

The Effects of Psychological Trauma on Children with Autism Spectrum Disorders: a Research Review

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Received: 13 May 2015 / Accepted: 18 June 2015 / Published online: 9 July 2015
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Abstract Traumatic events such as abuse, bullying, and exposure to violence are commonplace among typically developing children and occur at least as often among those with autism spectrum disorder (ASD). Children with ASD are vulnerable to traumatization due to their deficits in social communication and emotion regulation. Research on posttraumatic symptoms among children with ASD is reviewed. Bullying has received much attention while there is a paucity of research on other types of trauma. Anxiety, social isolation, and developmental regression are associated with trauma. Further research is needed to clarify the symptom presentation and frequency of PTSD. Sensitive self-report measures are needed as well as validation of existing measures for assessing trauma in this population.

Keywords Autism spectrum disorder · Posttraumatic stress · Child maltreatment

Children with autism are exposed to traumatic events at least as often as their typically developing peers but the effects in this group are not well understood (Sullivan 2009; Turner et al. 2011). Child maltreatment and other potentially traumatic experiences of youth are a major national health problem and frequently cited priority for research and intervention (Fairbank 2008). Traumatic experiences include childhood maltreatment such as physical and sexual abuse, emotional abuse, and physical neglect. Other types of traumatic

experiences include death and separation from loved ones, witnessing domestic violence or other community violence, verbal and physical bullying by peers, exposure to natural and man-made disasters, and painful medical interventions, among others (National Child Traumatic Stress Network 2012).

A recent survey of child maltreatment such as physical abuse and neglect reported a trauma incidence rate of 9.1 per 1,000 children in the USA in 2013 (US Department of Health and Human Services Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau 2015). In a nationally representative study, 68 % percent of youth were found to have experienced a potentially traumatic event by the age of 16. Less than one half of 1 % of the children and youth were subsequently diagnosed with posttraumatic stress disorder (PTSD) but for those who experienced more than one traumatic event the rate of PTSD was nearly 50 %. Other trauma-related problems such as academic, emotional, and somatic difficulties were present in more than 20 % of the exposed children (Copeland et al. 2007).

Posttraumatic stress disorder is described in the DSM-5 as a syndrome arising from witnessing, directly experiencing, or being otherwise exposed to serious physical or sexual violence, threats to bodily integrity, or death of family members (American Psychiatric Association 2013). The central symptom pattern is as follows: (a) re-experiencing of traumatic thoughts or images through memories, dreams, or intrusive thoughts; (b) negative cognitive and mood states related to the trauma; and (c) alteration of physical arousal related to the trauma. Other types of adjustment difficulties, including impairment of relationships and attachment, avoidance of traumatic reminders, and behavior and emotional problems are labeled "trauma related symptoms" while they may not meet full criteria for PTSD (Goenjian et al. 1995; Perkonig

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et al. 2005). Trauma effects children differently at each stage of development and can interfere with the acquisition of developmental milestones (Lieberman et al. 2011; Trickett et al. 2011). Males and females are exposed to violence and abuse at about the same rate (US Department of Health and Human Services Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau 2015). However, there are gender differences in the expression of trauma-related symptoms. Males on average tend to display more externalizing behavior and females tend to display more internalizing behavior with heightened susceptibility to PTSD especially following sexual abuse (Darves-Bornoz et al. 1998; Evans et al. 2008; Walker et al. 2004). Broad and long-lasting negative health effects have been found in those exposed to trauma in childhood (Felitti et al. 1998).

Given the high percentage of traumatic exposures among youth, it is likely that a significant proportion of those with autism spectrum disorder (ASD) have been exposed to trauma with resulting mental health symptoms. Several factors may set them up for traumatization. They are more socially isolated, less accepted and liked by peers, and more often excluded and ridiculed (Carter 2009; Rotheram-Fuller et al. 2010). Children with ASD lack the social support networks that have been shown to protect or buffer children from the effects of peer bullying (Bauminger and Kasari 2000; Estell et al. 2009). Children with ASD have been shown to become more angry and upset in response to bullying than typically developing children, which could lead to more targeted aggression directed toward them (Rieffe et al. 2012). Language delays may get in the way of reporting abuse or expressing reactions to trauma (Cook et al. 1993). Verbal expression and processing form a key part of most therapies for trauma in children but may be difficult or impossible for children with autism (Howlin and Clements 1995). Perhaps because of these developmental vulnerabilities they show high rates of co-morbid anxiety and other emotional and behavioral problems (Konst and Matson 2014; Vasa et al. 2014). They may therefore be expected to have more severe emotional reactions to traumatic events.

