



Physical Aggression Toward Others and Self: Correlates in Autism, Attention-Deficit/Hyperactivity Disorder, and Population-Based Child Samples

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Objective: This is the first study investigating physical aggression toward others and toward self (self-injurious behavior [SIB]) and its association with comorbid disorders and symptoms and demographics in large autism, ADHD, and population-based samples.

Method: The referred sample comprised 2,456 children (1,415 with autism, 739 with ADHD-combined, and 302 with ADHD-inattentive) aged 2 to 17 years. The population-based sample consisted of 665 children evaluated at baseline (6-12 years of age) and 259 reevaluated at follow-up (12-17 years). The Pediatric Behavior Scale was rated by mothers yielding scores on 2 dependent variables: physical aggression (“hits, bites, or throws things at people”) and SIB (“bites or hits self, bangs head, or repeats other acts causing self-injury”) and 9 independent variables (oppositional behavior, irritability, conduct problems, hyperactivity, impulsivity, autism, inattention, anxiety, and depression).

Results: Physical aggression was strongly linked with the autism and ADHD-combined groups (28% and 20% often a problem) but not the ADHD-inattentive or community group (<2%). SIB was primarily associated with autism (16% often a problem). Irritability, conduct problems, and younger age were significant concurrent predictors of physical aggression in most groups, and irritability predicted SIB in autism and ADHD-combined. IQ, sex, race, and parent occupation were not predictors.

Conclusion: Physical aggression is common in autism and ADHD-combined, whereas SIB is strongly linked with autism. The irritability component of oppositional defiant disorder and not oppositional behavior significantly predicted physical aggression and SIB. In addition to treating aggression directly, addressing irritability with the use of pharmacological, behavioral, and psychosocial interventions may also decrease aggression.

Key words: ADHD-combined; ADHD-inattentive; autism; physical aggression; self-injurious behavior

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Physical aggression toward others and toward self (self-injurious behavior [SIB]) is a common reason for children and adolescents being referred for mental health evaluations and treatment, causes considerable stress for families, and can be difficult for clinicians to manage. Physical aggression in childhood increases the risk of violence and other psychopathology in adolescence and adulthood, which has obvious negative impacts on society.^{1,2} SIB in children with autism and other conditions can cause serious physical harm.

This study focuses on 2 objectively defined aspects of aggression in children and adolescents: physical aggression toward others (eg, hits, bites, or throws things at people) and SIB (eg, bites or hits self and bangs head). This is in contrast to other investigations that define aggression broadly (including and often combining reactive, proactive, verbal, physical, overt, covert, indirect, impulsive, and relational aggression). Tremblay *et al.* argue the need to

analyze physical aggression separately from other forms of aggression because physical aggression is the most serious form of aggression and because studies are confounded by aggregating different types of aggression.^{3,4} Similarly, SIB research is confounded by studies that broadly define self-harm to include SIB as well as suicide attempts and self-mutilation.

Physical aggression is common in youth with autism, with estimates ranging from 17% to 56%.^{5,6} Similarly, physical aggression is prevalent in the ADHD-combined presentation (ADHD-C). In one study, 26% of youth with ADHD exhibited physical aggression,⁵ and in another study 54% demonstrated physical or verbal aggression.⁷ Among youth with ADHD, comorbid conduct disorder (CD) increased the risk for physical aggression, and comorbid oppositional defiant disorder (ODD) increased the risk of verbal aggression.⁸ ODD has 2 subdimensions: irritable and oppositional.⁹ Irritability (angry, touchy, temper

outbursts) and oppositional behavior are common in ADHD-C and in autism.^{5,10,11} In a pediatric clinical sample, aggression (physical, verbal, or relational) was significantly associated with irritability.¹² A review article⁹ reported that chronic irritability is a risk factor for later depression, anxiety, and suicidality, whereas oppositional behavior is associated with aggression. There is a need to further examine which subdimensions of ODD, as well as other psychopathology symptoms, predict physical aggression (and SIB) in youth with ADHD and autism and in population-based samples.

