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Methodological considerations when assessing restricted and repetitive behaviors and aggression

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Abstract

Methodological issues impacting the relationship between aggression and restricted, repetitive, and stereotyped behaviors and interests (RRSBI) were examined in 2648 children and adolescents with autism spectrum disorders (ASD) using a multi-method, multi-informant analysis model to assess the effects of informant, assessment method, and aggression phenotype. Overall, a significant, but small relationship was found between RRSBI and aggression ($p < .05$). There was significant heterogeneity of estimates with large effect sizes observed when utilizing teacher report and a broad phenotype of aggression. Variance in estimates was attributed to differences in informant and assessment method with two times greater effect attributed to informant. Results suggest strategies to optimize future investigations of the relationship between RRSBI and aggression. Findings also provide the opportunity for the development of targeted interventions for aggression in youth with ASD.

Keywords

Aggression; Repetitive behavior; Methodology

1. Introduction

Aggression is a common and highly impairing problem in individuals with autism spectrum disorders (ASD), impacting the individual, family, and community. Two large cross-sectional studies of aggression in youth with ASD report a prevalence of 56% (Kanne &

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Mazurek, 2011) and 54% (Mazurek, Kanne, & Wodka, 2013), respectively. Consequences of aggression in individuals with developmental disabilities can be serious and include increased risk for personal injury (Akrami, Ekehammar, Claesson, & Sonnander, 2006), out-of-home placement (Bromley & Blacher, 1991), long-term inpatient care (Matson & Nebel-Schwalm, 2007), crisis intervention re-referrals (Shoham-Vardi et al., 1996) and parent stress (Baker, Blacher, Crnic, & Edelbrock, 2002). The presence of aggression can also compromise the effectiveness of therapeutic interventions (Horner, Diemer, & Brazuea, 1992) and academic instruction (Chalfant, Rapee, & Carroll, 2007). As a result, the assessment and treatment of aggression in individuals with ASD has been identified as a critical area for future research (Matson & LoVullo, 2008; Matson & Nebel-Schwalm, 2007).

Despite its multiple deleterious effects and high incidence, correlates of aggression in youth with ASD have not been identified. For example, aggression is not associated with any particular demographic factors (i.e., race, age, gender, parental marital status, and parental education) in the ASD population (Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007; Hartley, Sikora, & McCoy, 2008; Kanne & Mazurek, 2011; Mazurek et al., 2013; McTiernan, Leader, Healy, & Mannion, 2011; Shattuck et al., 2007). Studies examining the relationship of ASD symptom severity, communication delays, and social deficits with aggressive behavior have also not yielded consistent findings (Dominick et al., 2007; Durand, 1993; Kanne & Mazurek, 2011; Matson & Rivet, 2008; Matson, Neal, Fodstad, & Hess, 2010; Mazurek et al., 2013). However, there is some preliminary support for a relationship between restricted, repetitive, and stereotyped behaviors and interests (RRSBI) and aggression in individuals with ASD. Dominick et al. (2007) examined children with ASD and found that among a number of potential correlates, RRSBI was the only significant variable associated with aggressive behavior. Similarly, Kanne and Mazurek (2011) found that self-injurious behaviors, ritualistic behaviors, and resistance to change were positively associated with aggression in youth with ASD. Additionally, Matson and Rivet (2008) reported a positive correlation between RRSBI and challenging behaviors (i.e., aggression, self-injury, and disruptive behaviors) in adults with both ASD and ID.