As with childhood trauma, ASD is being increasingly diagnosed, a trend that gained momentum with the labeling of a wider range of symptoms as pertaining to autism in the DSM-IV (American Psychiatric Association 1994). Recent CDC estimates in the USA indicate a prevalence rate of 1 in 68 children being identified with ASD in 2010 based on national survey data, whereas similar surveillance methods identified a rate of 1 in 150 children in 2002 (Centers for Disease Control and Prevention 2014). Estimates vary based on method of assessment, country or region studied, and definition of ASD but have shown a general trend of increasing prevalence that may be starting to level off (Tsai 2014). The increased prevalence rate is most likely due to changes in diagnostic criteria but may also reflect genetic and/or environmental

factors (Simonoff 2012). ASDs are characterized by pervasive developmental deficits in social communication and interaction as well as rigid, repetitive patterns of behavior, interests, or activities. The DSM-5 groups those diagnosed into three severity levels based on functional behavior. At the lower-functioning end of the spectrum are those who require “very substantial support” due to severe deficits in verbal and non-verbal communication and often display markedly impairing rigidity and repetitive behavior. At the higher-functioning end are individuals who show difficulty initiating and maintaining successful social contact, may be quite inflexible in behavior and routines, and have difficulty organizing and transitioning between activities (American Psychiatric Association 2013).

Outside of the growing literature on bullying which comprises the majority of studies of potential trauma in children with ASD, there is little clear information about the rate or effects of traumatization in this population. The purposes of this article are to review the literature regarding the types of traumatic exposure and symptoms occurring in children with ASD, address measurement problems arising in the assessment of this population, and to make recommendations for further investigation efforts.

Trauma in Children with ASD

For the purposes of this review, Psychinfo and PubMed were searched using the following autism related keywords: *autism*, *Asperger*, *PDD*, and *PDD-NOS* in combination with trauma-related keywords: *posttraumatic/post-traumatic*, *PTSD*, *child abuse*, *child neglect*, *interpersonal violence*, *child maltreatment*, *domestic violence*, *peer victimization*, and *bullying*. Reference lists in the identified articles were also searched for relevant articles.

Articles were selected for review if they were: (a) empirical research published in a peer-reviewed journal of any date up to the current issue; (b) non-dissertation; (c) reported in English; (d) clearly identified ASD in children and youth; and (e) reported a quantifiable assessment of PTSD or specified emotional, behavioral, and/or functional problems associated with potentially traumatic experiences. Case studies, purely theoretical, position, or clinical papers without quantitative data were excluded from this research review.

There is a clear divide in the literature between studies of bullying (used interchangeably here with *peer victimization*) and studies of child trauma, abuse, and other maltreatment. This distinction was followed in presenting articles for this review. Twenty-two studies of bullying were found that met criteria A–D above. Of these, 11 also met criterion E by reporting measured emotional, behavioral, or functional outcomes of bullying, the central purpose of the review. These 11 were selected for inclusion. Of the 10 bullying studies that did

not meet criterion E, most focused on predictors of bullying rather than outcomes.

The literature search revealed eight studies of non-bullying child trauma in children with ASD that met criteria A–C above. Two of these studies were excluded from formal review as they did not adequately identify autism as separate from other developmental disabilities and did not report on emotional or behavioral outcomes of trauma. Given the relative paucity of studies and wide differences in methodology, no quantitative analysis of reviewed articles was attempted.

Peer Victimization

Peer victimization/bullying studies account for the majority of empirical articles about potential traumatization of children with ASD. Two recent reviews summarize much of the available research on incidence, causal and contributory factors, and recommendations for prevention and intervention practices (Schroeder et al. 2014; Sreckovic et al. 2014).

Prevalence estimates vary depending on time frames and reporters but by all reports, children with ASD are bullied more often than peers with other disabilities and more often than non-disabled peers (Sreckovic et al. 2014), those with intellectual disabilities alone (Zeedyk et al. 2014), and their typically developing siblings (Nowell et al. 2014). One estimate summarizing data from a variety of studies (Storch et al. 2012) indicates that broad-scale parent and children surveys report 44–77 % of ASD children being bullied within a 1-month period, as compared to a rate of 2–17 % in self-report surveys of typically developing children (van Roekel et al. 2010). Another estimate based on a large parent survey suggests that as many as 94 % of children with ASDs and non-verbal learning disorders are bullied at some point in the past year as rated by mothers (Little 2002).

As trauma symptoms are the central focus of this review, the studies summarized in Table 1 specifically assessed functional and mental health impacts of bullying.

The following comprises a review of the studies listed in Table 1. Cappadocia et al. (2012) conducted a survey of 192 parents of children diagnosed with ASD, contacted through autism support websites and snowball sampling. Types of victimization included physical, social, verbal, and cyber-bullying. Sixty-seven percent of the sample reported that their child had experienced physical, social, verbal, and/or cyber-bullying in the previous month. Of that group, 46 % were reported to have experienced frequent peer victimization one time per week or more. Sixty-eight percent experienced more than one type of bullying. Social ostracism and verbal teasing were the most frequently reported types. Parent report measures were used to assess for mental health problems among the subjects. Higher levels of victimization, i.e., one or more episodes per week, were associated with relatively more emotional and behavioral concerns than lower levels of

victimization. There was a greater tendency for anxiety, hyper-sensitivity, self-injury, stereotypes, and hyperactivity in children who experienced the most frequent victimization.