Higher levels of anxiety were associated with greater aggressive behavior in high-functioning adolescents with autism but not in control subjects.¹³ In a 7-year longitudinal study of community children, relational and physical aggression predicted later depression, whereas depression did not predict aggression.¹⁴ A large student survey revealed a significant association between self-reported anxiety scores and aggressive behavior, with anxiety more strongly associated with anger and hostility than with physical and verbal aggression.¹⁵

SIB was present in 28% of children with autism across multiple clinical sites,¹⁶ and a meta-analysis of 37 papers revealed a pooled prevalence of 42% in children and adults with autism.¹⁷ Soke *et al.* found that SIB was associated with aggression, hyperactivity, and anxiety in children with autism.¹⁸ A systematic literature review reported that the strongest risk marker for persistence of SIB in individuals with intellectual disability was symptoms of autism.¹⁹ A review of 15 child and adult studies found a significant relationship between self-harm and ADHD in all studies.²⁰ However, multiple definitions of self-harm were used across studies (including suicide attempts and self-mutilation) and none focused on our narrow definition of SIB in children and adolescents.

Some demographic correlates of physical aggression and SIB differ from study to study, possibly reflecting varying definitions of aggression and severity thresholds and sample characteristics (eg, diagnoses and age ranges). Multiple studies demonstrated that physical aggression decreases with age after the “terrible twos” in the general population.^{3,4} Similarly, in autism and ADHD-C samples with wide age ranges, physical aggression was more common in younger than in older children.^{6,21} In general population samples, physical aggression is more common in boys than in girls.²²⁻²⁵ In contrast, no sex differences in physical aggression were reported among youth with autism and clinic-referred children without autism.^{6,26} In a population-based preschool sample, low family income predicted physical aggression,² whereas higher income was associated with aggression in children and adolescents with autism.⁶ Lower IQ was related to physical aggression in youth with and

without autism referred to a behavior clinic.²⁶ However, in another study IQ was not associated with aggression of children and adolescents with autism.⁶

Lower intelligence has been identified as a risk factor for SIB among youth with autism in some studies,^{27,28} but not in others.^{17,29} In a study of 2- to 19-year-olds with autism, age was not a significant predictor of SIB when specific autism symptoms and IQ were controlled,²⁷ nor was age associated with SIB prevalence rates in an autism meta-analysis of children and adults.¹⁷ However, an investigation of children below the age of 7 with autism reported that lower chronological age was associated with SIB, whereas socioeconomic status (SES) and sex were not.³⁰ Sex and race were not related to SIB in another study of children with autism.¹⁸ A review article indicated mixed findings for the relationship between autism severity and SIB.²⁸

A review of 15 studies found that ADHD was a potential risk factor for self-harm. However, types of self-harm varied considerably across the studies and were not consistent with our narrow definition of SIB.²⁰ A systematic literature review revealed that externalizing psychopathology (eg, ADHD, ODD, and CD) was associated with self-injury across studies using 11 different terms for self-injury.³¹

It is important to examine and compare the prevalence and correlates of physical aggression and SIB in diagnostic groups and community samples of children and adolescents. The present study fills an important research gap as the first to compare 2 types of specifically and narrowly defined physical aggression (ie, toward others and toward self) and to determine associated comorbid symptoms and demographics in 3 large clinical samples of children with autism, ADHD-C, and ADHD-inattentive (ADHD-I) as well as in a general population sample evaluated in childhood and again in adolescence. Findings will further our understanding of aggression in children and have implications for clinical practice and future research.

METHOD

Sample

The autism and ADHD samples comprised 2,492 children (1,436 with autism, 747 with ADHD-C, and 309 with ADHD-I), 2 to 17 years of age, evaluated in a psychiatry and behavioral health diagnostic clinic. All children underwent a diagnostic evaluation by 1 of 2 licensed PhD psychologists. The evaluation included a diagnostic interview with the parents, parent and teacher rating scales (Pediatric Behavior Scale [PBS]³² and Checklist for Autism Spectrum Disorder [CASD]³³), administration of psychological tests (IQ, achievement, and neuropsychological), and clinical observations of the child during the evaluation. All

TABLE 1 Demographic Data for Children in the Autism, ADHD-C, ADHD-I, and Elementary School Samples

