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Association of autistic traits in adulthood with childhood abuse, interpersonal victimization, and posttraumatic stress

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Abstract

Persons with autistic traits may be at elevated risk for interpersonal victimization across the life course. Children with high levels of autistic traits may be targeted for abuse, and deficits in social awareness may increase risk of interpersonal victimization. Additionally, persons with autistic traits may be at elevated risk of posttraumatic stress disorder (PTSD) symptoms subsequent to trauma. We examined retrospectively reported prevalence of childhood abuse, trauma victimization and PTSD symptoms by autistic traits among adult women in a population-based longitudinal cohort, the Nurses' Health Study II (N=1077). Autistic traits were measured by the 65-item Social Responsiveness Scale. We estimated odds ratios (OR) for childhood sexual and physical/emotional abuse and PTSD symptoms by quintiles of autistic traits. We examined possible mediation of PTSD risk by abuse and trauma type. Women in the highest versus lowest quintile of autistic traits were more likely to have been sexually abused (40.1% versus 26.7%), physically/emotionally abused (23.9% versus 14.3%), mugged (17.1% versus 10.1%), pressured into sexual contact (25.4% versus 15.6%) and have high PTSD symptoms (10.7% versus 4.5%). Odds of PTSD were elevated in women in the top three quintiles of autistic traits compared with the reference group (OR range=1.4 to 1.9). Childhood abuse exposure partly accounted for elevated risk of PTSD in women with autistic traits. We identify for the first time an association between autistic traits, childhood abuse, trauma victimization, and PTSD. Levels of autistic traits that are highly prevalent in the general population are associated with abuse, trauma and PTSD.

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Keywords

child physical abuse; child sexual abuse; autistic traits; broad autism spectrum; posttraumatic stress disorder; violence victimization

Introduction

Autistic traits (the “broad autism phenotype”), which are continuously distributed in the population (J. N. Constantino & Todd, 2000, 2003), are characterized by difficulties in interpreting social information such as tone of voice and facial expression, deficits in understanding what others are thinking and feeling, difficulties in communicating ideas and emotions, reduced desire to interact with others, and by autistic mannerisms, such as repetitive and rigid behaviors (J. N. Constantino et al., 2004). These traits may elevate the risk for interpersonal victimization for those who exhibit them across the life course.

Parents of children with higher levels of autistic traits may become more emotionally and physically punitive in frustration at the child’s non-responsiveness. It has been hypothesized that the intense, rigid adherence to routine exhibited by children with autistic traits may be perceived by parents as oppositional (Grayson, Childress, & Baker, 2013). Parents’ expectations of successfully reasoning with and being understood by their child may also affect abuse perpetration. Mothers of profoundly deaf children, for example, were more likely to choose physical discipline in a misbehavior scenario than were mothers of hearing children (Knutson, Johnson, & Sullivan, 2004). Children with communication impairments (Brownlie, Jabbar, Beitchman, Vida, & Atkinson, 2007; Knutson et al., 2004; Spencer et al., 2005) and children with cognitive and physical disabilities (Jones et al., 2012; Sullivan & Knutson, 2000) are at increased risk of being targeted for abuse in childhood.

Additionally, adults with high levels of autistic traits may be at increased risk of interpersonal victimization. Deficits in emotional and social cognition, specifically, inability to identify sexually inappropriate behavior (Marx & Soler-Baillo, 2005; Soler-Baillo, Marx, & Sloan, 2005), inability to detect violations in social exchange rules (DePrince, 2005) and inability to identify one’s own discomfort at inappropriate behavior (Zeitlin, McNally, & Cassidy, 1993) increase risk of victimization and characterize persons with autistic traits.

Posttraumatic stress disorder (PTSD) is a common sequela of childhood abuse (Heim, Shugart, Craighead, & Nemeroff, 2010; Maniglio, 2009) and interpersonal victimization (Breslau et al., 1998; Copeland, Keeler, Angold, & Costello, 2007; Darves-Bornoz et al., 2008). Consequently, if persons with more versus fewer autistic traits are at higher risk of abuse and interpersonal victimization, they may also be at increased risk of PTSD symptoms. Very few studies have examined risk of abuse in children with autism spectrum disorder (ASD); these suggest higher risk of abuse, though evidence is mixed (Mandell, Walrath, Manteuffel, Sgro, & Pinto-Martin, 2005; Spencer et al., 2005; Sullivan & Knutson, 2000). The association of autistic traits below clinical thresholds for ASD with childhood abuse, interpersonal victimization in adulthood and PTSD has not been examined.