In a sociometric study conducted among school children in northern UK, students were asked to rate their classmates on a continuum from most to least liked (Symes and Humphrey 2010). Reports of bullying frequency, perceived social standing, and social support were obtained from students with and without ASD diagnosis. Along with being more often bullied than the comparison groups of children with dyslexia and those without special education needs, youth with ASD reported more feelings of isolation and lack of peer support (Symes and Humphrey 2010). Similarly, Twyman et al. (2010) obtained ratings from ASD-identified youth with victimization histories, suggesting increased feelings of being left out and ostracized.

Bitsika and Sharpley (2014) administered a semi-structured interview to boys with ASD and their parents, asking about frequency and types of bullying experiences as well as the children's responses to the bullying. Eighty-one percent of the children said that they had been bullied (83 % of parents), with daily bullying being reported by 41.7 % of the children (39.6 % of parents). The boys most frequently reported experiencing the following types of bullying: "Make mean jokes and laugh at me;" "Call me mean names and swear at me;" "Being hit, pushed, or kicked;" and "Have ganged up on me." They reported having both emotional and physiological reactions including "Angry," "Sad," "Lonely," "Nervous," "Stomach Butterflies," and "Headaches."

Rieffe et al. (2012) found that adolescents with ASD experienced and expressed more anger when bullied than typically developing peers who were bullied. The authors suggest that this is consistent with the emotional reactivity and upset commonly observed in children with ASD that in turn may lead to more bullying (Sofronoff et al. 2007; Volker et al. 2010). Storch et al. (2012) showed that bullied children with ASD and their parents reported that they had symptoms consistent with panic disorder, major depression, loneliness, and social anxiety.

As part of a large survey of parents reporting that their child had a "current ASD diagnosis from a medical professional," Zablotsky et al. (2013, p. 2) administered a questionnaire to parents regarding their children's victimization experiences. Results of the survey confirmed the high rate of bullying reported elsewhere by children with ASD (Cappadocia et al. 2012). The children were reported to have internalizing symptoms connected with the bullying, including increased nervousness, fearfulness, and anxiety. Comparisons were made between children with ASD who bullied others, those who were victims, and those who were both victims and bullied others. The latter group was most likely to have co-morbid disruptive behavior and diagnoses including attention-deficit/hyperactivity disorder, conduct disorder, and oppositional

Table 1 Summary of research studies examining youth with autism spectrum disorders and effects of peer victimization

Author (year)	Age range (mean)	Number	ASD subtypes	Post-bullying symptoms	Symptom measures
Adams et al. (2014)	10.39–17.99 (14.62)	54	Asperger PDD-NOS Autism	Internalizing symptoms	Self-/Parent Report of Peer Victimization (Schwartz et al. 2002); CBCL Internalizing Problems Scale Youth Self-Report/Parent Report (Achenbach 2001); Children's Depression Inventory ^a (Kovacs 1992); Social Responsiveness Scale ^a (Constantino and Gruber 2005); Repetitive Behavior Scale-Revised ^b (Bodfish et al. 2000). Authors' semi-structured interview of five topic areas: (1) friendships and social interactions at school, (2) recognition of specific bullying behavior, (3) strategies for reporting bullying, (4) responses to being bullied, (5) emotional and physiological impacts of being bullied ^a
Bitsika and Sharpley (2014)	7–12 (9.9)	48	ASD, Asperger, PDD-NOS	"Angry," "Sad," "Lonely," anxiety, somatic complaints	Kessler 6-Item Psychological Distress Scale ^b (Kessler et al. 2003); Nisonger Child Behavior Rating Form ^b (Aman et al. 1996)
Cappadocia et al. (2012)	5–21 (11.71)	192	Asperger PDD-NOS Autism	Increased anxiety, hyperactivity, self-injury, stereotypies, sensitivities	Pediatric Behavior Scale ^b (Lindgren and Koeppl 1987)
Mayes et al. (2013)	1–16 (6.6)	791	High Functioning, Low Functioning Autism	Suicide ideation or attempts	Chart review, diagnoses, suicide attempts/ideation history
Mikami et al. (2009)	14–19 (17.1)	12	Autism Spectrum PDD-NOS	Suicide attempts/ideation	The Bully/Victim Questionnaire ^a (Olweus 1997); The Mood Questionnaire ^a (Rieffe et al. 2004); Maladaptive and Adaptive Scales ^a (Ferguson et al. 2000)
Rieffe et al. (2012)	9.4–14.75 (11.75)	64	High functioning ASD	Significant anger	Social Experience Questionnaire ^a (Crick and Grotpeter 1996); Patient Health Questionnaire for Adolescents ^a (Johnson et al. 2002); Suicidal Ideation Questionnaire ^a (Reynolds 1991).
Shayemman (2007)	(19.7)	10	ASD	Suicidal ideation	Revised Peer Experiences Questionnaire ^a (Prinstein et al. 2001); Asher Loneliness Scale ^a (Asher et al. 1984); Child Behavior Checklist ^b (Achenbach 1994); Columbia Impairment Scale ^b (Bird et al. 1993); Revised Children's Anxiety and Depression Scale ^b (Chorpita et al. 2005); Social Responsiveness Scale ^b (Constantino and Gruber 2005)
Storch et al. (2012)	11–14 (12.2)	60	Asperger, PDD-NOS, Autism	Reputational victimization; loneliness; panic disorder symptoms; major depressive symptoms; generalized anxiety disorder symptoms	Social Inclusion Survey ^a (Fredrickson and Furham 1998); My Life in School Checklist ^a (Arora and Thompson 1987); Social Support Scale for Children ^a (Harter 1985)
Symes and Humphrey (2010)	(13.75)	40	Not reported	Isolation, lower levels of social support	Reynolds Bully-Victimization Scale ^a (Reynolds 2003); Bully and Ostracism Student Screen ^a (Twyman et al. 2010)
Twyman et al. (2010)	8–17 (11.0)	32	Not reported	Social ostracism	Bullying and School Experiences of Children with ASD Survey ^b (Zablotsky et al. 2013)
Zablotsky et al. (2013)	(10.57)	1221	Asperger, Other ASD Autism	Internalizing symptoms, i.e., nervous, withdrawn, sad, fearful; bullying behavior	