	Autism	ADHD-C	ADHD-I	Community 6-12 y ^a	Community 12-17 y ^b
n	1,436	747	309	665	259
Age range, y	2-17	2-16	2-17	6-12	12-17
Age, y, mean ± SD	6.6 ± 3.3	8.2 ± 2.7	9.2 ± 2.8	8.7 ± 1.7	15.2 ± 1.4
IQ range	9-149	42-149	38-142	71-147	78-144
IQ, mean ± SD	92.1 ± 24.9	102.7 ± 17.0	103.0 ± 16.8	106.5 ± 12.9	108.2 ± 13.1
Male, %	79.0	72.0	56.3	52.6	56.4
SES, % ^c	34.1	36.7	48.5	48.9	49.8
White, %	90.6	90.1	92.9	80.5	80.3

Note: ADHD-C = attention-deficit/hyperactivity disorder—combined; ADHD-I = attention-deficit/hyperactivity disorder—inattentive; SES = socioeconomic status.

^aBaseline.

^bFollow-up.

^cOne or both parents have a professional or managerial occupation.

children in the ADHD group had a *DSM-IV* or *DSM-5* (whichever version was current when the child was evaluated) diagnosis of ADHD, ADHD symptoms observed during psychological testing, and PBS ratings of short attention span or distractible rated as often or very often a problem by at least 2 raters (mother, father, or teacher). Children were classified with ADHD-C if the median mother, father, and teacher hyperactive-impulsive PBS rating was often or very often a problem. Children were classified with ADHD-I if the median hyperactive-impulsive rating was less than often a problem. All children in the ADHD group scored below the autism range on the CASD. Children in the autism sample had a *DSM-IV* or *DSM-5* diagnosis of autism (ie, autistic disorder, Asperger's disorder, or autism spectrum disorder) and a score in the autism range on the CASD. The CASD is a 30-item autism diagnostic instrument normed and standardized on 2,469 children (1-18 years of age, IQs 9-146) with autism, other clinical disorders, and typical development.³³ In the national standardization study, the CASD identified children with and without autism with 99.5% accuracy. The CASD has strong diagnostic agreement (93% to 98%) with the Autism Diagnostic Interview—R, Childhood Autism Rating Scale, and Gilliam Asperger's Disorder Scale. Most children with autism had symptoms of ADHD. Eighty percent had elevated (often or very often a problem) maternal ratings on the PBS ADHD-C subscale, and an additional 9% had elevated ratings on the attention deficit subscale without impulsivity/hyperactivity (ADHD-I). Children with autism who had ADHD symptoms were included in the autism and not the ADHD group.

The population-based samples were from an epidemiological study of the prevalence of sleep disorders in children.³⁴ Children with symptoms of autism, ADHD, or

other disorders were not excluded, so that the sample is representative of the general population. Children in our study were the 665 children evaluated at baseline (6-12 years of age) and 259 of these children reevaluated at follow-up (12-17 years of age). Demographic data are reported in Table 1. The study was approved by the Institutional Review Board, which waived informed consent for the retrospective analysis of existing clinical data for the autism and ADHD groups. Parent written consent and child assent were obtained for the population-based samples.

Instrument

The 165 items on the PBS were rated by mothers on a 4-point scale (0 = almost never or not at all, 1 = sometimes, 2 = often, and 3 = very often a problem) indicating the extent to which the behaviors occurred during the past 2 months.³² The PBS assesses multiple psychological symptoms. The PBS corresponds well with other established rating scales and objective tests (eg, continuous performance tests assessing ADHD) and has been used to diagnose and differentiate psychological problems in multiple studies.^{5,35-40}

Variables

Aggression was assessed with 2 PBS items: physical aggression toward others (ie, "hits, bites, or throws things at people") and SIB (ie, "bites or hits self, bangs head, or repeats other acts causing self-injury"). Independent variables were demographics (age, IQ, sex, race, and parent occupation) and scores on PBS factors assessing oppositional behavior (disobedient, argues, uncooperative, defiant), irritability (irritable, angry, temper outbursts), conduct problems excluding aggression (mean/cruel, bully, lies, cheats, steals), inattention, hyperactivity, impulsivity, autism, anxiety (generalized, social, and separation), and depression.

