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Autism Spectrum Disorder and School Bullying: Who is the Victim? Who is the Perpetrator?

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Abstract While a growing number of studies indicate associations between experiences of bullying and autism spectrum disorder (ASD), it is not clear what roles comorbid behavioral problems may play. We investigated the experiences of children with ASD as victims and/or perpetrators of bullying. Children with ASD epidemiologically ascertained participated in a cross-sectional study. Although children with ASD showed significantly increased risk for bullying involvement compared to community children, after controlling for comorbid psychopathology and other demographic factors, increased risks for being perpetrators or victim-perpetrators disappeared while risk for being bullied/teased continued to be significantly elevated. This finding will help guide medical, educational and community personnel to effectively identify children with ASD at risk for school bullying and develop interventions.

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Introduction

Children and adolescents with autism spectrum disorder (ASD) show a myriad of atypical behaviors, including restricted and repetitive behaviors and interest, as well as spoken language and content that may be substantially socially inappropriate, if not frightening to some individuals (American Psychiatric Association 2013). These behaviors may include physical and verbal aggression (Kanne and Mazurek 2011). In some instances, these behaviors may be interpreted by others as the individual with ASD being a bully or even potentially dangerous, violent and/or aggressive (Cappadocia et al. 2011; Schroeder et al. 2014; Little 2001; van Roekel et al.2010). However, it is not altogether surprising that there is limited evidence linking ASD with violence of clear intent, such as bullying because: (1) bullying is defined as a perpetrating behavior by children and adolescents who hold and/or try to maintain dominant position over others; (2) bullying requires clear intent to cause mental and/or physical suffering to another; and, (3) it is a dynamic and complex social interaction (Olweus 1994a; Morita 1985; Nansel et al. 2004). Previous studies largely suggest that violent episodes involving individuals with ASD usually occur in the presence of comorbid psychiatric disorders, such as psychosis; this is similar to individuals without ASD (Newman and Ghaziuddin 2008; Wachtel and Shorter 2013). Despite these data, in the view of some, a connection between ASD and violence persists (Kanne and Mazurek 2011). This has raised considerable concern for

families, clinicians, and school officials. In addition, there has been significant concern regarding children with ASD becoming victims of school bullying due to their difficulties and limitations in social skills (Cappadocia et al. 2011; van Roekel et al.2010; Zablotsky et al. 2013a). While complex and difficult, the relationship between ASD and school violence, including bullying behaviors, deserves empirical exploration to provide clearer understanding and opportunities for effective interventions.

ASD is a lifelong condition, characterized by pervasive impairments in social reciprocity and/or communication, stereotyped behavior and restricted interests (Caronna et al. 2008; American Psychiatric; Association 2013). It has been suggested that the core deficits of ASD make children with ASD especially vulnerable to involvement with bullying, as victims and/or perpetrators (Cappadocia et al. 2011; Sterzing et al. 2012; Schroeder et al. 2014). Previous studies in the US, Canada, UK, and the Netherlands reported bullying prevalence ranging from 7 to 75% for individuals with ASD being victims and 19–46% for them acting as perpetrators (Cappadocia et al. 2011; van Roekel et al.2010; Little 2001; Twyman 2010; for a systematic review, see; Maiano et al. 2016b).

For many children, both with and without ASD, bullying (victimization by and perpetration of bullying) is associated with various psychological problems, either as a consequence of, or antecedent to bullying experiences (Salmon et al. 1998; Srabstein and Piazza 2008; Kim et al. 2005, 2006, 2009b, 2009a; Hebron et al. 2016). As for the children and adolescents with ASD, a study showed increased rates of perpetration in children with ASD and comorbid attention deficit hyperactivity disorder (ADHD), compared to children with ASD who did not have ADHD (Montes and Halterman 2007). Zablotsky et al. (2013a) found that among the children and adolescents with ASD, bullying victims are more likely to have internalizing problems, ADHD, and depression; in contrast, perpetrators were more likely to have emotion regulation problems, conduct disorder (CD) and oppositional defiant disorder (ODD). Thus, it appears reasonable to assume that, given their difficulties with complex social functioning, most children with ASD seem unlikely candidates for bullying others with such intent (Sofronoff et al. 2011). Also, perpetrating behaviors in children with ASD are more likely to result from other factors, such as behavioral problems related directly to ASD, communication problems, or comorbid psychopathology (Volker et al. 2010).

In most previous studies exploring bullying problems in children with ASD, interpretations of the findings were challenging due to methodological problems, including small sample sizes, the use of non-representative, convenience samples, and studying participants without evidence-based, confirmative diagnoses of ASD (Schroeder et al.

2014). The present study overcomes these limitations by using an epidemiologically-ascertained sample of children whose ASD diagnoses were confirmed with gold-standard assessments: the autism diagnostic observation scale (ADOS) and autism diagnostic interview-revised (ADI-R), using both DSM-IV and DSM-5, criteria to reflect the recent advent of DSM5 in 2013 and differences of ASD criteria between DSM-IV and DSM5 (American Psychiatric Association 2013; Kim et al. 2014). We drew a comparison group of community children from the same sampling frame and used standardized parent reports to identify bullying experiences and comorbid psychopathology in all participating children.

Based on prior findings, we tested the following hypotheses (Cappadocia et al. 2011; Little 2001; van Roekel et al.2010):

1. Children with ASD will show increased involvement in bullying, as victims and/or perpetrators, relative to community comparison children.
2. After adjusting for comorbid psychopathology, children with ASD will have higher risks for victimization relative to the community comparison children, but not of perpetration or victim-perpetration.

We also investigated the consistency of findings with respect to ASD and bullying across DSM-IV and DSM-5 diagnoses, in line with our previous study on prevalence of ASD across these two versions of the diagnostic system (Kim 2014).

Methods

Study Population

Following approval by the Yale University Institutional Review Board, the sample was drawn from children attending regular education elementary schools in a large suburb of Seoul, South Korea, between September 2005 and August 2009. The target population was all 7-12-year-old youth in the community. Of 22 schools in the target area, 16 schools agreed to participate (N = 22,382; 73% participation from the target N = 32,439). Parents at participating schools were asked to complete screening questionnaires about their children, including: the autism spectrum screening questionnaire (ASSQ) (Ehlers et al. 1999; Yim 2014) and the behavior assessment system for children, second edition, parent rating scales-child (BASC-2 PRS) (Volker et al. 2010). Teachers were also asked to complete the ASSQ.

Identification of Children with ASD

The study used a two-stage design to identify children with ASD. The screening stage used systematic, multi-informant screening with the ASSQ (Ehlers et al. 1999). For screen-positive children with parental consents (parental ASSQ score in top 5th percentile and/or teacher ASSQ scores ≥10), evidence-based diagnostic assessments were conducted with Korean-ADOS and ADI-R that have been standardized for Korean children, as well as cognitive tests (the Korean WISC-III or the Leiter International Performance Scale-Revised) (Kim et al. 2016; Kim et al. 2011). Because cognitive function is reported to be associated with risks for bullying involvement both as victims and perpetrators (Verlinden et al. 2014; Bowes et al. 2013), children with ASD were further subdivided by the presence of intellectual disability (ID).