^a Self-report^b Parent-report

defiant disorder. They were found to show higher rates of impulsivity and emotional regulation problems. Children who were victimized most frequently displayed the most nervousness, withdrawal, sadness, and fearfulness.

Several studies have examined the effects of bullying on suicide attempts and ideation in children who have ASD, following from the literature on suicide and bullying in samples of typically developing children (Borowsky et al. 2013; Litwiller and Brausch 2013; Pan and Spittal 2013). Mayes et al. (2013) found that while mood dysregulation and depression were the strongest co-morbid predictors of suicidality, youth who were teased were three times more likely than non-teased youth with ASD to report suicidal ideation or to make an attempt. In a small retrospective study of psychiatrically hospitalized children in Japan, Mikami et al. (2009) identified a group of youth diagnosed with ASD who had attempted suicide. These authors found in their review of demographics and risk factors, that in 9 of the 12 youth, self-reported bullying and interpersonal conflict were the primary precipitating factors of suicide attempts. Shtayermman (2007) also found in a small group of adolescents and young adults, that self-reported peer victimization was strongly correlated suicidal ideation.

Perceptions of Bullying Given their unique styles of processing social information, one might ask how accurately children with ASD perceive or recognize bullying and other traumatic situations. Some researchers have called into question their ability to pick up on the socially inappropriate behavior of others, especially in complex interpersonal situations. For example, Rieffe et al. (2012) suggested that children with ASD may not be so much affected by negative relational messages from their peers but that their style of social disconnection impedes full recognition of the implications of such messages. In their sample, levels of overt reputational and relational victimization effects were not beyond what is found among typically developing children.

In one study, scenes of verbal and non-verbal interactions were video recorded and youth with and without ASD were asked to rate the scenes for social appropriateness (Loveland et al. 2001). While the ASD and non-ASD groups were equally able to identify inappropriate behavior (e.g., hitting someone, destroying property) from the scenarios, youth diagnosed with ASD missed more verbal inappropriateness (e.g., insults, talking loudly in a quiet environment) than typically developing youth did. When asked to explain their answers, developmentally typical youth relied on social norms while their counterparts with ASD showed fewer reasonable explanations for their answers.

Similarly, van Roekel et al. (2010) demonstrated that teens with higher-functioning ASD were just as accurate in identifying bullying from videotaped scenarios as typical peers, but

more prone to false positives when they had been extensively bullied. Their accuracy in defining bullying also depended on their level of Theory of Mind (TOM; Baron-Cohen 2000). Those with less well-developed TOM gave more false negatives. Teachers in this special education setting reported more bullying than peers or the target youth themselves reported.

Adams et al. (2014) found that parents reported greater frequency of bullying than their teens with ASD but teens' self-reports of victimization were closely associated with the youths' internalizing symptoms. Parent reports of their children's bullying experiences were associated with internalizing symptoms only in the case of physical victimization. This study highlights the importance of self-report information as a unique contribution to assessment that captures the experience in ways that are lacking in parent reports alone.

Shtayermman (2007) demonstrated in a self-report study, that children and teens with ASD reported more victimization at higher-functioning levels than at lower-functioning levels. Rowley et al. (2012) reported similar results. Children with higher-functioning ASD both reported more depth of relationships and more bullying. These authors concluded that children with ASD may be more attuned to social rejection and victimization because they are higher functioning and because they are more likely to socialize often in groups of peers without ASD.