Several important methodological aspects of the aggression literature should be considered when interpreting current findings. First, studies employed various assessment methods (e.g., semi-structured interviews, standardized, normative-based rating scales, project specific questionnaires) and different informants (e.g., parent, residential worker, data collector, teacher). Second, there is a lack of uniformity in the phenotype of aggression utilized in previous investigations. For example, physical aggression has been defined as targeting an individual's body (e.g., hitting, biting, kicking) in some studies and targeting others using objects and implements in other studies. Additionally, some studies include affective symptoms (e.g., irritability; mood lability) and self-injury in the definition of aggression; whereas, others adhere to strictly behavioral definitions (e.g., physical injury to others) (Hartley et al., 2008; Kanne & Mazurek, 2011; Matson & Rivet, 2008). As a result, it is difficult to determine whether the relationship between aggression and clinical correlates differs as a function of measurement strategy and/or operational definition. Therefore, while data on the characteristics of aggression are emerging, it will be important to parse out the effects of informant, assessment method, and aggression phenotype.

Given the preliminary evidence for a relationship between aggression and RRSBI, the current study is a first attempt to examine how methodological factors (i.e., informant, assessment method, aggression phenotype) impact this relationship. Accordingly, the first objective of the study will be to investigate the prevalence of aggression in children and adolescents with ASD using varying assessment methods. The second objective will be to determine if RRSBI is positively associated with the presence of aggression and if this relationship holds across multiple informants and assessment methods. The final objective will be to identify what assessment factors (i.e., informant vs. assessment method) have a greater effect on the relationship between aggression and RRSBI and if aggression phenotype (i.e., either narrowly defined as physical aggression or broadly defined across multiple behaviors) affects this association. It is hypothesized that RRSBI will be positively associated with increased aggressive behavior overall, but that differences in informant, assessment method, and aggression phenotype will substantially impact the strength of this relationship.

2. Methods and measures

2.1. Participants and procedures

Data for the present study came from a large, multisite research network known as the Simons Simplex Collection (SSC), a 12-site North American, university-based research study. The SSC measurement battery includes biological and phenotypic data from families with a single child with ASD between the ages of 4–17 years. Inclusion criteria for the SSC include: (a) no first through third-degree family members, besides the affected child (or proband), can be diagnosed or suspected of having an ASD; (b) the child must have idiopathic ASD; (c) the proband must have an established diagnosis of ASD (i.e., DSM-IV diagnoses: Autistic Disorder, Asperger's Disorder, or Pervasive Developmental Disorder Not Otherwise Specified) based on meeting clinical cutoff criteria on the Autism Diagnostic Interview – Revised (ADI-R; Rutter, Le Couteur, & Lord, 2003) and the Autism Diagnostic Observation Schedule (ADOS; Lord, DiLavore, & Risi, 2002), both of which were administered by research reliable clinicians. The Institutional Review Board at each site approved the study.

Data used in the present analyses involved 2648 children ($M = 9.0$ y, $SD = 3.6$ y, 87% male, 74% Caucasian).¹ Full scale IQ scores ranged from 7 to 167 (mean score = 81.2, $SD = 27.9$). Mothers, the primary informants, were well-educated (9% no college; 65% some college to bachelor's degree; 25% graduate-level education).

Minimal data were missing (<3% for any variable of interest) from the database for all measures except the teacher report version of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001a, 2001b), which was available on 58% of children (ages 6 and older, $n = 1193$). Similarly, data from the teacher-report version of the Social

¹Kanne and Mazurek (2011) examined data from an earlier subset of the SSC database (approximately half of the current study sample) in their investigation of aggression in children with ASD. The objectives, methods, and analytic plan of the current study (i.e., to examine the influence of multiple assessment methods on aggression prevalence and its relation to repetitive behaviors) are distinct from those previously reported by Kanne and Mazurek (2011).

Responsiveness Scale (SRS; Constantino et al., 2003) was available on a subset of the sample ($n = 1310$ or 64% of children 6 years).

2.2. Measures

2.2.1. Aggression—Two instruments were used to measure aggression, and the data from each measure were analyzed separately. The first consisted of two items from the ADI-R that measured current physical aggression (i.e., within past 3 months) toward caregivers and non-caregivers. The ADI-R is a 93-item semi-structured clinician-administered caregiver interview that assesses behaviors across symptom domains. Aggression items included #81 “Aggression Toward Caregivers or Family Members” and Item #82 “Aggression Toward Non-caregivers or Nonfamily Members.” Possible scores on each item ranged from zero to three and were defined as follows: ‘0’-No aggression or only very rare episodes; ‘1’-Mild aggressiveness (threatening, rough play, or provoked lashing out); ‘2’-Definite physical aggression involving hitting or biting; ‘3’-Violence including the use of implements.