The detailed case identification and informed consent processes are summarized in Fig. 1. Children were classified as having an ASD or social communication disorder (SCD) if they met DSM-IV criteria for any pervasive developmental disorder, or DSM 5 criteria for ASD or SCD. To generate best-estimate clinical diagnoses, all relevant data, including information from the ADOS and ADI-R, were reviewed by one of two clinical teams who were independent of the original evaluators. The final diagnosis was based on clinical judgment. In order to minimize cultural bias in the processes of case identification and determination of best estimate clinical diagnoses, each diagnostic team included a board-certified Korean child psychiatrist clinically and research trained both in Korea and in the United States and a second board-certified child psychiatrist or child psychologist clinically trained in Korea and research trained in Northa America. Disagreements were resolved by consensus between diagnosing clinicians (Kim et al. 2011, 2014); see Table 1 for demographics of study group.

Identification of Community Comparison Children

Of the participating students, those who were both parent- and teacher-ASSQ screen negative served as the Community Comparison group.
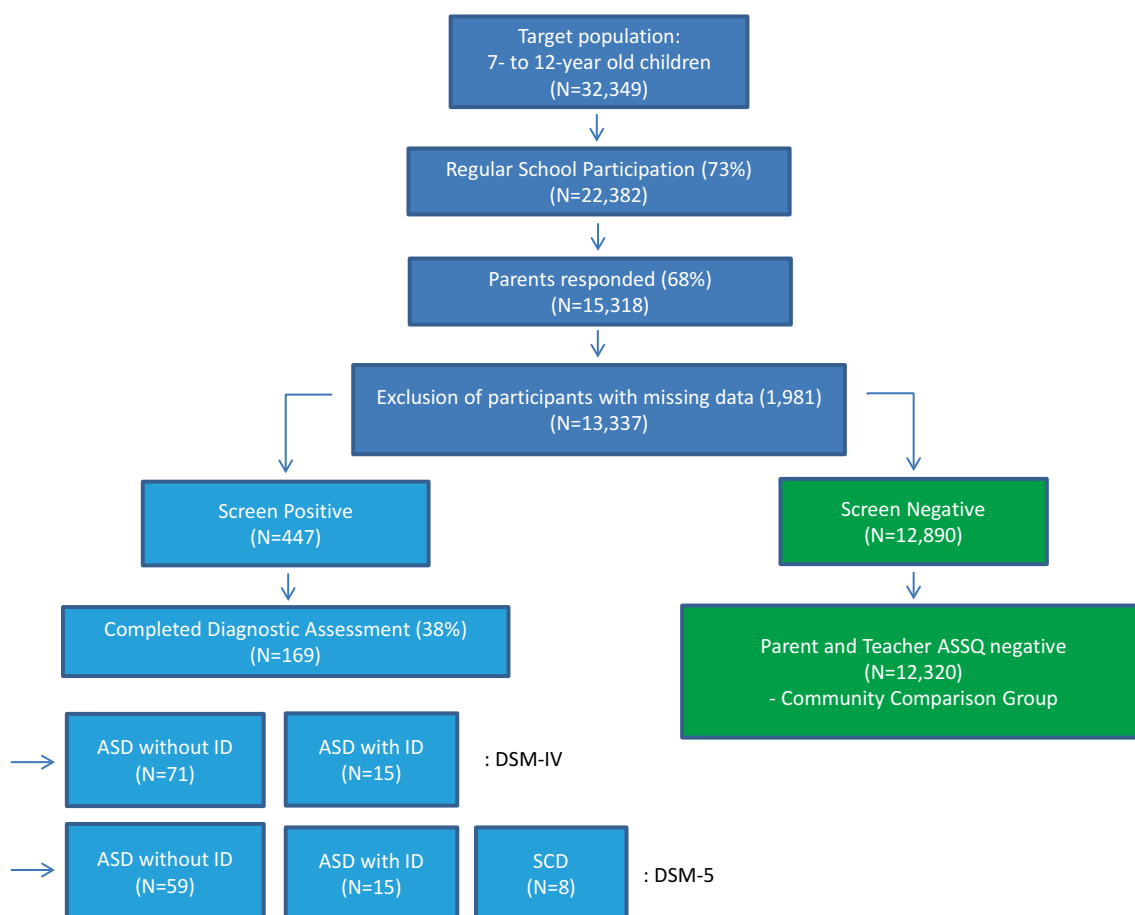

Fig. 1 Case identification process for ASD and community comparison group

Table 1 Demographics of Study Group

	ASD without ID DSM-IV (DSM5)	ASD with ID DSM-IV (DSM5)	DSM5 SCD	Community comparison
Number of children	71 (59)	15 (15)	8	12,320
Gender	Male 80.2 (81.4) (%)	Male 73.3 (73.3) (%)	Male 75 (%)	Male 48.7 (%)
Mean age (year ± SD)	8.9 ± 1.6	9.9 ± 2.3	9.7 ± 1.7	9.3 ± 1.7
	(9.0 ± 1.6)	(9.9 ± 2.3)		
Mean IQ	99.11 ± 15.40	55.53 ± 10.75	102.25 ± 21.89	
	(98.71 ± 17.42)	(55.53 ± 10.75)		

Measurement of Psychopathology and Bullying Experience

The BASC-2 PRS was used to assess comorbid developmental psychopathology and bullying experiences in participating children (Reynolds and Kamphaus 2004). The BASC 2-PRS, is composed of 160 items, scored on 4-point ordinal scale (anchors: "Never," "Sometimes," "Often," and "Almost always"); it is a widely-used developmental psychopathology assessment instrument with optimal internal consistency and reliability. The BASC- 2 PRS assesses behavioral problems in nine separate clinical domains, including: hyperactivity, attention problems, aggression, conduct problems, anxiety, depression, somatization, atypicality, and withdrawal. The Korean-BASC 2-PRS has been standardized in Korean children with adequate psychometric properties, consistent with those reported in US children (Song et al. 2017). The average scores of these clinical domains in our study sample are summarized in Table 2.

While the definition of "bullying" was not provided in the BASC-2 PRS, specific bullying behaviors were captured by several items: (1) Item 18 ("complains about being teased") for Victimization; and, (2) for Perpetration, Items 8 ("tease others"), 24 ("bullies others"), 26 ("hits other children"), 58 ("threatens to hurt others"), 72 ("annoys others on purpose") and, 104 ("calls other children names"). For the purposes of analyses, bullying experiences for the children were identified using these items. Similar methods have been used in previous research to identify bullying experiences using the BASC-2 PRS (Volker et al. 2010). We identified bullying experience in children with ASD with the same items, following examples of previous epidemiological studies using a single item for bullying victimization in various populations (Bowes et al. 2009; Kaltiala-Heino et al. 1999; Frizzo et al. 2013; Wu et al. 2016; Case et al. 2016; Sutin et al. 2016), including children with ASD (Cappadocia et al. 2011; Zablotsky et al. 2013b). For the perpetration items, internal consistency was measured by calculating Cronbach's alpha. This yielded a good level of internal consistency (0.712). The mean, mode and median scores for the bullying items in our study samples are summaried in the Supplementary Table 1 and Fig. 2.