Data Analyses

Descriptive statistics summarized physical aggression and SIB prevalence rates for the 5 study samples. Differences in mean physical aggression and SIB scores between the clinical groups were explored by means of analysis of covariance (controlling for possible differences between groups in age, IQ, sex, race, and SES) and Cohen's *d*. Pearson's correlations and explained variance were calculated between the physical aggression and SIB scores and between the 2 aggression scores and age, IQ, and the PBS oppositional behavior, irritability, conduct problems (excluding physical aggression), hyperactivity, impulsivity, inattention, autism, anxiety, and depression scores. Independent *t* tests and Cohen's *d* were used to examine differences in physical aggression and SIB scores between male and female subjects, whites and others, and children with a parent who has a professional or managerial occupation vs other. Dependent *t* tests and Cohen's *d* were used to compare differences in physical aggression and SIB scores between the baseline and follow-up general population samples. Stepwise linear regression analysis predicted physical aggression and SIB scores from PBS oppositional behavior, irritability, conduct problems (excluding aggression), hyperactivity, impulsivity, inattention, autism, anxiety, and depression scores and demographics that were significant in at least 1 of the univariate analyses to determine significant and unique concurrent predictors of physical aggression and SIB when controlling for other variables.

RESULTS

Differences in Physical Aggression and SIB Between Diagnostic Groups

Physical aggression and SIB rated as often or very often a problem by mothers was rare in the ADHD-I and general population baseline and follow-up samples (<2%) and far more common in the autism and ADHD-C samples (Table 2). Physical aggression and SIB mean scores were highest for children with autism, followed by ADHD-C and then ADHD-I. Pairwise comparisons controlling for demographic differences between the 3 clinical groups were all significant ($F = 20.2-75.6$; $p < .001$; $d = 0.4-0.8$), except for physical aggression between children with autism vs ADHD-C ($F = 3.5$; $p = .06$; $d = 0.2$).

Differences in Physical Aggression and SIB between Demographic Groups

In the 5 study samples, physical aggression and SIB scores did not differ between whites and others and only 1 of the 10 comparisons (physical aggression in the community 6-12 y age group) yielded a significant difference between male and female subjects with a small effect size ($d = 0.2$)

TABLE 2 Percentage of Children Rated by Their Mothers as Exhibiting Physical Aggression (PA) and Self-Injurious Behavior (SIB) Sometimes and Often to Very Often

	Autism		ADHD-C		ADHD-I		Community 6-12 y ^a		Community 12-17 y ^b	
	Sometimes	≥ Often	Sometimes	≥ Often	Sometimes	≥ Often	Sometimes	≥ Often	Sometimes	≥ Often
PA	29.4	27.8	24.5	19.5	12.3	1.9	14.4	2.0	4.2	0.8
SIB	18.5	16.4	12.7	6.6	3.2	0.9	2.6	0.3	0.0	0.8

Note: ADHD-C = attention-deficit/hyperactivity disorder—combined; ADHD-I = attention-deficit/hyperactivity disorder—inattentive.

^aBaseline.

^bFollow-up.

TABLE 3 Mean Physical Aggression (PA) and Self-Injurious Behavior (SIB) Scores^a and Differences Among Demographic Groups

	Autism			ADHD-C			ADHD-I			Community 6-12 y ^b			Community 12-17 y ^c		
	M	F	t	M	F	t	M	F	t	M	F	t	M	F	t
PA	1.0	0.9	1.6	0.7	0.6	1.0	0.2	0.2	0.6	0.2	0.1	3.2*	0.0	0.1	1.0
SIB	0.6	0.5	1.3	0.3	0.2	2.1	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1
	W	Other	t	W	Other	t	W	Other	t	W	Other	t	W	Other	t
	PA	0.9	1.2	2.3	0.7	0.6	0.8	0.2	0.2	0.2	0.2	0.1	2.0	0.1	0.0
SIB	0.6	0.7	1.5	0.3	0.3	0.3	0.0	0.4	2.0	0.0	0.0	0.6	0.0	0.1	0.8
	P	NP	t	P	NP	t	P	NP	t	P	NP	t	P	NP	t
	PA	0.7	1.1	7.3*	0.5	0.8	5.5*	0.2	0.2	0.5	0.2	0.2	1.9	0.1	0.1
SIB	0.5	0.7	4.2*	0.2	0.3	3.7*	0.0	0.1	1.3	0.0	0.0	0.3	0.0	0.0	1.4

