parent-Report	Proactive Aggression [Baseline]	2.04	2.92	0.16	-0.28**	0.22*	0.31**	0.35***	-0.09	-0.14	-0.12	-0.22*	-0.14	-0.19
	Reactive Aggression [FU]	6.21	4.23	0.05	-0.33***	0.18	0.36***	0.40***	0.07	-0.24*	-0.20*	-0.24*	-0.20	-0.28**
	Proactive Aggression [FU]	1.40	2.30	-0.01	-0.29**	0.13	0.25*	0.30**	-0.07	-0.07	0.07	0.01	0.06	-0.06
	Reactive Aggression [Baseline]	1.61	3.45	0.04	-0.13	0.28*	0.30**	0.12	0.02	-0.08	-0.19	-0.23*	-0.16	-0.20
Teacher-Report	Proactive Aggression [Baseline]	0.37	1.07	0.07	-0.17	0.28*	0.24*	0.09	0.07	-0.12	-0.21	-0.25*	-0.16	-0.25*
	Reactive Aggression [FU]	1.51	3.18	-0.07	-0.04	0.26*	0.23*	0.18	0.14	-0.22*	-0.13	-0.14	-0.17	-0.17
	Proactive Aggression [FU]	0.62	2.45	0.05	-0.08	0.20	0.19	0.18	0.12	-0.10	0.01	-0.01	0.01	-0.08

Note. Significant correlations are in bolded black text and represent significant associations between study variables. FU = 9-month follow-up. The following variables were coded as binary: sex (0 = male, 1 = female), minoritized racial status (0 = white, 1 = minoritized racial identity), family receipt of public assistance (0 = no public assistance, 1 = public assistance), and group (0 = recruited from community, 1 = recruited from high emotional reactivity sample). For each of these variables, values in the "mean" column represent percentage of the total sample with values coded as 1

*** $p < .001$; ** $p < 0.01$; *$p < 0.05$

Table 2 Cognitive, affective, and somatic empathy as predictors of youth-reported aggression at baseline and 9-month follow-up

	Baseline						9-month Follow-Up					
	Reactive Aggression			Proactive Aggression			Reactive Aggression			Proactive Aggression		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Predictors												
Cognitive Empathy	0.11	0.15	0.45	0.05	0.37	0.72	-0.02	-0.11	0.92	-0.10	-0.64	0.52
Affective Empathy	**0.46**	**0.20**	**0.02**	0.12	0.72	0.47	0.28	1.65	0.10	0.09	0.63	0.53
Somatic Empathy	**-0.52**	**0.18**	**0.00**	**-0.39**	**-2.43**	**0.02**	**-0.34**	**-2.12**	**0.03**	**-0.32**	**-3.04**	**0.00**
Covariates												
Age	**-0.22**	0.09	**0.02**	-0.11	-1.12	0.26	**-0.21**	-2.31	**0.02**	-0.16	-1.44	0.15
Sex	0.06	0.09	0.49	-0.04	-0.38	0.70	0.05	0.58	0.56	-0.10	-1.50	0.13
Minoritized Status	0.06	0.08	0.43	-0.01	-0.07	0.95	-0.02	-0.29	0.77	0.01	0.18	0.86
Public Assistance	0.01	0.10	0.93	0.01	0.11	0.91	0.02	0.18	0.86	0.06	0.98	0.33
Recruitment Group	**0.38**	0.08	**0.00**	**0.19**	1.94	**0.05**	**0.30**	3.23	**0.00**	-0.01	-0.11	0.91

Note. All paths were estimated simultaneously, and model fit was good ($\chi^2(3) = 3.43$, $p = 0.33$, CFI = 0.99, TLI = 0.98, RMSEA = 0.04, SRMR = 0.02). Significant estimates are bolded and represent standardized values

Table 3 Positive and negative empathy as predictors of youth-reported aggression at baseline and 9-month follow-up