The second measure of aggression was the Aggressive Behavior syndrome scale of the Child Behavior Checklist (CBCL-P; Achenbach & Rescorla, 2001a, 2001b). The CBCL is a well-established parent-report measure of child psychopathology with strong psychometric properties (e.g., Ebesutani et al., 2010; Ivanova et al., 2007; Kendall et al., 2007; Nakamura, Ebesutani, Bernstein, & Chorpita, 2009). Although not designed specifically for the ASD population, the CBCL is widely employed in ASD research (Kanne, Abbacchi, & Constantino, 2009; Pandolfi, Magyar, & Dill, 2009; Pandolfi, Magyar, & Dill, 2012). The CBCL has two parent-report versions, one for children ages 1½–5 years and the other for ages 6 to 18 years (Achenbach & Rescorla, 2001a, 2001b), with a total of 19 and 18 items on the 1½–5 years and 6–18 years versions, respectively. Seventy six percent of the present sample was administered the 6–18 years version. The CBCL also comes in teacher-report format (CBCL-T; Achenbach & Rescorla, 2001a) for children 1½–5 (i.e., young child) and 6–18 years (i.e., school age) (Achenbach & Rescorla, 2001b). Teacher report forms were available for 51% ($n = 311$) of the young child version and 43% for the school-age version ($n = 882$).

The Aggressive Behavior syndrome scale from the CBCL measures a wide variety of behaviors within the past 6 months including physical (e.g., attacks, fights) and verbal aggression (e.g., argues, threatens), antisocial behaviors (e.g., mean, no guilt), property destruction (e.g., destroys others/own property), affective symptoms (e.g., mood changes, demands attention), and response style (e.g., uncooperative, sulks). Each item is rated on a 3-point scale (ranging from “Not True” to “Very True”). Only T-scores were used in the analyses, in which scores between 65 and 69 are indicative of borderline clinical or ‘at risk’ for aggression, and scores of 70 and above represent clinical levels of aggression. Parent and teacher ratings of aggression were analyzed separately.

2.2.2. Restricted, repetitive, and stereotyped behaviors and interests (RRSBI)

—Three instruments were used to measure RRSBI. The first was the restricted, repetitive, and stereotyped patterns of behavior subscale of the ADI-R. This 8-item subscale assessed the presence of current (i.e., occurring consistently within the last 3 months) RRSBI through

a semi-structured, clinician-administered parent interview. Possible scores on individual behaviors ranged from “0” to “3,” reflecting increasing levels of intrusion and resulting impairment. The 8 items were summed to calculate a total RRSBI score.

The second measure of RRSBI was the Repetitive Behavior Scale – Revised (RBS-R; Lam & Aman, 2007). The RBS-R is a 43-item parent report scale that measures the presence of repetitive behaviors commonly seen in children with ASD including: ritualistic behaviors, sameness behaviors, self-injurious behaviors, stereotyped behaviors, compulsive behaviors, and restricted interests. Items are rated on a 4-point scale assessing impairment during the past month (“0 = behavior does not occur” to “3 = behavior occurs and is a severe problem”). The total score of all items was utilized in the present analysis.

The third measure of RRSBI was the autistic mannerisms subscale from the Social Responsiveness Scale (SRS; Constantino et al., 2003). Available in parent and teacher report forms, the SRS is a 65-item rating scale that assesses 5 domains of ASD symptoms: social awareness, social cognition, social communication, social motivation, and autistic mannerisms. The autistic mannerisms subscale includes 12 items (rated on a scale from 1 to 4) pertaining to a broad range of repetitive behaviors and interests (ranging from “shows rigid or inflexible patterns of behavior that seem odd” to “touches others in an unusual way”). Total scores from this domain were utilized. The parent (SRS-P) and teacher (SRS-T) data were analyzed separately.