Note: ADHD-C = attention-deficit/hyperactivity disorder—combined; ADHD-I = attention-deficit/hyperactivity disorder—inattentive; F = female; M = male; NP = nonprofessional; P = professional (≥ 1 parent with a professional or managerial occupation); W = white.

^a0 = almost never or not at all, 1 = sometimes, 2 = often, 3 = very often.

^bBaseline.

^cFollow-up.

* $p < .01$.

(Table 3). SES differences were nonsignificant for the ADHD-I and community baseline and follow-up samples, but children who had a parent with a professional or managerial occupation had significantly lower physical aggression and SIB scores than lower-SES families in the autism and ADHD-C samples, but effect sizes were overall small ($d = 0.2$ – 0.4).

Physical Aggression and SIB Correlations With Age, IQ, and Psychopathology Scores

In the total autism/ADHD sample, the correlation between physical aggression and SIB scores was medium to large (.41; $p < .001$; explained variance 16.8%), and in the baseline and follow-up population-based samples, correlations were small to medium (.22 and .30; $p < .001$; explained variances 4.8% and 9.0%). All but one of the 20 correlations between age and IQ and physical aggression and SIB scores were negative (Table 4), but none of the IQ correlations were significant ($p > .01$). Correlations between age and physical aggression and SIB scores were nonsignificant in the ADHD-I and community baseline and follow-up samples but were significant in the autism and ADHD samples (explained variances of physical aggression: 8.4% autism and 7.3% ADHD-C; SIB: 2.6% autism and 1.0% ADHD-C). For the 259 children in the population-based samples evaluated at both baseline and follow-up, physical aggression was greater at baseline (6-12 years of age) than at follow-up (12-17 years of age) ($t = 4.4$; $p < .001$; $d = 0.3$), whereas the difference for SIB was nonsignificant ($t = 0.4$; $p = .66$; $d = 0.0$). Correlations between physical aggression and other PBS psychopathology scores were overwhelmingly significant in all groups. Most

correlations between SIB and psychopathology scores were also significant, except in children with ADHD-I.

Concurrent Predictors of Physical Aggression and SIB Scores

In the autism, ADHD-C, and ADHD-I samples, significant predictors of physical aggression (Table 5) were irritability and conduct problems (positive weight) and age (negative weight). In the baseline community sample, conduct problems and irritability (but not age) were significant predictors of physical aggression, and in the follow-up community sample, depression and irritability were significant predictors. Significant positive predictors of SIB in the autism and ADHD-C samples were irritability and symptoms of autism. Age, with a negative weight, was also significant in the autism sample. No variables were significant predictors of SIB in the ADHD-I sample. Autism symptoms were significant predictors of SIB in the baseline and follow-up community samples, as were depression in the baseline sample and anxiety in the follow-up sample.

DISCUSSION

Physical aggression and SIB were rated as often or very often a problem by mothers in 2% or fewer of children in the ADHD-I and general population baseline and follow-up samples. In contrast, physical aggression was reported in 28% and 20% of children with autism and ADHD-C, respectively, with a nonsignificant difference in scores between those 2 groups. Both physical aggression and SIB mean scores were significantly lower for children with

TABLE 4 Correlations Between Physical Aggression (PA) and Self-Injurious Behavior (SIB) Scores and Age, IQ, and Other Psychopathology Scores