Overall, it appears that higher-functioning youth with ASD are quite sensitive to bullying and are generally cognitively capable of discriminating between social victimization and non-bullying. It is possible that they report being bullied to a greater extent because they are more attuned to it than lower-functioning youth. Less is known about the perceptions and reactions of lower-functioning youth on the autism spectrum, when they are bullied. The quality of perception in target youth can be a powerful factor as it determines whether the target child suffers negative effects, and may lead to over-reaction (Rieffe et al. 2012), bullying behavior by the victim (Cappadocia et al. 2012), and possible over-identification (van Roekel et al. 2010) of being teased when in interactions with other youth.

Abuse, Neglect, and Other Traumatic Events

Studies of potentially traumatic experiences other than bullying are summarized in Table 2.

Bleil Walters et al. (2013) examined a group of youth adjudicated with sexual offenses residing in a state-operated sexual offender residential program. Of the 43 youth studied, 27 were identified as having an autism spectrum disorder. The authors found only minor differences between youth with and without ASD in terms of the severity or frequency of abuse and neglect. However, youth with ASD in this sample scored higher than their typically developing peers on a measure of depressive symptoms. Unlike other sub-groups in this sample,

Table 2 Summary of studies examining autism spectrum disorders and trauma-related symptoms (non-peer victimization)

Authors (year)	Age (years)	Number	ASD subtypes	Co-morbid symptoms	Types of trauma	Setting	Trauma/diagnostic measures
Bleil Walters et al. 2013	11–20	27	ASD	Depression	Physical, sexual, emotional abuse; physical neglect	State sex offender program	Childhood Trauma Questionnaire ^a (Bernstein and Fink 1997); Beck Depression Inventory, 2nd Edition ^a (Beck et al. 1996)
De Bruin et al. (2007)	6–12	94	Asperger PDD-NOS Autism	PTSD	Not reported	Outpatient psychiatry, Netherlands	DISC-IV Parent Report ^b (Ferdinand and van der Ende 1998)
Mandell et al. (2005)	8.3 (ave.)	125	Asperger Autism	Not reported	Physical, sexual abuse; domestic violence	Community mental health centers	Not reported
Mehtar and Mukaddes (2011)	6–18	20	Asperger PDD-NOS Autism	PTSD	Accidents, violence, sexual abuse, multiple trauma	Outpatient psychiatry, Turkey	K-SADS-PL PTSD Scale ^b (Kaufman et al. 1997); Aberrant Behavior Checklist ^c (Aman et al. 1985); Trauma Symptoms Investigation Form in Autism Spectrum Disorders ^c (Mehtar and Mukaddes 2011)
Storch et al. (2013)	7–16	6	Asperger PDD-NOS Autism	PTSD, Suicidal thoughts	Not reported	Anxiety treatment study group	ADIS-IV Child/Parent (Silverman and Albano 1996); CBCL Parent/Youth Self-Report (Achenbach 1994); Multidimensional Anxiety Scale for Children -Parent Form (March 1998); Columbia Impairment Scale ^b (Bird et al. 1996)
Valenti et al. (2012)	Children, adolescents	50	ASD	Not assessed	Earthquake	Semi-residential rehabilitation centers, Italy	Vineland Adaptive Behavior Scales ^b (Sparrow et al. 2008)

^a Self-report^b Parent-report^c Clinician/research-rated scale

a strong positive association was found in the ASD group between severity of abuse and level of depression, suggesting that the youth with ASD showed increased sensitivity to traumatic events.

Several studies tracked the incidence of various traumatic experiences and their psychological effects. Valenti et al. (2012) compared students with ASD in a semi-residential Italian training school before and after a 2009 earthquake. Children and adolescents (defined as medically post-puberty) who directly experienced the earthquake showed significant declines in the Communication, Daily Living, Socialization, and Motor Skills scores on the Vineland Adaptive Behavior Scales (VABS; Sparrow et al. 2005; Sparrow et al. 2008) at 6 and 12 month intervals following the earthquake. Students at the same age levels at institutions outside of the earthquake zone did not show VABS declines during the same time period.

A study that focused on suicidal thoughts and actions in a sample of youth with ASD and co-morbid anxiety disorders

identified six subjects with co-occurring ASD and PTSD (Storch et al. 2013). These youth showed increased propensity for suicidal thoughts over those without PTSD. This is similar to research previously cited on youth with ASD who have been bullied with subsequent suicidal thoughts and actions (Mayes et al. 2013; Mikami et al. 2009).

In a Dutch study that looked at the prevalence of co-morbid diagnoses among children with ASD, none of the sample of 94 children ages 6 to 12 who met research criteria for pervasive developmental disorder, not otherwise specified (PDD-NOS) were identified as having PTSD (de Bruin et al. 2007).