The nine BASC-2 PRS clinical subscales were used to identify comorbid psychopathology in the participating children. To avoid collinearity, the clinical subscales study were computed, after excluding the seven items used to identify bullying experience.

Table 2 BASC-2 PRS clinical subscale raw scores in community children and children with DSM IV/DSM 5 ASD and ID (mean ± standard deviation)

	DSM IV ASD with ID	DSM 5 ASD with ID	DSM IV ASD without ID	DSM 5 ASD without ID	Community children
Hyperactivity	11.1 ± 7.3[a]	11.8 ± 7.0[a]	9.2 ± 5.4[a]	8.9 ± 5.4[a]	4.4 ± 3.3[b]
Attention problems	11.3 ± 3.1[a]	11.6 ± 2.9[a]	9.7 ± 3.6[a]	9.5 ± 3.6[a]	5.8 ± 3.1[b]
Aggression	6.8 ± 4.6[a]	6.7 ± 4.7[a]	6.1 ± 4.1[a]	5.8 ± 4.0[a]	3.4 ± 2.8[b]
Conduct problems	5.2 ± 3.8[a]	5.4 ± 3.8[a]	4.6 ± 3.3[a]	4.3 ± 3.2[a]	2.4 ± 2.3[b]
Anxiety	14.2 ± 6.7[a]	13.4 ± 6.2[a]	12.4 ± 6.7[a]	11.7 ± 6.2[a]	8.8 ± 4.8[b]
Depression	11.2 ± 3.8[a]	10.8 ± 3.6[a]	10.3 ± 5.2[a]	9.9 ± 5.5[a]	4.1 ± 3.4[b]
Somatization	4.4 ± 6.2[a]	4.6 ± 6.4[a]	3.4 ± 3.7[a]	3.1 ± 3.0[a]	2.1 ± 2.7[b]
Atypicality	12.5 ± 7.7[a]	13.0 ± 7.7[a]	9.5 ± 3.8[a]	9.3 ± 5.3[a]	2.0 ± 2.4[b]
Withdrawal	17.6 ± 5.3[a]	16.9 ± 4.8[a]	14.1 ± 6.9[a]	13.7 ± 7.0[a]	5.7 ± 3.7[b]

[a,b] All averages scores are significantly different between a (clinical subscale raw scores for children with ASD, as marksed as superscript letter a) and b (clinical subscale raw scores for community children as marked as superscript letter b) (p < 0.002)
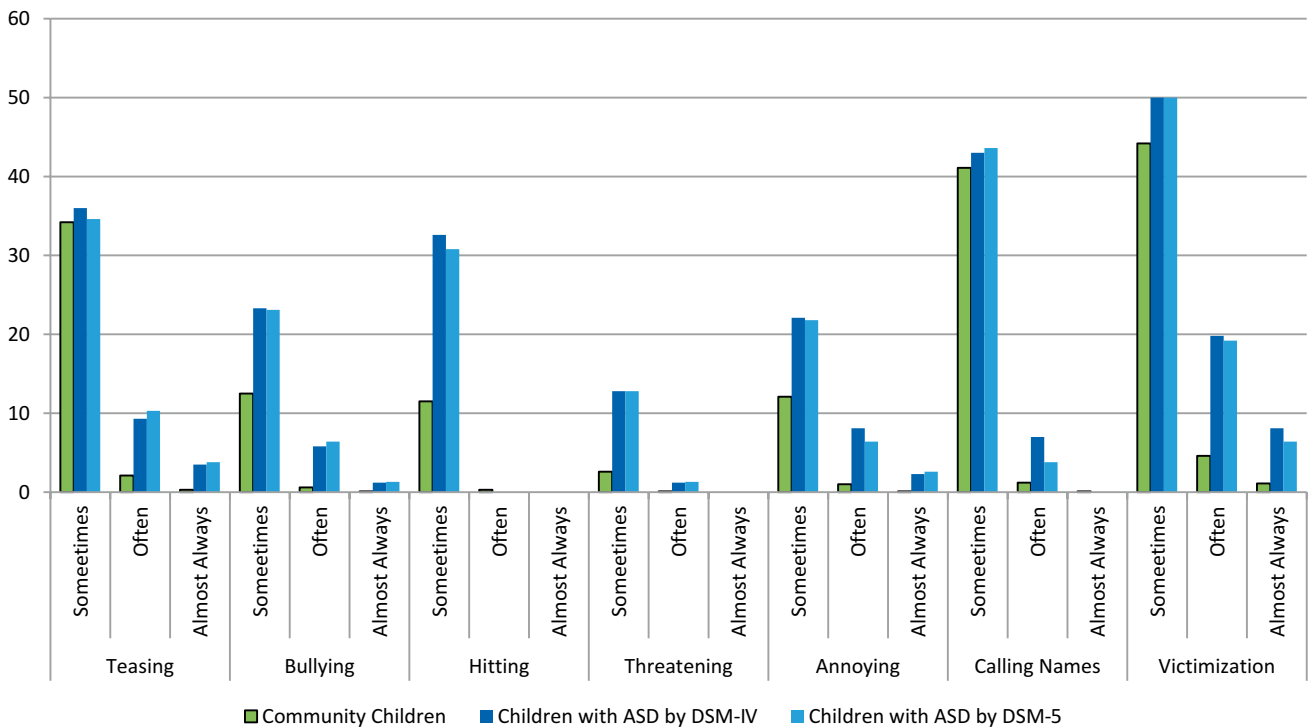
Fig. 2 Comparison of bullying involvement (%) by type and frequency between children with ASD and community children. Difference in percentage in the involvement of bullying, and linear trends in the involvement of bullying with increased frequency between children with ASD and community comparison group were statistically significant (all at p-value < 0.01 except linear trend for name calling at p-value = 0.028) for all types of perpetrating behaviors and victimization

Statistical Analysis

To compare victimization/perpetration between children with ASD and the community comparison group, three analyses were conducted: Chi square statistics for bivariate analyses, correlational analyses and ordinal regression for multivariate analyses with sex, age and comorbid psychopathologies as coviarates. To test the study hypotheses, ordinal regression analyses were conducted to examine the association between having a diagnosis of ASD and risk for bullying experiences, with frequency of bullying as an outcome ("never" as a reference level, yielding odds ratio [OR] for each level of sometimes, often, and almost always bullying experiences), having a diagnosis of DSM-IV ASD as a predictor. To compute adjusted ORs, covariates were entered in the regression models in the order of: sex, age, school, and the nine psychopathologies. We further divided children with ASD into two groups—those with ID (ID: K-WISQ full IQ score <70) vs. without ID; we then repeated the ordinal regression to adjust for intellectual function on the relationship between ASD and bullying.