In the present study we examine the association of autistic traits in adulthood with retrospectively reported childhood physical, emotional and sexual abuse, lifetime exposure to traumatic events, and lifetime PTSD symptoms among women in a large case-control study nested in a population-based longitudinal cohort, the Nurses' Health Study II (NHS II). Further, we examine the extent to which childhood abuse and type of trauma exposure account for possible associations between autistic traits and PTSD symptoms.

Methods

Sample

The NHS II is a cohort of 116,430 female nurses recruited in 1989 from 14 populous U.S. states and followed up biennially. The present study uses data from the 3,756 women (90% response rate) who participated in the 2007 Autism Case-Control Substudy of the NHS II,^{24,25} details of which have been described (K. Lyall, Pauls, Spiegelman, Santangelo, & Ascherio, 2012).. The present analyses include only those participants returning the measure of autistic traits (n=1247, ~40% of women who were initially mailed questionnaires). Women in the Autism Case-Control Substudy were selected on the basis of reporting having had a child with an ASD (cases) or having had a child without ASD (controls). Thus, all women in our study were mothers. The Partners Healthcare Institutional Review Board approved this research. Completion and return of questionnaires sent by U.S. mail constitutes implied consent.

Measures

We measured current autistic traits in NHSII mothers using the 65-item Social Responsiveness Scale (SRS, possible range, 0 to 195, higher scores indicate more autistic traits)(J. Constantino, 2002; J. N. Constantino & Todd, 2003). These items have been found to be a manifestation of one continuously distributed underlying "autism" factor (J. N. Constantino et al., 2004). This factor has been found to be highly heritable with the same genetic structure as autism (J. N. Constantino & Todd, 2000). The SRS has five subscales that separately capture social cognition (e.g., "Is able to understand the meaning of people's tone of voice or facial expressions"), social communication (e.g., "Avoids eye contact or has unusual eye contact"), social awareness (e.g., "Focuses his or her attention where others are looking"), social motivation (e.g., "Would rather be alone than with others"), and autistic mannerisms (e.g., "Shows unusual sensory interests, such as spinning or mouthing objects"). The SRS had high stability over time in a longitudinal study with 1–5 years of follow up (test-retest correlation=0.90) (J. N. Constantino et al., 2009). The SRS has been validated against the Autism Diagnostic Interview-Revised (J. N. Constantino et al., 2003) and the Autism Diagnostic Observation Schedule and is widely used both in the US and internationally (Bölte, Knecht, & Poustka, 2007). The NHSII participant's spouse/partner completed the SRS regarding her autistic traits. For women who were not partnered at the time of data collection, a close relative completed the SRS.

To examine a possible dose-response relation between autistic traits and childhood abuse and PTSD, to account for possible nonlinearity in the relation between autistic traits and our outcomes, and to characterize levels of autistic traits found in the general population, we

divided the SRS score into quintiles based on scores in control mothers, although SRS scores in case and control mothers were similar (case mothers, mean=22.1, standard deviation (SD)=19.3; control mothers, mean=19.2, SD=15.9, $p=0.03$) (Kristen Lyall et al.). Mothers of children with autism were then included in the appropriate quintile given their SRS score. As dividing the score into quintiles was somewhat arbitrary, we conducted sensitivity analyses with the score divided into deciles.