These findings stand in marked contrast to the results of a Turkish study conducted in a children's autism clinic (Mehtar and Mukaddes 2011). In this study, 18 of the participating sample of 69 patients with ASD were reported to have been exposed to significant traumatic experiences. Twelve of these patients (69 %) were judged to meet DSM-IV criteria for PTSD. Of the three patients exposed to multiple traumas (i.e., combinations of physical violence, accidents, sexual

abuse), all met criteria for diagnosis with PTSD. In addition to having PTSD features of re-experiencing, hyper-arousal, and avoidance, the traumatized patients in this study showed a higher frequency of disruptive behaviors than those patients who did not have notable PTSD symptoms, as measured by the Aberrant Behavior Checklist—Turkish Version (Aman et al. 1985). They also showed deterioration in their social functioning including verbal and non-verbal communication and imitation as well as increased motor mannerisms and increased stereotypical interests.

While in the Mehtar and Mukaddes (2011) sample, the rate of exposure to potentially traumatizing events (26 %) was less than is usually reported in typically developing samples (Fairbank 2008), the proportion of individuals diagnosable with trauma-related symptoms was considerably higher than the 20 % range usually reported in the trauma literature (e.g., Copeland et al. 2007); as high as 100 % among those who were multiply traumatized. The authors conclude that children with ASD may be more sensitive to the effects of traumatizing situations than other groups.

Overall, these 17 studies of peer- and non-peer related victimization constitute the entire existing empirical base for understanding the effects of trauma on children with ASD. The list is even shorter if one includes only studies that measured the full PTSD syndrome including exposure, re-experiencing, alterations in cognition and mood, and arousal (de Bruin et al. 2007; Mehtar and Mukaddes 2011; Storch et al. 2013). Despite the limitations of the aforementioned studies, including inconsistently reported and sometimes inadequate identification of ASD (Cappadocia et al. 2012; Mikami et al. 2009; Shtayermman 2007; Symes and Humphrey 2010), small sample sizes (Storch et al. 2013), and no agreed-upon means for assessing trauma in the children, there is enough early information to suggest that many children with ASD exposed to trauma develop symptoms of post-traumatic stress.

Assessment of Trauma in ASD Children

If the goal is to ascertain whether children exposed to trauma develop post-traumatic or related symptoms, measurement becomes a key issue. Several central factors must be taken into account including: (a) raters as sources of information; (b) the sensitivity and specificity of measures for children with ASD, and (c) the content validity or coverage of the intended dimensions being measured.

Sources of Information—Who Are the Best Reporters?

Due to their core deficits in communication, emotional understanding, and expression, children with ASD are often poor reporters of their own psychological symptoms and under-report problems on symptom rating scales (Mazefsky et al. 2011; White et al. 2012). Clinicians have come to rely on the reports of parents or other observers

for this purpose (Mahan and Matson 2011). The assessment literature provides much evidence that even parents of typically developing, emotionally expressive children often rate them much differently than children rate themselves on a variety of measures (Renk and Phares 2004). In order to satisfy the reasonable suggestion that children be evaluated by multiple observers using multiple techniques (Achenbach et al. 1987), a reliable self-report format is needed to assess the child's experience. The self-reports of children and adolescents have been shown to add significantly to the diagnostic picture in ways that are unique and not accounted for by observer reports (Becker et al. 2004). For example, Adams et al. (2014) found that internalizing symptoms in children with ASD who had been bullied were highly correlated with the children's self-reports of victimization and largely uncorrelated with parent reports of victimization.

Psychometric Properties of Co-morbid Symptom Measures While it appears that children with ASD have relatively high rates of co-morbid behavioral and emotional symptoms (Mannion and Leader 2013), appropriately validated assessment instruments are lacking (Konst and Matson 2014). A few instruments have been developed for co-morbid diagnosis in ASD, which have shown acceptable psychometric qualities, but none of these directly assess trauma symptoms (Matson et al. 2009).

One solution is to evaluate the application of symptom measures developed for non-ASD groups. Mazefsky et al. (2011) assessed the validity of several commonly used self-report rating scales including the Revised Child Manifest Anxiety Scale (RCMAS; Reynolds and Richmond 1985), the Children's Depression Inventory—Short Scale (CDI—S; Craighead et al. 1998; Kovacs 1992), and the Conners-Wells Adolescent Self-Report Scale—Short Edition (CASS—S; Conners 1997; Conners et al. 1997). All of these measures have been found to have significant clinical utility with typically developing children. However, when administered to children with ASD, high false negative and false positive rates resulted. The authors recommend caution in using these self-report measures for children with ASD.

Another well-validated and widely used measure, the Behavioral Assessment System for Children—2nd Edition (BASC-2; Reynolds and Kamphaus 2004) has been shown to produce characteristically different pattern types when applied to children on the autism spectrum (Goldin et al. 2014; Mahan and Matson 2011). These differences likely reflect and are sensitive to the unique behavioral tendencies of the population but must be interpreted with these differences in mind.