	Autism		ADHD-C		ADHD-I		Community 6-12 y ^a		Community 12-17 y ^b	
	PA	SIB	PA	SIB	PA	SIB	PA	SIB	PA	SIB
Age	-.29*	-.16*	-.27*	-.10*	-.10	-.09	-.06	.05	-.13	-.04
IQ	-.04	-.05	-.05	-.08	-.08	-.04	-.09	-.02	-.13	-.09
Oppositional	.41*	.26*	.46*	.25*	.34*	.11	.41*	.17*	.26*	.20*
Irritability	.47*	.34*	.52*	.29*	.34*	.12	.42*	.17*	.43*	.22*
Conduct	.46*	.27*	.52*	.22*	.43*	.04	.52*	.23*	.36*	.02
Hyperactivity	.29*	.25*	.21*	.12*	.04	.13	.26*	.08	.30*	.23*
Impulsivity	.37*	.29*	.29*	.15*	.22*	.11	.35*	.17*	.30*	.03
Inattention	.17*	.14*	.04	.11*	.13	.05	.24*	.14*	.23*	.07
Autism	.15*	.27*	.18*	.24*	.19*	.11	.24*	.27*	.16	.52*
Anxiety	.06	.13*	.10*	.17*	.15*	.02	.18*	.15*	.20*	.10
Depression	-.04	.06	.04	.19*	.12	.10	.22*	.28*	.44*	.23*

Note: ADHD-C = attention-deficit/hyperactivity disorder—combined; ADHD-I = attention-deficit/hyperactivity disorder—inattentive.

^aBaseline.

^bFollow-up.

* $p < .01$.

ADHD-I than for children with autism or ADHD-C. This is consistent with research showing that children with autism or ADHD-C have more externalizing problems than children with ADHD-I and highlights the importance of analyzing data for ADHD-C and ADHD-I separately in research studies, which often is not done.⁵

SIB scores were significantly higher for children with autism (16% often a problem) than for those with ADHD-C (7%). This may in part be because children with autism often have reduced sensitivity to pain, engage in abnormal sensory-seeking behaviors, are emotionally overreactive, and are distressed and frustrated by input and occurrences (eg, transitions, change, and certain sensory experiences) more than children who have ADHD-C.³⁹ Indeed, Duerden *et al.* found that when autism symptoms were considered together in regression analysis, abnormal sensory processing was the strongest single predictor of SIB in children with autism.²⁷ Related to this, in individuals 1-21 years of age referred to a behavior clinic, individuals with autism had more reactive than proactive aggression compared with individuals without autism.²⁶ Although SIB was much more common in autism than in ADHD-C in our study, the 7% prevalence of SIB in children with ADHD-C without autism is still significant clinically. Notably, research on SIB in ADHD and other externalizing disorders is very limited, and studies of self-injury in ADHD are confusing and difficult to interpret because of huge differences in definitions, terminology, and types of self-injury analyzed.^{20,31}

Overall, physical aggression and SIB scores did not differ by race, sex, or parent occupation, except that

children who had a parent with a professional or managerial occupation had significantly lower physical aggression and SIB scores than lower-SES families in the autism and ADHD-C samples. However, effect sizes were relatively small. Parent occupation was not a significant independent predictor of physical aggression or SIB when controlling for other relevant variables in regression analysis in any group.

None of the correlations between IQ and physical aggression and SIB scores were significant. The finding that SIB was linked with autism independently from IQ in our study is important, because studies analyzing SIB in children with intellectual disability do not always control for autism or consider the possibility that SIB may primarily be explained by the presence of autism. Indeed, one study showed that the strongest predictor of the persistence of SIB in individuals with intellectual and developmental disabilities was autism symptoms.¹⁹

Overall, findings show that physical aggression decreased with age from childhood to adolescence in autism, ADHD-C, and population-based samples. The negative relationship between age and SIB was also significant in children with autism and ADHD-C, but not as strong as the relationship between physical aggression and age. The decrease in physical aggression with age may reflect in part strong societal sanctions against physical aggression, the effectiveness of behavioral intervention over time (eg, negative consequences for aggression and positive reinforcement for prosocial behavior), and developmental changes in impulsivity and self-control. Factor analysis of the PBS items shows that physical aggression loads on the

TABLE 5 Significant Concurrent Predictors of Physical Aggression and Self-Injurious Behavior