Second, the types of bullying experience in all children were categorized into victim-only, perpetrator-only, and victim-perpetrator. For example, in the hitting domain, children scoring positive for hitting (BASC item 26) but negative for victimization (item 18), were categorized as perpetrator-only; children scoring negative for hitting and positive for victimization as victim-only; and, children who scored positive for both hitting and victimization as victim-perpetrator. Three logistic regression analyses were conducted for each type of bullying, controlling for covariates to examine the impact of ASD diagnoses on different types of bullying experiences in children. Follow-up analyses were completed after dividing ASD children into those with and without ID. We repeated ordinal and logistic regression for children with ASD and Social Communication Disorder (SCD) by DSM-5 criteria.

Results

Demographic Characteristics

15,318 parents of 22,382 students in the participating schools (68% participation rate) returned the questionnaire: 1981 children were later excluded due to missing data. Only grade information was available for non-respondents in participating schools. Non-participation by grade ranged from 28 to 46%. Therefore, age was controlled in subsequent analyses to adjust for the potential confounding effects of

age. Of the 447 screen positive children with parental consents, 169 (38%) completed diagnostic assessment, 86 children were confirmed to have ASD (ASD without ID = 71, with ID = 15) by DSM-IV-TR criteria. By DSM-5 criteria, 74 children were diagnosed with ASD (86% of DSM-IV ASD) and 8 children with SCD (9% of DSM IV-ASD). Four children with DSM-IV PDD NOS who no longer met the DSM-5 ASD criteria still received other psychiatric diagnoses (Kim et al. 2014). The community comparison group was limited to those children from the 12,890 who were parent- and teacher-ASSQ screen negative in order to exclude children who might have ASD; this left 12,320 children in the comparison group (Fig. 1). While the mean ages for children with ASD and community children were similar (9.1 ± 1.6 vs. 9.3 ± 1.7, respectively), there were more boys with ASD (80%) when compared to the even sex distribution in the comparison group; previous findings of prevalence also indicate higher rates in boys (Table 1) (American Psychiatric Association 2013).

Bullying Experience and its Relation to Psychopathology

All nine psychopathologies were significantly correlated with bullying experiences in both groups of children with ASD and community control children (Supplementary Table 2). Compared to the community comparison children, children with both DSM-IV PDD and DSM5 ASD had significantly higher scores in all nine BASC-2 clinical subscales (t = 3.5–12.7, p < 0.002, Table 2).

Compared to the community children, the children with ASD showed significantly increased involvement in bullying, as either victims or perpetrators. The parents of children with ASD reported that 19.8/19.2% (DSM-IV and DSM-5 ASD, respectively) of their children were often victims, versus 4.6% for community children. The parents of ASD children also reported that 9.3/10.3% (DSM-IV PDD and DSM-5 ASD, respectively) were often involved in teasing others, compared to 2.1% for the community control children. Furthermore, children with ASD were more likely to be involved with frequent bullying when compared to comparison children, as demonstrated by a significant linear trend (p = 0.001–0.009) in all frequency categories of perpetration and victimization. This finding was also similar in both subgroups of DSM-IV and DSM-5 ASD, with and without ID (Table 3, Supplementary Table 1, Fig. 2). Separate multivariate ordinal regression analyses of children with ASD and community control children indicate that age, sex and psychopathologies are significantly associated with bullying experiences in both groups (Supplementary Table 3).

In subsequent ordinal regression analyses to test study hypotheses, demographic covariates (sex, age and school) were entered in models, the risks for bullying, both as victims and perpetrators, remained significantly increased in children with DSM-IV PDD and DSM-5 ASD (OR for victims 19.5–21.7, p < 0.001; ORs for perpetrators 1.8–14.1, p = 0.001–0.026). When the four comorbid behavioral problems (hyperactivity, attention problems, aggression, conduct problem) were then introduced into the models, however, risks for perpetrating behaviors in children with ASD ceased to be significant (ORs 0.8–1.1, p = 0.058–0.962) and remained so after the five clinical subscales (anxiety, depression, somatization, atypicality and withdrawal) were entered in the models. Perhaps more importantly, having ASD (with or without ID) became a significant protective factor for name calling directed at other children. However, the adjusted OR of victimization for children with ASD remained significantly higher than comparison children (ORs = 4.1–12.6, p = 0.001–0.005). These results remained the same for individuals with DSM-5 diagnoses of ASD (Table 4).

Sub-group analyses of ASD children, with and without ID, indicated that most of the observed findings in the main analyses stemmed from the comparison between the children with ASD without ID and the community children (Tables 4, 5). Additionally, the children with ASD but without ID showed significantly decreased OR for bullying others, when compared to the community control children; the results remained the same for those with ASD by DSM-5 classification.

When covariates were controlled, analyses of the experience of victim-only, perpetrator-only, and victimi-perpetrator revealed that not only did all the significantly increased risks for perpetration disappear but also a diagnosis of ASD (DSM-IV or DSM-5) became a protective factor with respect to becoming a perpetrator. Also, children with ASD showed significantly decreased risk for being a victim-perpetrator, when compared to the community children. However, children with ASD but without ID were still at an increased risk for victimization, even after controlling for covariates (Table 6). Similar to the previous analyses, most of the significant findings resulted from the differences between children with ASD without ID and the community children.

Analyses for DSM-5 SCD did not yield meaningful result, due to the small number of subjects (n = 8).

Discussion

To our knowledge, this is a novel study that: (1) examined the rates of bullying experiences, for individuals with both DSM-IV PDD and DSM-5 ASD; and (2) used an epidemiologically-ascertained, representative community sample of children and their non-ASD counterparts. This may explain a higher prevalence of children with ASD compared to the previous epidemiological studies, since we used total

Table 3 Prevalence (%) of bullying involvement in children according to DSM IV and DSM 5 ASD criteria and ID

	Never	Sometimes	Often	Almost always
Perpetration				
Teasing				
DSM IV ASD/DSM 5 ASD with ID	52.1/52.1	36.6/36.6	9.9/9.9	1.4/1.4
DSM IV ASD/DSM 5 ASD without ID	46.7/51.6	33.3/34.4	6.7/12.5	13.3/1.6
Community children	63.4	34.2	2.1	0.3
Bullying				
DSM IV ASD/DSM 5 ASD with ID	71.8/71.8	23.9/23.9	4.2/4.2	0.0/0.0
DSM IV ASD/DSM 5 ASD without ID	60.0/71.9	20.0/21.9	13.3/6.3	6.7/0.0
Community children	86.8	12.5	0.6	0.1
Hitting				
DSM IV ASD/DSM 5 ASD with ID	69.0/69.0	31.0/31.0	0.0/0.0	0.0/0.0
DSM IV ASD/DSM 5 ASD without ID	60.0/73.4	40.0/26.6	0.0/0.0	0.0/0.0
Community children	88.1	11.5	0.3	0.0
Threatening				
DSM IV ASD/DSM 5 ASD with ID	87.3/87.3	11.3/11.3	1.4/1.4	0.0/0.0
DSM IV ASD/DSM 5 ASD without ID	80.0/85.9	20.0/12.5	0.0/1.6	0.0/0.0
Community children	97.3	2.6	0.1	0.0
Annoying				
DSM IV ASD/DSM 5 ASD with ID	67.6/67.6	21.1/21.1	8.5/8.5	2.8/2.8
DSM IV ASD/DSM 5 ASD without ID	66.7/70.3	26.7/20.3	6.7/6.3	0.0/3.1
Community children	86.8	12.1	1.0	0.1
Calling Names				
DSM IV ASD/DSM 5 ASD with ID	50.7/50.7	40.8/40.8	8.5/8.5	0.0/0.0
DSM IV ASD/DSM 5 ASD without ID	46.7/51.6	53.5/43.8	0.0/4.7	0.0/0.0
Community children	57.6	41.1	1.2	0.1
Victimization				
Being teased				
DSM IV ASD/DSM 5 ASD with ID	21.1/21.1	52.1/52.1	18.3/18.3	8.5/8.5
DSM IV ASD/DSM 5 ASD without ID	26.7/21.9	40.0/51.6	26.7/21.9	6.7/4.7
Community children	50.1	44.2	4.6	1.1