All of these measures are likely sensitive to trauma-associated anxiety, mood, and behavior difficulties, but they are not specific to PTSD assessment.

Content Assessment—Trauma Perhaps the most researched and reliable measure for assessing PTSD in a population of children with ASD at this point is the Anxiety Disorders Interview Schedule—Parent and Child Report (ADIS-IV—C/P; Silverman et al. 2008). The measure has shown very strong inter-rater reliability for the PTSD subscale for use with children on the autism spectrum (Ung et al. 2014). The ADIS-IV has been used widely for assessing co-morbid anxiety disorders (Chalfant et al. 2007; Reaven et al. 2012; Storch et al. 2013). The ADIS-IV has also demonstrated validity and reliability for assessing treatment changes in non-pharmacotherapy intervention studies of anxiety with children who have been diagnosed with ASD (White et al. 2013). It has the benefit of having both parent and child report scales, allowing comparisons between different reporters on the same instrument.

However, while the ADIS-IV has shown sound psychometric properties overall, it has been employed in only one study of traumatized children with ASD (Storch et al. 2013). In another study, only one subject was identified who met PTSD criteria on the scale (White et al. 2013).

Another promising avenue is assessment of functional and adaptive competencies in association with trauma. Mehtar and Mukaddes (2011) found trauma-related declines in appetite and eating, self-care abilities, and regression in social interactions using their own *Trauma Symptoms Investigation Form*.

In their study of children with ASD exposed to a natural disaster, Valenti et al. (2012) employed the Vineland Adaptive Behavior Scales (Sparrow et al. 2005; 2008) to assess functional changes on the Communication, Daily Living, Socialization, and Motor Skills domains at 6 months and 1 year following the earthquake. They found 30 % average decreases in Vineland scores in the first months after the trauma across all domains studied, and a 15 % decline compared to baseline one year following the trauma. The comparison ASD group unexposed to the traumatic event showed no such declines in adaptive behavior.

Discussion

This review has attempted to summarize the existing research about childhood trauma and its implications for children with ASD. Several trends are suggested. First, the research on PTSD in autism is in its infancy but studies of bullying constitute a major initial thrust of inquiry. It does seem clear from the existing bullying literature that children with ASD are sensitive to peer victimization and suffer deleterious effects much as has been found in typically developing children (Borowsky et al. 2013; Reijntjes et al. 2010). They report social concerns such as ostracism and loneliness (Storch et al. 2012; Symes and Humphrey

2010; Twyman et al. 2010) as well as a host of internalizing problems (Adams et al. 2014; Cappadocia et al. 2012; Zablotsky et al. 2013) and suicidality as a direct result of being teased and bullied (Mayes et al. 2013; Mikami et al. 2009; Shtayermman 2007). This is especially concerning as there is evidence to suggest that children and youth with ASD are bullied even more often than their peers without ASD (Cappadocia et al. 2012). As most of these individuals show internalizing emotional symptoms in response to bullying and are not necessarily good at verbally or non-verbally expressing emotion, their distress may be missed by teachers and caregivers (Adams et al. 2014). These findings are potentially beneficial for informing intervention and policy in schools and communities (Schroeder et al. 2014).

Posttraumatic stress as a co-morbid symptom pattern in autism needs more study, much as do other co-morbid conditions (Konst and Matson 2014; Mannion and Leader 2013). It remains unclear whether children with ASD exhibit classical features of PTSD in the same or similar manner shown by their typically developing peers. The studies presented here provide initial evidence that these children experience mental health symptoms in response to potentially traumatic events such as various kinds of abuse (Bleil Walters et al. 2013; Mandell et al. 2005; Mehtar and Mukaddes 2011) and natural disasters (Valenti et al. 2012). They show resulting symptoms including anxiety, regression in adaptive behavior, increased behavior problems (Mehtar and Mukaddes 2011), in some cases suicidal ideation (Storch et al. 2013).

However, it is not known whether children with ASD experience the characteristic PTSD syndrome of re-experiencing, arousal, avoidance, and trauma-related alteration in cognition and mood (American Psychiatric Association 2013). Results have varied when structured interviews are employed using DSM criteria to identify PTSD in children with ASD. These have ranged from a lack of PTSD-diagnosed cases in one study (de Bruin et al. 2007) to a larger proportion than the typical population in another study (Mehtar and Mukaddes 2011). Of the available studies, only Mehtar and Mukaddes (2011) reported data on individual PTSD symptom endorsement. It is recommended that future studies closely track and report on symptom patterns present in children with ASD following traumatic events.