2.2.3. Intelligence tests—Intellectual functioning was assessed using the Differential Ability Scales, Second Edition (DAS-II; Elliott, 2007), the Mullen Scales of Early Learning (Mullen; Mullen, 1995), the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003), or the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). Instrument selection was made based on the child’s age or ability to complete other measures. Deviation verbal and nonverbal IQ scores were calculated when possible; otherwise, ratio IQ scores were computed.

2.3. Data analysis

Descriptive statistics were computed to characterize the sample and variables of interest. Prevalence of aggression was established using the CBCL cutoffs and ADI-R item scores. Next, multiple linear regression models were employed to examine mean differences in RRSBI score across levels of aggression (i.e., each cell in Table 2), the primary independent variable of interest, while adjusting for child age, race, family income, maternal education, IQ, and gender. To assess effect size, Cohen’s δ (represented as delta) was calculated as the difference in adjusted means between groups (using no aggression as the reference) divided by the pooled standard deviation. Effect sizes for mean differences were interpreted as small (.2–.49), moderate (.5–.79), and large (>.8)

The second step was to better understand the influence of informant (parent vs. teacher) vs. assessment method (semi-structured interview vs. rating scale) on the relationship between RRSBI and aggression. To accomplish this, a 4×4 matrix (shown in Table 1) was created to collapse the different combinations of informant and method into four groups: (a) Same informant, same method (SI-SM; e.g., parent report on ADI-R aggression items vs. parent

report on ADI-R repetitive behaviors subscale); (b) Same informant, different method (SI-DM; e.g., parent report on ADI-R aggression items vs. parent report on RBS-R); (c) Different informant, same method (DI-SM; e.g., teacher report on CBCL-T vs. parent report on RBS-R); and, (d) Different informant, different method (DI-DM; e.g., parent report on ADI-R aggression items vs. teacher report on SRS-T). Effect sizes were calculated for each of these cells (which are a direct product/summation of effect sizes from Table 2) and averaged across the groups (see Section 3 for details on average effect size for each group). A formula was then derived to estimate the average differences (in the relationship between aggression and RRSBI) due to informants vs. assessment method. To assess informant effects (parent vs. teacher), this equation $[(SI-SM - DI-SM) + (SI-DM - DI-DM)]$ takes the difference in the mean effect size across informants while subtracting or accounting for the effect of method. A similar approach was taken for calculating method effects $[(SI-SM - SI-DM) + (DI-SM - DI-DM)]$, which quantifies mean effect differences across methods while removing the effect of informant.

The final objective was to determine if the relationship between aggression and RRSBI was influenced by whether aggression was defined using a narrow phenotype (i.e., as physical aggression via the ADI-R) or a broad phenotype (i.e., across multiple behaviors via the CBCL). For this analysis, a broad and narrow measure of aggression for both the teacher and parent report was needed. Teacher report measures were limited, however. Therefore, mean effect sizes were compared across the ADI-R (using both aggression toward caregivers and others) vs. CBCL for parent-informant measures only (i.e., only SI-DM and SI-SM when the teacher was not the informant). This resulted in controlling for informant but not method variance.

3. Results

3.1. Aggression prevalence

As shown in Table 2, 60% of the children in the sample demonstrated physical aggression (i.e., mild, definite, and with implements) toward their caregivers as measured by the ADI-R; whereas, 34% of children exhibited physical aggression toward others. Using the CBCL, which employs normed cutoff scores, 27% of individuals demonstrated parent reported borderline clinical and clinical levels of aggression and 25% demonstrated these levels of aggression based on teacher ratings.