Difference in percentage in the involvement of bullying and linear trends in the involvement of severe forms of bullying between children with ASD and community comparison group were statistically significant (all at p-value < 0.01 except linear trend for name calling at p-value = 0.028) for all types of perpetrating behaviors and victimization. Also number of children for each diagnostic categories as follows (DSM-IV ASD with ID = 15, DSM-IV ASD without ID = 71, DSM-5 ASD with ID = 15, DSM-5 ASD without ID = 59, and community children = 12,320)

population study sample along with the gold standard of diagnosis for ASD (Kim et al. 2011, 2014); such a sample may not only increase detection of ASD but also reflect the actual bullying experiences of children with ASD in their community. Other strengths of this study include: individuals with ASD were examined both as victims and/or perpetrators and potential confounding factors in the relationship between ASD and bullying experiences, including ID and other comorbid conditions were carefully examined and considered in the analyses.

Our results support Hypothesis 1. Children with ASD show higher involvement in bullying, as both victims and/or perpetrators, compared to their community counterparts. Furthermore, children with ASD have bullying experiences more frequently, both as victims and/or perpetrators than do community comparison children.

Hypothesis 2 was affirmed. Even after controlling for comorbid psychopathology, children with ASD have significantly increased experience as victims, compared to community comparison children. The initial observation of increased risks for being a perpetrator and victim-perpetrator disappeared when there was control for comorbid psychopathology. Thus, it seems clear that children with ASD are much LESS likely to be involved in bullying as perpetrators and/or victim-perpetrators.

In addition, we demonstrated that that the nature of involvement in bullying does not differ if there is either a DSM-5 ASD and DSM-IV PDD diagnosis.

Table 4 Association between bullying experience and ASD

		Crude OR	Adjusted OR[a]
Bullying			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	**3.1(1.9–4.8)/2.6(1.6–4.2)**	0.6 (0.3–1.1)/0.6 (0.0–11.1)
	Significance	**<0.001/<0.001**	0.085/0.645
DSM IV/DSM 5ASD without ID	OR (CI)	**2.7 (1.6–4.4)/12.3 (4.3–35.1)**	**0.5 (0.3–1.0)**/0.8 (0.2–3.3)
	Significance	**<0.001/<0.001**	**0.035**/0.775
DSM IV/DSM 5 ASD with ID	OR (CI)	**6.0 (2.2–16.4)/6.0 (2.2–16.4)**	1.3 (0.4–4.1)/1.3 (0.4–4.1)
	Significance	**<0.001/<0.001**	0.699/0.699
Teasing			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	**2.0 (1.3–3.0)/1.6 (1.0–2.4)**	0.8 (0.5–1.2)/0.6 (0.0–11.1)
	Significance	**0.001/0.049**	0.263/0.645
ASD without ID	OR (CI)	**1.8 (1.2–2.9)/7.8 (3.5–17.0)**	0.7(0.4–1.2)/0.3 (0.0–5.3)
	Significance	**0.008/<0.001**	0.167/0.483
ASD with ID	OR (CI)	**3.0 (1.1–8.0)/3.0 (1.1–8.0)**	1.2 (0.4–3.6)/1.2 (0.4–3.6)
	Significance	**0.033/0.033**	0.738/0.738
Hitting			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	**3.5 (2.2–5.5)/3.0 (1.9–4.9)**	1.2 (0.7–2.9)/1.7 (0.9–3.1)
	Significance	**<0.001/<0.001**	0.544/0.069
ASD without ID	OR (CI)	**3.3 (2.0–5.4)/2.8 (1.6–4.9)**	1.1 (0.6–2.1)/1.0 (0.5–2.0)
	Significance	**<0.001/<0.001**	0.655/0.945
ASD with ID	OR (CI)	**4.8 (1.7–13.5)/4.8 (1.7–13.5)**	1.4 (0.4–5.1)/1.4 (0.4–5.1)
	Significance	**0.003/0.003**	0.598/0.598
Threatening			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	**5.8 (3.1–10.8)/4.7 (2.5–9.0)**	0.8 (0.4–1.8)/5.0 (0.5–52.9)
	Significance	**<0.001/<0.001**	0.602/0.182
ASD without ID	OR (CI)	**5.2 (2.6–10.6)/5.5 (2.6–11.7)**	0.8 (0.3–1.9)/7.0 (0.5–103.6)
	Significance	**<0.001/<0.001**	0.603/0.679
ASD with ID	OR (CI)	**8.8 (2.5–31.5)/8.8 (2.5–31.5)**	0.9 (0.2–4.3)/0.9 (0.2–4.3)
	Significance	**0.001/0.001**	0.874/0.874
Annoying			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	**3.5 (2.3–5.5)/2.6 (1.6–4.2)**	0.8 (0.4–1.4)/2.1 (0.3–13.0)
	Significance	**<0.001/<0.001**	0.418/0.422
ASD without ID	OR (CI)	**3.6 (2.2–5.8)/2.1 (1.1–3.9)**	0.9 (0.5–1.7)/*
	Significance	**<0.001/0.019**	0.810/*
ASD with ID	OR (CI)	**3.4 (1.2–9.9)/3.4 (1.2–9.9)**	0.4 (0.1–1.4)/0.4 (0.1–1.4)
	Significance	**0.022/0.022**	0.146/0.146
Calling names			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	1.5 (1.0–2.3)/1.2 (0.8–1.9)	**0.5 (0.3–0.8)**/0.8 (0.2–3.1)
	Significance	0.053/0.42	**0.008**/0.747
ASD without ID	OR (CI)	1.5 (1.0–2.4)/1.2 (0.7–2.0)	**0.6 (0.3–1.0)**/0.7 (0.2–2.8)
	Significance	0.076/0.495	**0.038**/0.532
ASD with ID	OR (CI)	1.5 (0.5–4.1)/1.5 (0.5–4.1)	**0.3 (0.1–1.0)/0.3 (0.1–1.0)**
	Significance	0.434/0.434	**0.049/0.049**
Victimization			
Entire DSM IV/DSM 5 ASD Group	OR (CI)	**16.3 (6.8–39.6)/12.0 (4.4–32.6)**	**7.8 (2.7–22.9)/7.4 (2.2–24.4)**
	Significance	**<0.001/<0.001**	**<0.001/0.001**
ASD without ID	OR (CI)	**17.8 (6.8–46.5)/12.1 (4.0–37.1)**	**8.2 (2.6–25.7)/7.2 (2.0–26.5)**
	Significance	**<0.001/<0.001**	**0.015/0.003**
ASD with ID	OR (CI)	**11.4 (1.3–102.5)/11.4 (1.3–102.5)**	8.2 (0.7–98.5)/8.2 (0.7–98.5)
	Significance	**0.030/0.030**	0.098/0.098