	Baseline						9-month Follow-Up					
	Reactive Aggression			Proactive Aggression			Reactive Aggression			Proactive Aggression		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Predictors												
Positive Empathy	-0.02	0.19	0.91	-0.12	0.17	0.50	-0.25	0.17	0.15	**-0.29**	0.13	**0.02**
Negative Empathy	0.07	0.19	0.71	-0.09	0.20	0.64	0.20	0.17	0.26	-0.01	0.13	0.91
Covariates												
Age	-0.17	0.10	0.08	-0.09	0.11	0.41	-0.18	0.10	0.07	-0.14	0.11	0.22
Sex	0.03	0.11	0.78	-0.06	0.14	0.68	-0.02	0.11	0.88	-0.14	0.08	0.06
Minoritized Status	0.04	0.09	0.61	-0.02	0.08	0.82	-0.02	0.08	0.77	0.01	0.07	0.86
Public Assistance	-0.02	0.11	0.88	0.01	0.11	0.93	-0.02	0.08	0.84	0.05	0.07	0.49
Recruitment Group	**0.40**	0.09	**0.00**	**0.19**	0.09	**0.05**	**0.31**	0.09	**0.00**	0.00	0.07	1.00

Note. All paths were estimated simultaneously, and model fit was good ($\chi^2(2) = 1.48$, $p = 0.29$, CFI = 0.99, TLI = 0.98, RMSEA = 0.05, SRMR = 0.02). Significant estimates are bolded and represent standardized values

at baseline and 9-month follow-up. Somewhat consistent with hypotheses, cognitive empathy and somatic empathy were significantly associated with teacher-reported reactive and proactive aggression at baseline. Specifically, youth who reported higher cognitive empathy had higher levels of teacher-reported reactive aggression. Conversely, youth who reported more somatic empathy had lower levels of teacher-reported reactive and proactive aggression.

Table S5 shows results from analyses examining associations between positive and negative empathy and teacher-reported reactive and proactive aggression at baseline and 9-month follow-up. Contrary to hypotheses, no associations were found.

Associations Between Subtypes of Empathy and Aggression: Accounting for Emotional Reactivity

Tables S6 and **S7** depict the results from models controlling for the direct effects of emotional reactivity on youth-reported reactive and proactive aggression. Higher levels of emotional reactivity were associated with increased reactive and proactive aggression at baseline, and increased reactive aggression at follow-up. Importantly, even after accounting for these effects, all significant associations between empathy and youth-reported aggression remained, with two exceptions. Somatic empathy no longer predicted youth-reported reactive aggression at follow-up, and positive empathy no longer predicted proactive aggression at follow-up. Additionally, higher levels of affective empathy significantly predicted higher levels of reactive aggression at 9-month follow-up. The inclusion of emotional reactivity in models predicting parent- and teacher-reported aggression did not alter any findings and these results are available upon request.

Discussion

This pre-registered study explored associations between empathy and aggression assessed across multiple time-points and informants in a sample of high-risk adolescents. We tested associations between subtypes of empathy (i.e., cognitive, affective, and somatic; positive and negative) and aggression (i.e., reactive and proactive) simultaneously while accounting for theoretically relevant covariates. Across all models, somatic empathy emerged as the most consistent predictor of aggression, such that youth reporting *higher* levels of somatic empathy had *lower* levels of youth- and teacher-reported reactive *and* proactive aggression at baseline and 9-month follow-up. Consistent with hypotheses, youth who endorsed higher levels of affective empathy had higher levels of reactive aggression, though this was specific to youth report at baseline and only after accounting for the effects of emotional reactivity at follow-up. Increased affective empathy was also associated with greater parent-reported proactive aggression at follow-up, and cognitive empathy was associated with more teacher-reported reactive and proactive aggression at baseline. Finally, positive and negative empathy were unrelated to reactive and proactive aggression across informants and contexts, with one exception; youth who reported more positive empathy also reported less proactive aggression at the follow-up assessment. Our findings demonstrate unique associations between subtypes of empathy and aggression and point to potential risk and resilience mechanisms for aggression as well as targets for intervention.

In partial support of our hypotheses, somatic empathy, or the ability to mirror or experience the emotion of another person viscerally and physiologically, was protective against reactive and proactive aggression assessed cross-sectionally and longitudinally. This effect was present for youth- and teacher-reported aggression, even after accounting for emotional reactivity and other relevant covariates. Moreover, though parent-reported aggression was not significantly associated in the full model, bivariate associations between somatic empathy and reactive and proactive aggression showed the same protective effect across all informants. These results highlight the robust nature of this finding in our high-risk adolescent sample and build on emerging work that has documented associations between somatic empathy and reduced risk for proactive aggression in youth (Chen et al., 2021; Raine & Chen, 2018) and adults (Raine et al., 2022). Findings also clarify prior work that document null (Raine et al., 2022) or positive associations (Chen et al., 2021; Raine & Chen, 2018) between somatic empathy and reactive aggression in low-risk community samples and suggest that among high-risk youth, increased somatic empathy may lower risk for impulsive, emotionally driven forms of aggression as well.