Significant predictor ^a by group	R	Explained variance ^b %	Standardized β	t	p	Model summary	
						F	p
Physical aggression							
Autism						334.3	<.001
Irritability	.47	22.0	.28	12.1	<.001		
Age	.56	30.8	-.36	17.4	<.001		
Conduct	.64	41.2	.38	15.9	<.001		
ADHD-C						188.6	<.001
Irritability	.52	27.1	.31	9.6	<.001		
Conduct	.60	36.6	.39	12.2	<.001		
Age	.66	43.2	-.26	9.3	<.001		
ADHD-I						32.3	<.001
Conduct	.43	18.6	.38	6.6	<.001		
Age	.46	21.6	-.17	3.4	<.001		
Irritability	.49	24.1	.18	3.2	.002		
Community 6-12 y						139.4	<.001
Conduct	.52	26.7	.41	10.6	<.001		
Irritability	.54	29.6	.20	5.3	<.001		
Community 12-17 y						41.2	<.001
Depression	.44	19.3	.29	4.4	<.001		
Irritability	.49	24.4	.27	4.1	<.001		
Self-injurious behavior							
Autism						106.3	<.001
Irritability	.34	11.4	.29	11.9	<.001		
Autism	.39	15.2	.21	8.4	<.001		
Age	.43	18.2	-.17	7.2	<.001		
ADHD-C						48.1	<.001
Irritability	.29	8.5	.25	7.0	<.001		
Autism	.34	11.4	.18	4.9	<.001		
ADHD-I							
No variables explained >2% of the variance							
Community 6-12 y						37.7	<.001
Depression	.28	7.6	.19	4.7	<.001		
Autism	.32	10.2	.18	4.4	<.001		
Community 12-17 y						56.4	<.001
Autism	.52	26.6	.64	10.5	<.001		
Anxiety	.55	30.6	-.23	3.8	<.001		

Note: ADHD-C = attention-deficit/hyperactivity disorder—combined; ADHD-I = attention-deficit/hyperactivity disorder—inattentive.

^aSignificant predictor $p < .05$ and increase in explained variance >2% over previous predictors.

^bCumulative R and explained variance including each previous significant predictor.

conduct problems factor and not on ODD in clinical and population-based samples.^{41,42} Notably, many conduct problems (eg, vandalism, fire setting, truancy, stealing, and running away) appear at a later age than physical aggression. These property and status offenses increased with age cross-sectionally in a study of community children 9-17 years old, although aggression peaked at 11-13 years.⁴³

In the total autism and ADHD sample, the correlation between physical aggression and SIB scores was medium to

large (explaining 17% of the variance), and in the baseline and follow-up population-based samples, correlations were small to medium (explaining a mean 7% of the variance). Related to this, in another study, SIB was the strongest predictor of physical aggression in children and adolescents with autism when SIB and autism symptoms were entered as predictor variables in regression analysis.⁶ The majority of correlations between physical aggression and PBS psychopathology scores in our 5 study groups were significant, as were correlations

between SIB and psychopathology scores except in the ADHD-I group. However, in multivariate analyses when psychopathology scores were considered together (and therefore controlled) to determine independent predictors of physical aggression and SIB, many psychopathology variables significant in the univariate analyses were no longer significant.

Irritability, conduct problems, and decreasing age were significant independent predictors of physical aggression in the 3 clinical groups, and irritability was significant in the 2 community groups (6-12 y and 12-17 y). Irritability was the only variable that significantly predicted physical aggression across all groups. Importantly, PBS symptoms composing the irritable mood component of ODD (ie, irritability, anger, and temper outbursts) and not the oppositional behavior component of ODD (disobedient, argues, uncooperative, and defiant) were unique and independent predictors of physical aggression when other variables were controlled. These findings support previous research indicating that ODD comprises 2 distinct factors⁹ and highlight the importance of considering the irritability and oppositional components of ODD separately in research and clinical practice.