3.2. Relationship between aggression and RRSBI

As shown in Table 2, adjusted descriptive statistics were calculated for measures of RRSBI (means and standard deviations) as well as effect sizes () across the levels of aggression severity per the ADI-R and CBCL. Overall, 31 of 40 mean differences (using no aggression as the reference) met statistical significance at $p < .05$; however, the overall average effect size across all measures was small (mean $d = .36$).

Next, mean differences in RRSBI scores were examined between levels of physical aggression measured via the ADI-R. Across the 4 measures of RRSBI, differences in repetitive behaviors between children who displayed mild vs. no physical aggression toward

caregivers ($d = 0.11$) and others ($d = 0.21$) were small. Differences in RRSBI were greater between children who displayed definite vs. no physical aggression to caregivers ($d = .33$) and definite vs. no physical aggression toward others ($d = .37$). For the relatively few children who displayed physical aggression with implements, effect sizes were near moderate when the aggression was toward the caregiver ($d = .40$) and others ($d = .41$).

An identical procedure was undertaken for the parent reported CBCL aggression data. Differences in RRSBI between children who displayed no to mild vs. borderline clinical aggression were significantly higher ($d = .43$). For those with no or mild versus clinical aggression, mean effect sizes were moderate ($d = .58$). These data mirror the differences in RRSBI among children with no-mild vs. borderline clinical aggression ($d = .37$) and no-mild versus clinical aggression ($d = .44$) when teachers reported on levels of aggression (see Table 2 for details on effect sizes described above).

3.3. Effects of informant and assessment method in relationship between aggression and RRSBI

There was great heterogeneity in effect sizes across levels of aggression (e.g., range from 0 to 1.19). To better understand if this variability was due to informant or assessment method, mean effect sizes (average effect sizes for SI-SM was .58, SI-DM was .34, DI-SM was .21, and DI-DI was .20) across informant versus assessment method were compared (see Table 1 for combinations). Applying this formula resulted in differences in mean effect sizes across informants and assessment methods of .51 $[(.58 - .21) + (.34 - .20)]$ and .25 $[(.58 - .34) + (.21 - .20)]$, respectively. Taking the ratio of these values $(.51/.25 = 2.04)$ shows that informant effects/variance is twice that of assessment method.

3.4. Effects of aggression phenotype in relationship of aggression and RRSBI

To understand the variance attributed to aggression phenotype (broadly defined vs. narrowly defined), a similar procedure was performed by calculating adjusted mean effect sizes across the ADI-R (narrow phenotype) and CBCL (broader phenotype). Since there was no semi-structured measure of a broader phenotype of aggression, differences in method could not be accounted for. As such, the mean effect size was averaged across SI-SM and SI-DM when using a narrow phenotype of aggression (via the ADI-R; $.26 + .36/2$) and was .31; whereas, mean effect size when using a broad phenotype of aggression (through the CBCL vs. RBS-R and SRS-P; $.90 + .22/2$) was .56. Taking the ratio of these values $(.56/.31 = 1.81)$ shows that mean effect sizes are 1.8 times greater when using a broad phenotype rather than a narrow phenotype of aggression.

4. Discussion

Previous studies have supported a preliminary relationship between RRSBI and aggression in individuals with ASD. However, several important methodological factors must be considered when interpreting these as well as other findings regarding potential correlates of aggression in this population. This study examined the role of methodological factors, including informant, assessment method, and phenotype of aggression in the relationship of RRSBI and aggression using a large, heterogeneous, and well-phenotyped sample.