Table 4 (continued)

OR odds ratios, *CI* confidence interval

*Cell size is too small to compute OR

[a]Adjusted OR were controlled for sex, age, school, and nine comorbid developmental psychopathologies

Children with ASD have considerable difficulty in reciprocal social interactions along with impairment in social communication skills (Frith and Hill 2004; van Roekel et al.2010). These difficulties make them vulnerable to peer victimization (Sharp and Cowie 1994). Additionally, stereotyped behaviors and a limited range of interests (often in unusual subjects) make children with ASD "stand-out" among their peers. Our data also support this by showing increased atypicality on BASC-2 for children with ASD, compared to the community children (Table 2); these ASD symptoms appear to make them targets for ridicule (Cappadocia et al. 2011). Other challenges faced by children with ASD, including unusual sensory responses, and poor motor coordination/performance in physical education, contribute to the risk of the peer victimization (Bejerot et al. 2011). Finally, having a close friendship/positive relationship is an established protective factor against peer victimization (Hebron and Humphrey 2013; Hebron et al. 2016); however, this protective factor is often absent for children with ASD as they have difficulty in establishing/maintaining friendship. Taken together, these factors suggest that it is not surprising that children with ASD are much more likely to be victims of bullying.

It has been established that bullying is related to the later development of psychopathology (Kim et al. 2006). There is no reason to suggest that children with ASD are less vulnerable to this outcome. One study reported that 45% of adults with Asperger's Syndrome had long-term sequelae of prior bullying experiences (Samson et al. 2011). One recent study also reported increased levels of anxiety in individuals with ASD and experience of bullying victimization (Weiss et al. 2015). In our ordinal regression analyses, children with ASD who have symptoms of anxiety and depression showed increased risks for victimization (Supplementary Table 3). Therefore, careful attention must be given to the children with ASD in order to protect these already vulnerable children from the consequences of bullying.

Perpetrating behaviors in bullying are characterized by the perpetrators' intention to cause mental and/or physical suffering to others (Olweus 1994b). Perpetrators generally determine what will cause pain and/or discomfort for their victims and then act accordingly. Children with ASD will be likely to have considerable difficulty conducting this level of social analysis and execution, due to their difficulty in understanding and using the subtle and not-so-subtle social rules and cues, as well as their general inability to take the perspective of others (Yirmiya et al. 1998). Despite these problems, the behaviors of children with ASD might be interpreted as perpetrating behaviors for several reasons. First, children with ASD have limited insight into social processes (Frith and Hill 2004; van Roekel et al.2010) and they may not be aware of the consequences of their own behaviors/words. For example, children with ASD may say "brutally frank," but accurate, things regarding characteristics of their peers causing seemingly purposeful offense (van Roekel et al.2010). Second, children with ASD may have increased levels of aggressive behaviors (van Roekel et al.2010), especially if routines are disrupted or they are exposed to irritating sensory stimuli; thus, those with ASD with increased levels of aggression may be labeled as bullies, even in the absence of social intention (van Roekel et al.2010). Third, the high level of comorbidity in children with ASD can contribute to the aggressive behavior or irritable affect, which, in turn, can be perceived as perpetrating behavior. Indeed, prior studies demonstrated increased rates of bullying but only in adolescents with ASD and comorbid ADHD (Montes and Halterman 2007; Sterzing et al. 2012). Another recent study has suggested that the perpetrating behaviors of children with ASD are only related to comorbidity with disruptive behavior disorder (CD and ODD) and to emotional regulation difficulties (Zablotsky et al. 2013a).

Our study confirms these previous findings, by showing that perpetrating behaviors in children with ASD disappear when comorbid psychopathology is controlled. Those comorbid psychopathologies, such as hyperactivity, aggression, conduct problems, and atypicality (see Supplementary Tables 1 and 3) are in line with the previous findings that showed increased perpetration behavior related to comorbidity in ASD (Montes and Halterman 2007; Zablotsky et al. 2013b; Volker et al. 2010; van Roekel et al.2010; Sterzing et al. 2012). Furthermore, it seems that having a diagnosis of ASD is associated with decreased perpetrating behaviors. This is in line with the prior finding that comorbidities increased the risk for victim-perpetrator experiences in children with ASD (Zablotsky et al. 2013b). Thus, less sophisticated, non-intentional forms of aggressions are likely to be associated with presence of comorbidities rather than with ASD, per se.

Given the high prevalence of bullying and its association with psychiatric/psychological comorbidity in children with ASD, recognition along with comprehensive and careful assessments are required to prevent bullying or to allow for early identification of bullying for children with ASD (Zablotsky et al. 2013b; Hebron and Humphrey 2013;

Table 5 Association between victimization, perpetration, and victimization-perpetration experience and ASD