A systematic review of the literature indicates that medication reduces aggression in children with psychiatric disorders,⁴⁴ and that applied behavior analysis is effective in decreasing aggressive behavior in individuals with autism and developmental disabilities.⁴⁵ Given that irritability was the strongest predictor of physical aggression (as well as SIB) in our study, it may be helpful for intervention to not only target aggression directly, but also incorporate treatments effective in reducing irritability, which may underlie the aggression. Controlled studies show that medication (particularly risperidone and aripiprazole) and some psychosocial interventions (eg, parent management training) are effective in decreasing irritability in children with various psychiatric disorders.⁴⁶⁻⁴⁹

The conduct problems score (which excluded physical aggression) was also a significant predictor of physical aggression in 4 of our 5 groups. This is not surprising, because factor analysis of the PBS items shows that physical aggression loads on the conduct problems factor and not on ODD.^{41,42} This is consistent with the *DSM-5*, which includes aggressive behavior as a core feature of CD but not ODD. Therefore, irritability is an associated correlate and concurrent predictor of physical aggression, whereas physical aggression is a core symptom of conduct disorder. For children with conduct problems, physical aggression may be instrumental. For children who are irritable and angry, aggression may be part of their temper outbursts.

The only significant concurrent predictor of SIB in all groups (with the exception of ADHD-I which had no significant predictors) was the presence and severity of autism symptoms. This indicates that SIB is strongly linked with

autism, more so than with other psychopathology. The absence of significant predictors in the ADHD-I group in contrast to ADHD-C again points to the need to separate the 2 subtypes in research studies.

Irritability was a significant predictor of SIB in the autism and ADHD-C groups, similarly to results for physical aggression. Together, these findings suggest that irritability is a strong underlying factor leading to aggression toward self and others in the 2 diagnostic groups that have a high prevalence of aggression.

Overall, explained variance for physical aggression was much higher than for SIB using the same predictor variables. This in part reflects the stronger correlations between irritability and externalizing behavior problems and physical aggression vs irritability and externalizing behavior problems and SIB. Furthermore, SIB may have biological determinants (eg, reduced sensitivity to pain) that do not underlie physical aggression. Related to this, explained variance in SIB was only 13% in a large sample of youth with autism using 3 autism symptoms, IQ, and anxiety as predictor variables, leading the authors to conclude that “psychological, cognitive, and behavioral factors alone” do not adequately explain SIB.⁵⁰ The present study, using a far larger number of predictor variables (15 psychological, behavioral, cognitive, and demographic variables), yielded similar results, with only 18% of the SIB variance explained in the autism sample.

This study has several limitations. A significant weakness is the use of single items assessing physical aggression toward others and self-injurious behavior from a rating scale (PBS) that is not as commonly used or well researched as some other instruments. Results need to be replicated with alternative multiple-item scales. However, the goal of our study was to investigate 2 very specific and narrowly defined constructs (physical aggression toward others and SIB), which are typically single items on rating scales. Children with autism and ADHD were from a single clinical site, so the sample may have more severe symptoms than nonreferred children. Findings need to be replicated in other settings with greater racial diversity and include samples of children with autism and no ADHD and children with other diagnoses. Data from multiple informants (mother, father, teacher, and self) in different contexts are needed. Other specific types of aggression need to be considered along with other potential predictor variables. Future research needs to determine why some children become physically aggressive when angry and others do not and what function SIB serves in children with autism vs ADHD and other disorders.

In conclusion, physical aggression was common in children with autism and ADHD-C (28% and 20%, respectively, often or very often a problem), whereas SIB was

strongly linked with autism (16% often or very often a problem vs 7% in ADHD-C). In contrast, physical aggression and SIB were rated as often or very often a problem by mothers in $\leq 2\%$ of children in the ADHD-I and general population baseline and follow-up samples. Irritability, conduct problems, and decreasing age were significant concurrent predictors of physical aggression in most groups, and irritability predicted SIB in the autism and ADHD-C groups. Notably, the irritability component of oppositional defiant disorder and not the oppositional behavior component was a significant concurrent predictor of physical aggression and SIB. In addition to directly treating aggression by means of pharmacological, behavioral, and psychosocial interventions, addressing irritability with evidence-based interventions may also decrease physical aggression and SIB.

This article is part of a special series devoted to addressing aggressive behavior as a focus of psychiatric attention and how its manifestations and treatment needs may vary across psychiatric disorders. The series is edited by Guest Editor Joseph C. Blader, PhD, Deputy Editor Robert L. Findling, MD, MBA, and Editor Manpreet K. Singh, MD, MS.

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