4.1. Aggression prevalence

Commensurate with the previous data, high rates of aggression were observed in this sample. When assessed using the ADI-R, 60% of the sample was reported to be currently engaging in physical aggression toward caregivers, and 34% was reported to be physically aggressing toward others. Lower rates of aggression were found when using the CBCL (i.e., 27% and 25% demonstrated borderline clinical and clinically significant levels of aggression by parent report and teacher report, respectively) to assess aggression. Variability between these estimates of aggression may be a product of instrument selection. The symptom severity threshold on the ADI-R is largely determined by the assessor and may be lower than the norm-referenced cut-offs of the CBCL. In contrast, the CBCL measures a broad range of symptoms within the Aggressive Behavior syndrome scale. Rate estimates of aggressive behavior may therefore be diluted if an aggressive child does not display clinically significant levels of other psychiatric symptoms assessed by this scale (e.g., antisocial behaviors, verbal aggression). Additionally, these psychiatric symptoms may not co-occur as frequently with physical aggression in children with ASD as observed in typically developing youth.

4.2. Relationship between aggression and RRSBI

There was a small positive relationship between aggression and RRSBI, although there was significant variability in the effect size estimates. Notably, although teachers reported lower rates of aggression and RRSBI than parents, large effect sizes for this relationship were found among teacher ratings. Effect size estimates of this relationship using caregiver ratings were also highly variable but generally small. These findings suggest that aggression is more closely associated with RRSBI in classroom settings than at home and that RRSBI have only a small association with aggression demonstrated toward caregivers. The implication of these findings presents setting/informant as a moderator of the relationship between RRSBI and aggression, reflecting previous research demonstrating that setting differentially affects the presentation of psychiatric symptoms in individuals with ASD (Kanne et al., 2009).

4.3. Effects of informant, assessment method, and aggression phenotype in relationship between aggression and RRSBI

Results of this study indicate that differences in both informant and assessment method substantially influence findings (i.e., using the same informant and assessment method produces higher effect sizes than when using different informant and assessment method types) and that the variance (or differences in the strength of the relationship between RRSBI and aggression) attributed to informant was twice as great when compared to assessment method. This finding is expected since different informants bring unique experiences and biases to bear (see review by Reyes, Thomas, Goodman, & Kundey, 2013). It is important to note that the present study contrasts differences in informant vs. assessment method using effect sizes, a standardized metric, which has been adjusted for potential confounders. This approach differs from other methods which tend to treat informant discrepancies as measurement error (e.g., combinatorial algorithms or latent variable techniques) rather than instructive data that can inform the design of future investigations.

Another finding that emerged was that aggression was more strongly associated with RRSBI when aggression was considered as a broad cluster of behaviors than when defined narrowly as physical aggression. This finding is somewhat surprising as lower rates of aggression were found when using a measure that employs a broader phenotype of aggression (i.e., CBCL). These results suggest that there may be a stronger relationship between other forms of aggression (e.g., verbal aggression, property destruction, affective problems, or unstable temperament) and RRSBI. As such, it is possible that a third psychiatric construct (e.g., mood disturbance) may moderate the relationship between these variables.

4.4. Research implications

Researchers need to be aware of the role of informant/setting, assessment method, and aggression phenotype a priori when designing future investigations of RRSBI and aggression. By adding greater heterogeneity in the data collection process, results from those analyses may provide greater external validity as well as identify the settings where interventions may be most effective (e.g., in the classroom, given the magnitude of the association when teachers provided report) or warranted (e.g., in the home, given the higher prevalence of aggression toward caregivers). Maintaining homogeneity in measurement and particularly informant types will reduce the variance in observed associations and thus will find the largest effects. However, this approach will yield a restricted perspective.

Longitudinal research is necessary to determine if there is a temporal and potentially causal relationship between RRSBI and aggression. Additionally, further research examining how specific mood or other psychiatric symptoms may relate to both aggression and RRSBI may yield insight into potential moderating variables associated with RRSBI. Furthermore, future examination of the moderating role of informant/setting in the presentation of psychiatric symptoms in individuals with ASD will be critical to guide future research and methodological strategy with this population.

4.5. Clinical implications

This study confirms the finding that aggression is highly prevalent in youth with ASD, and suggests that it is particularly directed toward caregivers. These findings highlight the importance of identifying intervention strategies for aggression targeted to the home setting.