Behavioral domain		Victimization only		Perpetration only		Victimization-perpetration	
		Crude OR	Adjusted OR[a]	Crude OR	Adjusted OR[a]	Crude OR	Adjusted OR[a]
Bullying							
Entire DSM IV/ DSM 5 ASD Group	OR	**1.6**/1.4	1.5/1.5	1.0/1.5	**0.2/0.3**	**2.6/2.7**	**0.4/0.4**
	(Interval)	**(1.0–2.4)**/ (0.9–2.2)	(0.9–2.4)/ (0.9–2.6)	(0.4–2.8)/ (0.9–2.2)	**(0.1–0.7)/(0.1–0.8)**	**(1.6–4.3)/(1.6–4.5)**	**(0.2–0.8)/(0.2–0.9)**
	Significance	**0.039**/0.118	0.097/0.132	0.968/0.118	**0.012/0.013**	**<0.001/<0.001**	**0.008/0.022**
DSM IV/DSM 5 ASD without ID	OR	**1.8/1.7**	**1.7**/1.8	1.2/0.7	0.3/0.7	**2.4/2.2**	**0.4/0.4**
	(Interval)	**(1.1–2.9)/(1.0–2.8)**	**(1.0–2.9)**/ (0.9–3.2)	(0.5–3.4)/ (0.4–1.3)	(0.1–1.0)/ (0.4–1.3)	**(1.4–4.2)/(1.3–3.6)**	**(0.2–0.8)/(0.2–0.9)**
	Significance	**0.011/0.035**	**0.046**/0.052	0.667/0.272	0.057/0.272	**0.002/0.002**	**0.011/0.025**
DSM IV/DSM 5 ASD with ID	OR	0.7/0.7	0.8/0.8	*/*	*/*	**4.1/4.1**	0.5/0.5
	(Interval)	(0.2–2.1)/ (0.2–2.1)	(0.2–2.5)/ (0.2–2.5)			**(1.4–12.0)/(1.4–12.0)**	(0.1–2.4)/ (0.1–2.4)
	Significance	0.537/0.537	0.666/0.666			**0.010/0.010**	0.385/0.385
Teasing							
Entire DSM IV/ DSM 5 ASD Group	OR	1.5/1.5	1.6/1.4	0.5/0.5	**0.2/0.2**	**2.4/2.4**	0.8/0.7
	(Interval)	(1.0–2.4)/ (0.9–2.3)	(0.9–2.6)/ (0.9–2.4)	(0.2–1.1)/ (0.2–1.1)	**(0.1–0.7)/ (0.1–0.7)**	**(1.6–3.8)/(1.4–4.2)**	(0.5–1.3)/ (0.3–1.4)
	Significance	0.066/0.094	0.078/0.167	0.073/0.124	**0.008/0.017**	**<0.001/0.003**	0.374/0.306
DSM IV/DSM 5 ASD without ID	OR	**1.7/1.7**	**1.8**/1.6	0.6/**0.4**	0.4/**0.4**	**2.2/2.5**	0.7/0.7
	(Interval)	**(1.1–2.8)/(1.1–2.8)**	**(1.0–3.1)**/ (0.9–2.9)	(0.2–1.3)/**(0.2–0.9)**	(0.1–1.1)/**(0.2–0.9)**	**(1.4–3.6)/(1.4–4.6)**	(0.4–1.3)/ (0.4–1.3)
	Significance	**0.022/0.031**	**0.036**/0.077	0.195/**0.025**	0.055/**0.025**	**0.001/0.002**	0.249/0.272
DSM IV/DSM 5 ASD with ID	OR	0.7/0.7	0.7/0.7	*/*	*/*	**3.9/3.9**	1.3/1.3
	(Interval)	(0.2–2.4)/ (0.2–2.4)	(0.2–3.0)/ (0.2–3.0)			**(1.4–10.7)/(1.4–10.7)**	(0.4–4.8)/ (0.4–4.8)
	Significance	0.537/0.537	0.677/0.677			**0.009/0.009**	0.654/0.654
Hitting							
Entire DSM IV/ DSM 5 ASD Group	OR	1.5/**1.8**	1.0/1.1	1.6/1.1	0.5/0.6	**2.6/4.0**	0.7/0.4
	(Interval)	(1.0–2.2)/**(1.1–2.8)**	(0.6–1.6)/ (0.6–1,8)	(0.6–3.9)/ (0.4–3.1)	(0.2–1.6)/ (0.2–1.8)	**(1.5–4.4)/(1.7–9.4)**	(0.4–1.4)/ (0.2–1.2)
	Significance	0.082/**0.016**	0.937/0.805	0.340/0.795	0.263/0.363	**<0.001/0.001**	0.314/0.129
DSM IV/DSM 5 ASD without ID	OR	**1.6/1.8**	1.1/1.3	1.5/0.6	0.5/0.6	**2.4/2.1**	0.7/0.6
	(Interval) Significance	**(1.0–2.6)/(1.1–2.9)**	(0.7–1.9)/ (0.7–2.2)	(0.5–4.1)/ (0.2–1.3)	(0.2–1.8)/ (0.2–1.3)	**(1.3–4.4)/(1.1–4.0)**	(0.3–1.4)/ (0.2–1.3)
		0.048/0.021	0.722/0.411	0.429/0.182	0.305/0.182	**0.003/0.028**	0.322/0.182
DSM IV/DSM 5 ASD with ID	OR	0.9/0.9	0.7/0.7	1.8/1.8	0.5/0.5	**3.6/3.6**	0.8/0.8
	(Interval)	(0.3–2.6)/ (0.3–2.6)	(0.2–2.2)/ (0.2–2.2)	(0.2–13.7)/ (0.2–13.7)	(0.1–5.4)/ (0.1–5.4)	**(1.1–11.3)/(1.1–11.3)**	(0.2–3.8)/ (0.2–3.8)
	Significance	0.887/0.887	0.536/0.536	0.570/0.570	0.603/0.603	**0.029/0.029**	0.774/0.774
Threatening							
Entire DSM IV/ DSM 5 ASD Group	OR	**1.9**/1.3	1.2/1.1	*/*	*/*	**4.2/3.0**	0.5/0.5
	(Interval)	**(1.2–3.0)**/ (0.8–2.1)	(0.7–1.9)/ (0.6–1.8)			**(1.9–9.2)/(1.8–5.1)**	(0.2–1.2)/ (0.2–1.0)
	Significance	**0.003**/0.219	0.579/0.795			**<0.001/<0.001**	0.130/0.061
DSM IV/DSM 5 ASD without ID	OR	**2.1/2.0**	1.3/1.2	*/*	*/*	**2.8/3.2**	0.3/0.3
	(Interval)	**(1.3–3.5)/(1.2–3.3)**	(0.7–2.2)/ (0.6–2.0)			**(1.0–7.8)/(1.2–9.0)**	(0.1–1.0)/ (0.1–1.2)
	Significance	**0.003/0.010**	0.406/0.631			**0.045/0.024**	0.058/0.088

Table 5 (continued)

Behavioral domain		Victimization only		Perpetration only		Victimization-perpetration	
		Crude OR	Adjusted OR[a]	Crude OR	Adjusted OR[a]	Crude OR	Adjusted OR[a]
DSM IV/DSM 5 ASD with ID	OR	1.2/1.2	0.7/0.7	*/*	*/*	**11.8/11.8**	1.4/1.4
	(Interval)	(0.5–3.4)/ (0.5–3.4)	(0.2–2.3)/ (0.2–2.3)			**(3.3–42.2)/(3.4– 42.2)**	(0.3–7.3)/ (0.3–7.3)
	Significance	0.670/0.670	0.616/0.616			**<0.001/<0.001**	0.670/0.670

OR odds ratios, *CI* confidence interval

*Cell size is too small to compute OR

[a]Adjusted OR were controlled for sex, age, school, and nine comorbid developmental psychopathologies

Table 6 Association between risk [odds ratio (OR)] for presence of victimization only, perpetration only, and victimization-perpetration only bullying experience and ASD