Research on the role of somatic empathy and aggression is in its infancy; however, this form of empathy has been studied more extensively at the neurophysiological level. While the exact mechanism continues to be debated, the activation of a sensorimotor experience in oneself that mirrors or imitates another has been posited as the fundamental, biological basis for empathy (Iacoboni, 2009; Van der Graaff et al., 2016). Empirical works suggests this shared motor or somatic response provides the necessary scaffolding for affective and cognitive empathy responses (Preston & De Waal, 2002; Van der Graaff et al., 2016). A heightened bodily sensitivity to the emotional experience of others may enhance one's affective and cognitive understanding of another's experience, and in turn serve as a deterrent for engaging in aggressive behavior. Research on interoception,

or the sensory-perceptual awareness of the body's internal state and sensations (Cameron, 2001), underscores the role of this mind-body connection in one's emotional experience (Critchley & Garfinkel, 2017; Wiens, 2005). Moreover, greater awareness of bodily sensations is associated with less psychopathology and increased psychological well-being (Hanley et al., 2017). Empirical work has also connected individual differences in interoception to empathy (Bird et al., 2010), finding that interoceptive sensitivity is linked with sensitivity to the emotions of others (Terasawa et al., 2014). Importantly, this bodily awareness can be trained and enhanced via mind-body protocols targeting sensory awareness (Bornemann et al., 2015; Price & Hooven, 2018), suggesting potential targets for intervention.

Also consistent with our pre-registered hypotheses, affective empathy was positively related to youth-reported reactive aggression cross-sectionally and longitudinally. Specifically, an increased tendency to emotionally resonate with the feelings of others was linked to *increased* reactive, emotionally "hot" aggression, echoing findings from the broader literature (see Fig. 1; Chen et al., 2021; Palumbo & Latzman, 2021; Raine & Chen, 2018). Prior theory and research have suggested that the link between increased affective empathy and increased reactive aggression may be related to individual differences in emotional reactivity (Lickley & Sebastian, 2018; Thompson et al., 2022). That is, heightened emotional sensitivity may enhance intense emotional responses in interpersonal interactions (Thompson et al., 2022), which could be experienced aversively and require more effective emotion regulation skills. In the absence of these skills, risk for aggression may be elevated (Raine et al., 2022). Notably, in our sample, longitudinal associations between affective empathy and aggression were only observed after controlling for the overlap between affective empathy and emotional reactivity. This suggests that affective empathy and emotional reactivity, while related constructs, may be *uniquely* related to aggression.

We found no support for our hypothesis that reduced affective empathy would be related to increased proactive aggression. In fact, youth with higher levels of affective empathy had *increased* parent-reported proactive aggression at the follow-up visit, a finding that contradicts prior work consistently demonstrating associations between lower empathy and higher proactive aggression (Austin et al., 2017; Euler et al., 2017; Fung et al., 2015; Tampke et al., 2020; Fig. 1**).** Also, contrary to hypotheses, increases in cognitive empathy were associated with higher levels of teacher-reported reactive and proactive aggression. While increased cognitive empathy has been associated with increased reactive aggression (Chen et al., 2021; Raine et al., 2022) associations with proactive aggression are consistently in the opposite direction (Mayberry & Espelage, 2007; Palumbo & Latzman, 2021; see Fig. 1). These unexpected findings may be related to differences in our sample (e.g., high-risk clinical sample with heightened emotional reactivity) or reflect potential differences in perception of aggression subtypes across informants.

Indeed, cross-informant reliability for reactive and proactive aggression is quite low (Polman et al., 2007), with reported estimates ranging from $r = 0.22–0.34$ in this sample (Achenbach et al., 1987; Little et al., 2003). Notably, our most robust findings emerged when examining associations between youth-reported empathy and youth-reported aggression. While this may be related to shared method variance (Spector et al., 2019), it is also possible that the interpretation of aggressive behaviors across informants varies. For example, parents or teachers could make assumptions about the intention of aggressive behaviors that may or may not reflect true form or function (e.g., assuming an aggressive behavior is planned or purposeful when it is reactionary or impulsive, or vice versa). Our results suggest the importance of prioritizing youth perception when assessing internal states, perceptions, and motivations, in line with other work in developmental psychopathology (Kahhalé et al., 2023; Vanwoerden et al., 2022). Future work that aims to quantify subtypes of aggression more objectively may help to clarify these cross-informant differences.