The data also indicate that the relationship between aggression and RRSBI may be differentially affected by the child's immediate environment. Therefore, clinicians should carefully consider pathways by which these variables may influence one another as well as the contributing role of the setting in which these behaviors occur. As findings indicate that this relationship is strongest in the school setting, this conceptualization may be most pertinent when considering these behaviors within the classroom milieu. One possible explanation for this finding is that parents and teachers experience differing tolerance levels for aggression which may influence their ratings of these behaviors. Another explanation may be that the increased demands of the academic environment may interfere with the performance of RRSBI, leading to an aggressive attempt to escape academic tasks (i.e., operant model, Reese, Richman, Belmont, & Morse, 2005; Reese, Richman, Zarcone, & Zarcone Reese, 2003; White et al., 2011). Additionally, the academic setting may place

greater burden on the individual's behavioral regulation system leading to higher rates of RRSBI and aggression (i.e., neuropsychological model; Oliver, Petty, Ruddick, & Bacarese-Hamilton, 2012; Turner, 1997). Clinical experience also suggests that anxiety and mood may play a role in the relationship of these factors as irritability, frustration, and stress may escalate in the absence of RRSBI (which may serve as a coping strategy), leading to an aggressive reaction. In contrast, demands at home may be less intense allowing the child more time to engage in RRSBI and, therefore, reducing the relationship of these factors in this setting. Findings also suggest that clinicians consider simultaneous treatment of aggression and RRSBI to maximize the potency of intervention. Both behavioral (i.e., applied behavioral analysis; Reese et al., 2003) and pharmacological (i.e., risperidone; McDougle et al., 2005) interventions have demonstrated efficacy in treating both of these behavioral domains.

4.6. Limitations

This study was cross-sectional and therefore precludes any conclusions about the temporal and/or causal relationship between RRSBI and aggression. Additionally, there was variability in the time range targeted by measures (e.g., ADI-R – assesses behaviors over past 3 months; CBCL – assesses behaviors over past 6 months) which may have limited the validity of comparison of behaviors across assessment tools. Furthermore, due to the absence of a teacher report measure utilizing a narrow definition of aggression, the analysis could not fully control for assessment method. The lack of this type of measure may have impacted findings regarding the relationship between narrowly vs. broadly defined physical aggression. However, as the effect of method variance in this study was small, the impact of the absence of such a measure was likely limited. Another potential limitation was the reliance on the ADI-R as a measure of aggression. This instrument utilizes a small number of items and its psychometric properties as a measure of aggression have not been investigated. In future analyses, it will be important to consider inclusion of other well-established measures of aggression such as the Aberrant Behavior Checklist (Arman, Singh, Stewart, & Field, 1985), the Children's Aggression Scale (Halperin, McKay, & Newcom, 2002), or the Overt Aggression Scale (Yudofsky, Silver, Jackson, Endicott, & Williams, 1986).

5. Conclusions

This study was the first to investigate methodological issues impacting the relationship between RRSBI and aggression. Strengths of the study included a large, carefully phenotyped sample, as well as the use of multiple informants and assessment methods of both aggression and RRSBI. The results indicated a consistent and significant, albeit somewhat small, overall effect size for this relationship. These findings further implore researchers and interventionists to consider, a priori, the role of operational definition, informant and measurement-type when planning an observational or intervention study, particularly for RRSBI and aggression among children with ASD.

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Table 1

Combinations of informant × method.

Measures of aggressive behaviors	Measures of repetitive behaviors, restricted interests, and stereotyped behaviors (RRSBI)			
	ADI-R ^a	RBS-R ^b	SRS-P: Autism Mannerisms Subscale ^b	SRS-T: Autism Mannerisms Subscale ^c
ADI-R: physical aggression toward caregiver ^a	SI-SM	SI-DM	SI-DM	DI-DM
ADI-R: physical aggression toward others ^a	SI-SM	SI-DM	SI-DM	DI-DM
CBCL-parent report: Aggression Subscale ^b	SI-DM	SI-SM	SI-SM	DI-SM
CBCL-teacher report: Aggression Subscale ^c	DI-DM	DI-SM	DI-SM	SI-SM

SI = same informant; SM = same method; DI = different informant; DM = different method.