		Victimization only		Perpetration only		Victimization-perpetration	
		Crude OR	Adjusted OR[a]	Crude OR	Adjusted OR[a]	Crude OR	Adjusted OR[a]
Annoying							
Entire DSM IV/ DSM 5 ASD group	OR	1.3/**1.7**	1.2/1.2	0.7/0.7	**0.1/0.1**	**3.2/3.1**	**0.5/0.4**
	(Interval)	(0.9–2.0)/**(1.1– 2.7)**	(0.8–2.0)/ (0.7–2.0)	(0.2–2.1)/ (0.2–2.4)	**(0.0–0.5)/(0.0– 0.5)**	**(1.9–5.2)/(1.7– 4.8)**	**(0.2–0.9)/(0.2– 0.8)**
	Significance	0.188/**0.026**	0.385/0.414	0.500/0.624	**0.003/0.005**	**<0.001/0.011**	**0.030/0.009**
DSM IV/DSM 5 ASD without ID	OR	1.4/1.5	1.3/1.3	0.8/0.5	**0.1**/0.3	**3.7/3.1**	0.5/0.5
	(Interval)	(0.9–2.3)/ (0.9–2.4)	(0.8–2.1)/ (0.8–2.3)	(0.3–2.6)/ (0.2–1.1)	**(0.0–0.6)/** (0.1–1.2)	**(1.8–5.3)/(1.7– 5.5)**	(0.2–1.1)/ (0.2–1.1)
	Significance	0.131/0.117	0.362/0.311	0.737/0.100	**0.008**/0.088	**<0.001/<0.001**	0.082/0.100
DSM IV/DSM 5 ASD with ID	OR	0.9/0.9	1.1/1.1	*/*	*/*	**3.6/3.6**	0.3/0.3
	(Interval)	(0.3–2.6)/ (0.3–2.6)	(0.3–3.3)/ (0.3–3.3)			**(1.1–11.2)/(1.1– 11.2)**	(0.1–1.4)/ (0.1–1.4)
	Significance	0.888/0.888	0.915/0.915			**0.030/0.030**	0.123/0.123
Calling names							
Entire DSM IV/ DSM 5 ASD Group	OR	**1.7**/1.6	1.5/1.6	**0.3/0.3**	**0.1/0.1**	1.5/1.5	**0.4**/0.8
	(Interval)	**(1.0–2.6)/**(0.9–2.6)	(0.9–2.5)/ (0.9–2.5)	**(0.1–0.7)/(0.1– 0.8)**	**(0.0–0.6)/(0.0– 0.7)**	(1.0–2.4)/ (0.9–2.4)	**(0.2–0.8)/**(0.5– 1.4)
	Significance	**0.030**/0.098	0.105/0.098	**0.011/0.020**	**0.008/0.010**	0.071/0.110	**0.004**/0.443
DSM IV/DSM 5 ASD without ID	OR	**1.7/1.8**	1.5/1.6	**0.2**/0.5	**0.2**/0.5	1.4/1.5	**0.4/0.5**
	(Interval)	**(1.1–2.9)/(1.1– 3.0)**	(0.9–2.6)/ (0.9–2.8)	**(0.1–0.8)/**(0.2– 0.9)	**(0.0–0.7)/** (0.2–1.1)	(0.8–2.3)/ (0.9–2.6)	**(0.2–0.8)/(0.2– 0.9)**
	Significance	**0.027/0.027**	0.113/0.112	**0.018/0.019**	**0.018**/0.100	0.218/0.137	**0.005/0.019**
DSM IV/DSM 5 ASD with ID	OR	1.2/1.2	1.3/1.3	0.4/0.4	*/*	2.4/2.4	0.6/0.6
	(Interval)	(0.4–3.9)/ (0.4–3.9)	(0.4–4.5)/ (0.4–4.5)	(0.1–3.0)/ (0.1–3.0)		(0.8–6.6)/ (0.8–6.6)	(0.2–2.0)/ (0.2–2.0)
	Significance	0.709/0.709	0.631/0.631	0.377/0.377		0.104/0.104	0.386/0.386

Crude OR and OR adjusted for sex, age, school, and nine comorbid developmental psychopathologies were calculated. Comparison was done between general population with negative screening by ASSQ and (1) entire ASD group, and (2) subdivided ASD with ID and without ID (continued)

OR odds ratios, *CI* confidence interval

*Cell size is too small to compute OR

[a]Adjusted OR were controlled for sex, age, school, and nine comorbid developmental psychopathologies

Schroeder et al. 2014). Also, it is important to understand what characteristics of children with ASD are related to an increased risk for bullying (not just perpetrating behaviors), so as to implement effective strategies for prevention, assessment, and intervention (Lerner et al. 2012). And, finally, it seems that a child with only ASD, but without comorbid psychopathology, is unlikely to engage in significant perpetrating forms of bullying behaviors.

However, we also offer a few caveats: While caregiver reports are a relatively reliable method for identifying bullying experiences in children, especially in children with ASD (Adams et al. 2014), the use of multiple informants, including teachers and peers might be a more comprehensive way to identify bullying experiences in children with ASD and community children (Ladd 2002). Due to the limited number of BASC-2 PRS items assessing bullying behaviors, only one item was available for examining victimization (teased), whereas perpetrating behaviors were examined with multiple items. This is in line with many previous epidemiological studies that also used single item to measure victimization by bullying on various population (Bowes et al. 2009; Kaltiala-Heino et al. 1999; Frizzo et al. 2013; Wu et al. 2016; Case et al. 2016; Sutin et al. 2016), including children with ASD (Cappadocia et al. 2011; Zablotsky et al. 2013b).

Future research should address how children with ASD are affected by the types of victimization they experience. We only studied the population in regular elementary school children, so future studies should include middle and high school aged children and adolescents, as well as children and adolescents attending special education schools. This also applies to the need to focus on female population with ASD, who may have different pattern of bullying experience, when separated from males. Unfortunately, the small number of participants with DSM-5 SCD did not allow us to perform meaningful analyses for their bullying experience. Similarly, most of the observed findings in the main analyses stemmed from the comparison between ASD without ID and the community children, due to the small sample size of children with ASD and comorbid ID. Alternatively, it is plausible that individuals with ASD but without ID are more vulnerable to bullying because they are likely to be an environments that are more inclusive, making them "stand out" more among typically developing children (Maiano et al. 2016a). More data are needed to learn about the peer interactions in the newly identified population of SCD, as well as those with ASD and comorbid ID. While our study participation rates are acceptable for a large epidemiologic study, potential unmeasured characteristics of non-participants may alter the findings, as might a sample from a different study population. While we subdivided children with ASD by presence of ID, this was not possible for community children because cognitive function data were not available. Finally, psychopathology was measured by parental survey (BASC-2 PRS),

and clinical diagnoses were not provided, leaving potential for inaccurate classification of comorbid conditions.

In summary, children with ASD may have potentially more aggressive behavior than typical children due to various comorbidities (Kanne and Mazurek 2011; Montes and Halterman 2007; Zablotsky et al. 2013b). They are not usually the perpetrators of bullying with clear intent. In fact, our research findings indicate that children with ASD are more likely to be the *victims* of bullying and less likely to bully others when compared with typically developing children. To focus attention on children with ASD as perpetrators of bullying, in order to prevent school violence, appears to be a distraction from many other known risk factors for violence that can be more valuable targets of preventive intervention.

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