Women's exposure to childhood abuse was assessed in an NHSII supplemental questionnaire in 2001. Combined childhood physical and emotional abuse before age 12 years was assessed with 5 questions from the Physical and Emotional Abuse Subscale of the Childhood Trauma Questionnaire (Bernstein et al., 1994) querying the frequency of people in the family: 1) hitting so hard it left bruises, 2) punishing in a way that seemed cruel, 3) insulting, 4) screaming and yelling, and 5) punishing with a belt or other hard object. For each item, response options included never, rarely, sometimes, often, or very often true. Responses were assigned values from 0 (never) to 4 (very often) and were summed following questionnaire scoring recommendations. In a validation study, the scale had good internal consistency (Cronbach's $\alpha=0.94$) and test-retest reliability (intraclass correlation = 0.82) over a 2- to 6-month interval (Bernstein et al., 1994). The resulting scale was divided into quintiles. Sexual abuse occurring in two time periods was assessed, before age 12 years and age 12 to 17 years. For each time period, two questions queried unwanted sexual touching by an adult or older child and forced or coerced sexual contact by an adult or older child (Moore, Gallup, & Schussel, 1995). Women who endorsed any of these events were considered to have experienced sexual abuse. Additionally, a single item from a 2008 PTSD and trauma assessment was included as a measure of childhood abuse ("Before age 18, were you ever physically punished or beaten by a parent, caretaker, or teacher so that: you were very frightened; or you thought you would be injured; or you received bruises, cuts, welts, lumps or other injuries?"). This item was strongly associated with the physical/emotional abuse measure. Whereas only 1.7% of women in the lowest quintile of physical/emotional abuse endorsed this item, 40.3% of women in the highest quintile endorsed it ($p<0.0001$).

Women's lifetime trauma exposure and PTSD symptoms were assessed in 2008. Trauma exposure was assessed with the 16-item Brief Trauma Questionnaire (Morgan et al., 2001; Schnurr, Vielhauer, & Weathers, 1995) which queried experience of 15 types of traumatic events and one "additional event not listed." Women were asked which of these experiences they consider their worst event. PTSD symptoms were assessed with regard to this worst event using the Short Screening Scale for DSM-IV PTSD (Breslau, Peterson, Kessler, & Schultz, 1999; A. L. Roberts, Galea, et al., 2012; A. L. Roberts, Rosario, Corliss, Koenen, & Austin, 2012), which assesses 7 symptoms of PTSD (e.g., "Since the event, have there ever been times when you: Became jumpy or got easily startled by ordinary noises or movements? Felt more isolated or distant from other people?"). Endorsement of 4 or more symptoms identified PTSD cases with 85% sensitivity, 93% specificity, 68% positive predictive value, and 98% negative predictive value, and endorsement of 6 or more symptoms identified PTSD cases with a sensitivity of 38%, specificity of 100%, positive predictive value of 87%, and negative predictive value of 95% in a validation study (Breslau et al., 1999). PTSD symptoms were coded as: no trauma, trauma exposure and no PTSD

symptoms; 1 to 3 symptoms; 4 or 5 symptoms; and 6 or 7 symptoms. We additionally examined “probable PTSD” by dichotomizing the number of symptoms using two cutoffs: 1) fewer than 4 versus 4 or more symptoms, and 2) fewer than 6 versus 6 or more symptoms.

We received SRS reporting of autistic traits for 1247 mothers, of whom 1077 (86%) had completed the 2001 childhood abuse questionnaire and 1013 (81%) had also completed the 2008 PTSD questionnaire. Autistic traits were slightly higher in women with versus without data on childhood abuse (with data, mean=20.0; without data, mean=17.8, $p=0.06$) and in women with versus without PTSD data (with data, mean=20.2; without data, mean=17.6, $p=0.01$). Nearly all missing data on childhood abuse and PTSD symptoms were missing because those women were not sent the supplemental questionnaires querying those factors. To retain participation in the main longitudinal study, only women who have responded to the most recent biennial questionnaire are sent supplemental questionnaires. To examine possible effects of missing data, we conducted sensitivity analyses using the statistical technique of multiple imputation (Graham, 2009). We imputed 20 datasets using SAS PROC MI (SAS Institute) and conducted analyses using these datasets.

Analyses

We examined prevalence of childhood abuse, trauma exposure, PTSD symptoms, and covariates by women’s autistic traits. To ascertain whether autistic traits in adulthood were associated with childhood abuse adjusted for covariates, we estimated odds ratios (OR) of any childhood sexual abuse and the highest quintile of childhood physical/emotional associated with quintiles of autistic traits in separate models. Next, to determine whether autistic traits were associated with PTSD symptoms, we modeled PTSD symptoms as an ordinal dependent variable with autistic traits as the independent variable, adjusted for covariates, using a cumulative logistic model. To ascertain the extent to which childhood abuse might account for possibly elevated risk of PTSD symptoms in women with higher levels of autistic traits, we added childhood abuse measures to the model. To ascertain the extent to which type of worst trauma (e.g., death of someone close, rape) accounted for risk of PTSD symptoms in women with higher levels of autistic traits, we restricted to women who were exposed to one or more traumatic event and modeled risk of PTSD, with further adjustment for worst trauma type, coded as a categorical variable. To determine whether possible associations of autistic traits and childhood abuse, trauma and PTSD were similar in women without children with ASD, we conducted sensitivity analyses restricted to controls.