^aParent, semi-structured interview.^bParent, self-report rating scale.^cTeacher, self-report rating scale.

Table 2

Effect Sizes for aggression and restricted, repetitive, and stereotyped behaviors and interests.^a

Aggression		Restricted, repetitive, stereotyped behaviors and interests								
ADI-R: physical aggression toward caregiver		ADI-R	RBS-R		SRS-Parent: Autism Mannerisms Subscale		SRS-Teacher: Autism Mannerisms Subscale		Mean effect size	
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)			
None	40.0%	6.2 (2.5)	–	23.2 (15.9)	–	17.4 (6.8)	–	15.9 (7.6)	–	
Mild	24.5%	6.4 (2.5)	.08	25.7 (15.9)	.16 *	18.2 (6.6)	.12 *	16.6 (7.3)	.09	
Definite	26.7%	6.9 (2.4)	.28 ***	30.9 (17.3)	.46 ***	20.0 (6.7)	.38 ***	17.5 (7.9)	.21 *	
With implements	8.8%	7.3 (2.5)	.44 ***	35.7 (20.9)	.67 ***	20.5 (6.7)	.46 ***	16.3 (7.9)	.05	
ADI-R: physical aggression toward others										
None	66.0%	6.3 (2.5)	–	25.1 (16.6)	–	17.9 (6.8)	–	15.6 (7.6)	–	
Mild	14.5%	6.9 (2.6)	.23	28.5 (16.9)	.20 **	19.1 (6.4)	.18 **	17.5 (7.4)	.25 **	
Definite	16.6%	6.9 (2.3)	.25 **	31.7 (17.8)	.38 ***	20.5 (6.8)	.38 ***	19.1 (7.3)	.47 ***	
With implements	2.9%	7.0 (2.4)	.28 *	35.3 (21.1)	.54 ***	20.6 (5.8)	.43 ***	18.8 (8.3)	.40 *	
CBCL-parent report: Aggression Subscale										
None-mild	73.0%	6.4 (2.5)	–	23.3 (15.2)	–	17.2 (6.6)	–	16.2 (7.6)	–	
Subclinical	14.2%	6.9 (2.5)	.20 ***	33.5 (16.7)	.64 ***	21.4 (6.0)	.66 ***	17.8 (7.3)	.21 **	
Clinical	12.8%	7.0 (2.4)	.24 ***	41.0 (19.7)	1.0 ***	23.3 (5.7)	.99 ***	16.8 (8.3)	.07	
CBCL-teacher report: Aggression Subscale										
None-mild	75.5%	6.6 (2.5)	–	26.5 (17.0)	–	18.5 (6.9)	–	15.0 (7.1)	–	
Subclinical	15.4%	6.6 (2.4)	0	31.1 (18.1)	.26 **	20.4 (6.8)	.28 **	21.5 (6.7)	.95 ***	

Aggression	Restricted, repetitive, stereotyped behaviors and interests									
ADI-R: physical aggression toward caregiver	ADI-R	RBS-R	SRS-Parent: Autism Mannerisms Subscale	SRS-Teacher: Autism Mannerisms Subscale	Mean effect size					
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)						
Clinical	9.0%	6.9 (2.4)	.12	30.3 (16.5)	.23	20.0 (5.7)	.24	23.1 (6.5)	1.19 ***	.44
Mean score, SD, and effect size	6.5 (2.5)	.21	28.0 (17.3)	.45	18.6 (6.8)	.41	16.7 (7.7)	.39	.36	

^a Means and α 's are adjusted for maternal education, race, family income, IQ, child age, and gender.

* $p < .05$.

** $p < .01$.

*** $p < .001$.