In order to address diagnostic and other questions, more accurate assessment of trauma reactions in ASD will be necessary. Communication differences, difficulty expressing emotion and responding in a straightforward manner to standard rating scales and measures complicate the task of assessment even for children with higher-functioning autism (Mazefsky et al. 2011). To further complicate matters, children with ASDs show wide variations in verbal and conceptual abilities ranging from those who are non-verbal with significant intellectual disability, to those with sophisticated language and processing skills. Executive functions including

planning and flexibility are often delayed in ASD and vary with age and intellectual function (Happé et al. 2006; Robinson et al. 2009). Regular achievement of developmental milestones can be disrupted or delayed by challenging behaviors, repetitive behavior and preoccupations, intellectual impairment, and weaknesses in executive functions (Matson et al. 2011). Also, as with typically developing children, those with ASD will likely manifest trauma symptoms differently at different ages (National Child Traumatic Stress Network 2012; Trickett et al. 2011).

Gender may also play a role in the expression of both ASD and PTSD symptoms. Overall, there is a 4:1 ratio of ASD diagnosis in boys as compared to girls. However, on the higher end of the spectrum, this discrepancy changes to 10:1 males vs. females, with a 2:1 ratio of males to females at lower-functioning levels (Fombonne 2009). While males and females with moderate to severe intellectual disabilities tend to show similar symptom patterns, diagnosis can be more difficult in higher-functioning females. It may be that females show relatively better developed social communication and emotional expression than males (Dworzynski et al. 2012). Given this difference, it has been suggested that gender bias exists in the diagnosis of higher-functioning females, essentially denying them of needed services based on assessment techniques developed mainly for boys (Constantino and Charman 2012). It has been noted that males and females, while experiencing trauma at essentially similar rates, may show different patterns of symptom expression (Darves-Bornoz et al. 1998; Evans et al. 2008; Walker et al. 2004).

Sensitive assessment tools must take into account these differences in age, gender, and developmental level. Further, given findings suggesting that self-report data provide a unique and important source of assessment data (Adams et al. 2014; Becker et al. 2004), more work needs to be done to develop valid instruments that incorporate self-report data from children with ASD (Mazefsky et al. 2011). This may be a relatively straightforward task for verbal children with normal intellectual functioning but more difficult with non-verbal or lower-functioning children. Suitable measures will need to be sensitive to symptoms and changes, specific to trauma, understandable, and psychologically accessible to children on the autism spectrum.

Particularly lacking are well-validated self-report measures that can capture these children's unique experience and reactions to trauma. Such measures would optimally be appealing, engaging, able to hold children's attention, and present material through more than one modality (e.g., visual, auditory, touch) to allow accessibility by individuals at different functional levels. Electronic devices such as tablets may provide a format for this kind of appeal and flexibility. Treatment providers and educators have increasingly turned to electronic platforms including iPads®, iPods® and other similar devices to present material to children with ASD (Neely et al. 2013). Some of these programs have been shown to effectively engage children with ASD

in treatment or learning activities in ways that may be more difficult otherwise (Kagohara et al. 2013). There are indications that children attend better to electronic, screen-based devices than to traditional means of teaching or presentation (van der Meer et al. 2012). Use of electronic devices has potential limitations, however. Devices themselves are prone to breaking and becoming obsolete, and the programming can be expensive. Also, the wide range of functioning in children with ASDs would likely require more than one program to meet the needs of users at different ages and verbal abilities.

A tablet-based trauma assessment instrument may adapt already existing rating scales or take the form of games or other interactive activities. One example is the Kid Trauma® (Markus Landolt, University Children's Hospital Zurich) assessment available as an Apple iOS application or through www.kidtrauma.com. It provides a self-report questionnaire for children over 6 and a parent questionnaire for younger children in a standard rating scale format. The software includes brief information about childhood trauma and links for obtaining treatment services.

A standard of care in assessing trauma in typically developing children is to combine validated structured interviews such as the Diagnostic Infant and Preschool Assessment (DIPA; Scheeringa and Haslett 2010), K-SADS (Kaufman et al. 1997) or other similar instruments with parent- and self-report rating scales. The UCLA PTSD Reaction Index (Pynoos and Steinberg 2013) and the Trauma Symptom Checklist (Briere 1996) are examples of frequently used and validated trauma measures that give a well-rounded, multi-informant view of both traumatic events and their effects. These measures and others should be tested with children on the autism spectrum to determine their psychometric properties and to determine whether they can be of help for initial assessment and ongoing treatment and research.

An understanding of the unique effects of trauma on children with ASD, combined with valid and reliable assessment tools should contribute much to developing effective treatment strategies. Accommodations to standard therapy approaches are often required to treat children and youth with ASD and co-morbid anxiety disorders (Scarpa et al. 2013). Some recommendations have been made to adjust evidence-based practices for trauma treatment for children with ASD (Grosso 2012) but this endeavor is in its infancy. More information about trauma and its evaluation in children with ASD can guide clinicians in their choice of approaches and assessment of outcomes.

Compliance with Ethical Standards The author declares that he has no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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