We used generalized estimating equations with a logit link and a binomial distribution to estimate odds ratios for dichotomous dependent variables and ordered logistic regression with a cumulative logit link and a multinomial distribution to estimate odds ratios for PTSD symptoms, an ordinal variable, using SAS PROC GENMOD (SAS Institute). All models adjusted for women’s birth year, childhood socioeconomic status, measured as the maximum of her parents’ education at her birth and coded categorically. Models of PTSD symptoms further adjusted for child’s case/control status.

Results

Women in the highest versus lowest quintile of autistic traits were more likely to have been sexually abused in childhood (40.1% versus 26.7%), to have experienced the highest quintile of physical/emotional abuse in childhood (23.9% versus 14.3%), to have been mugged (17.1% versus 10.1%), and to have been pressured into sexual contact (25.4% versus 15.6%), but not to have been sexually harassed at work (10.2% versus 10.6%, Table 1). High levels of PTSD symptoms were more prevalent in the highest versus lowest quintile of autistic traits (6–7 PTSD symptoms, 10.7% versus 4.5%). There were no notable differences by autistic traits in birth year or parent's education in childhood (Table 1).

Adjusted for covariates, women in the highest versus lowest quintile of autistic traits were at significantly elevated odds of experiencing childhood sexual abuse (OR=1.8, 95% confidence interval (CI)=1.2, 2.7, Table 2), and women in the top four quintiles of autistic traits were at elevated odds of experiencing the highest quintile of physical/emotional abuse (OR range=1.7 to 1.9, Table 2). Odds of PTSD were elevated in women in the top three quintiles of autistic traits compared with the reference group (OR range=1.4 to 1.9, Table 3, Model 1). Adding childhood abuse to models moderately attenuated the associations of autistic traits with PTSD symptoms (Table 3, Model 2). Child abuse exposure accounted for 31.7% of the increased risk of PTSD symptoms associated with higher autistic traits. Among women exposed to one or more traumatic events (n=835), the association of autistic traits with PTSD symptoms was somewhat stronger than in analyses including all women (Table 4, Model 1). Childhood abuse accounted for 24.9% of the elevated risk of PTSD in these women (Table 4, Model 2). Adding worst trauma type to the model did not further attenuate the association between autistic traits and PTSD symptoms (Table 4, Model 3).

Autistic traits were also associated with PTSD in analyses with PTSD dichotomized at <4 versus 4+ symptoms (highest quintile of autistic traits versus lowest, OR=1.99, 95% CI=1.20, 3.29, p=0.007) and with PTSD dichotomized at <6 versus 6+ symptoms (OR=2.53, 95% CI=1.12, 5.68, p=0.02). We found an association of childhood sexual abuse and PTSD in analyses examining deciles of autistic traits (highest decile versus lowest, sex abuse OR=2.14, 95% CI=1.16, 3.94, p=0.01; PTSD, OR=2.76, 95% CI=1.66, 4.58, p=0.001). Risk of physical/emotional abuse was elevated in these analyses but did not reach statistical significance (OR=1.86, 95% CI=0.92, 3.79, p=0.08). Results were very similar for all analyses when restricted to control mothers. Results in analyses using multiply imputed data were similar to results using complete data.