Finally, we failed to detect any consistent associations between positive and negative empathy and subtypes of aggression. Youth reporting more positive empathy did also report less proactive aggression; however, this was specific to the follow-up assessment. This is consistent with work suggesting that more positive empathy is associated with less proactive aggression in youth (Raine & Chen, 2018) and adults (Raine et al., 2022) and suggests that a stronger empathic response to positive emotions may be uniquely related to decreases in cold, calculated forms of aggression. This connection could reflect a positivity bias, or the tendency to attend to, process, or interpret information positively. This tendency is a core component of emotional and psychological well-being (Tov, 2018), and may decrease the likelihood of turning to aggression or violence as a means to end (Amad et al., 2021; Lee, 2014). Given the nascency of this work and our inability to consistently replicate these findings, future research is needed to elucidate the potential role of positive and negative empathy in aggression.

Limitations & Future Directions

The current study examines associations between multiple subtypes of empathy and aggression in a diverse sample of adolescents high-risk for aggression. While there are notable strengths and expansions of prior work

(e.g., assessment across multiple timepoints and informants), findings should be considered in the context of multiple limitations. First, this sample was notably small and high-risk; thus, it is unclear whether results can be generalized to community samples. Relatedly, this sample was recruited based on individual differences in emotional reactivity. While we controlled for the impact of emotional reactivity, we were unable to assess for potential moderation and future work with larger samples is needed. This study utilized questionnaire-based measures of both empathy and aggression in variable-centered analyses, which ignores individual differences in the co-occurrence of these constructs (Howard & Hoffman, 2018). Including more objective, multimodal assessments of these constructs (e.g., behavioral tasks, observed behavior, ecological momentary assessment) in person-centered analyses could enhance our understanding of dynamic, within-person associations. Additionally, while we controlled for theoretically relevant covariates, analyses were underpowered to examine how empathy and aggression may vary as a function of key sociodemographic variables such as sex, minoritized racial status, or socioeconomic status. Moreover, minoritized racial status was dichotomized and utilized in statistical models as a person-centered variable. We acknowledge that race is a non-discrete, socially created construct and reflects the effects of numerous risk factors for which minority status is a proxy (Kaufman & Cooper, 2001; Richeson & Sommers, 2016). Interestingly, there were significant bivariate associations between race, public assistance, and aggression as reported by parents and teachers (*but not youth*), such that racially minoritized youth and those receiving public assistance were rated as *more* aggressive. It will be important to consider and examine the direct impact of these sociodemographic factors on aggressive behavior in future work (Jones & Neblett, 2017). Finally, we focused on adolescence, which is a period characterized by the ongoing development of critical socioemotional skills like empathy (Portt et al., 2020) as well as increases in aggression and related psychopathology (Dahl et al., 2018). It will also be important to examine these associations during childhood and the transition to adolescence to better understand etiological trajectories.

Summary & Clinical Implications

Taken together, our results demonstrate differential associations between subtypes of empathy and aggression, underscoring the importance of parsing these constructs when examining potential risk and resilience pathways. These associations were examined across time and informant during the sensitive adolescent period, with findings highlighting informant perspective on aggression as particularly important. Somatic empathy consistently emerged as a protective factor against both reactive and proactive aggression in our high-risk adolescent sample across time (baseline and 9-month follow-up) and informant (youth- and teacher-report). This suggests that interventions that encourage youth to upregulate their emotional sensitivity or interoceptive awareness may reduce aggression over time. In fact, interventions focusing on modulating self- and other-emotion awareness and increasing sensitivity to the distress of others have led to decreases in aggressive behavior and increases in empathy (Dadds et al., 2012; Datyner et al., 2016; Pisano et al., 2017; White et al., 2022). Interestingly, youth with higher levels of affective and cognitive empathy also demonstrated more reactive and proactive aggression, though this varied by timepoint and informant. Among youth with heightened emotional reactivity, a strong empathic response may be experienced aversively or reflect emotion dysregulation. Working with these youth to regulate these more intense emotional responses may be particularly important in reducing risk for aggression (Lickley & Sebastian, 2018). In sum, continued work in this area is needed to better understand how empathy and aggression intersect for high-risk youth as this work has important implications for etiological models and intervention efforts.

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Declarations

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