To further explore our findings, we calculated mean autistic traits and prevalence of highest quintile of autistic traits by childhood abuse and PTSD symptoms. Women with high physical/emotional abuse had higher mean SRS scores (22.1 versus 18.6, p<0.01) and somewhat higher prevalence of being in the highest quintile of SRS (22.8% versus 17.0%, p=0.07) compared to women with no physical/emotional abuse history. Similarly, women exposed to severe childhood sexual abuse had higher mean SRS scores (23.7 versus 19.2, p=0.02) and greater prevalence of the highest quintile of the SRS (33.3% versus 17.4%, p=0.07) compared to women with no history of sexual abuse. Women with high PTSD symptoms (6–7 symptoms) had higher mean SRS score (24.5 versus 18.5, p=0.001) and

substantially greater prevalence of being in the highest quintile of the SRS (32.8% versus 16.3%, $p=0.03$) compared to women with no trauma exposure.

Discussion

We identify for the first time an association between autistic traits in adulthood and childhood abuse, lifetime trauma exposure and PTSD symptoms. Women with the highest level of autistic traits had 1.5 times the prevalence of sexual abuse and almost twice the prevalence of physical/emotional abuse and high PTSD symptoms as women with the lowest level of autistic traits. As we characterized autistic traits by quintiles among women without a child with ASD, our findings suggest that levels of autistic traits associated with elevated prevalence of abuse and PTSD are common in the general population. Women in the highest three quintiles versus the lowest quintile of autistic traits had elevated prevalence of physical/emotional abuse and PTSD symptoms.

Higher exposure to childhood abuse accounted for nearly one-third of the higher risk of PTSD symptoms in women in the top quintile of autistic traits. As childhood abuse accounted for only a moderate part of the association of autistic traits with PTSD symptoms, other factors must also drive these associations. Our results are consistent with at least three possibilities. First, it is possible that higher exposure to stressors from lifelong challenges in social interactions (Rosbrook & Whittingham, 2010) increased risk for PTSD symptoms in women with more versus fewer autistic traits. Chronic exposure to stressors is a risk factor for PTSD (Davidson & Baum, 1986). Second, women with more, versus fewer, autistic traits may have increased reactivity to stressors. Persons with ASD have difficulties coping with change and with adverse events (Gillott & Standen, 2007). Several studies have indicated that persons with ASD have stronger biological responses to stressors, both in laboratory settings and in daily life, as well as amplified emotional responses and poor emotional regulation compared with persons without ASD (Baron-Cohen, Leslie, & Frith, 1985; Corbett, Mendoza, Abdullah, Wegelin, & Levine, 2006; Jansen et al., 2006; Maher, Harper, MacLeay, & King, 1975; Mazefsky et al., 2013). Increased stress reactivity and emotional dysregulation are risk factors for PTSD (Weiss, Tull, Lavender, & Gratz) and could account for the associations we found. Third, autistic traits below clinical thresholds for ASD may share genetic risk with PTSD. Family history studies indicate higher prevalence of PTSD (Andrea L Roberts, Koenen, Lyall, Ascherio, & Weisskopf, 2014), depression, manic depression, obsessive compulsive disorder, anxiety disorders, and alcoholism in relatives of persons with ASD, indicating possible shared genetic risk (Miles, 2011). Likewise, twin studies demonstrate shared genetic risk between these phenotypes and PTSD (Afifi, Asmundson, Taylor, & Jang, 2010). If autistic traits share genetic risk with other psychiatric phenotypes, this shared risk could mean that children with high levels of autistic traits are more likely to have parents with mental illness or substance abuse compared with children with low levels of autistic traits. As parents' mental illness and substance abuse increase risk of child abuse (Parrish, Young, Perham-Hester, & Gessner, 2011; A. L. Roberts, Glymour, & Koenen, 2013; Sidebotham & Heron, 2006; Smith, Johnson, Pears, Fisher, & DeGarmo, 2007), this shared genetic risk could partly account for the high prevalence of childhood abuse we found in women with high levels of autistic traits.

We examined cross-sectional associations between adulthood autistic traits and lifetime experience of abuse, trauma, and PTSD, therefore we cannot determine the chronological sequencing of the development of autistic traits and abuse, trauma, and PTSD. Although autistic traits have been found to be stable across several years (J. N. Constantino et al., 2009; Holmboe et al.; Robinson et al., 2011), it is possible that abuse in childhood or interpersonal victimization may have led to increased autistic traits, or that symptoms of PTSD led to increased autistic traits. Child abuse has been hypothesized to create biases toward aggression and hostility in social interactions (Berlin, Appleyard, & Dodge, 2011; Taft, Schumm, Marshall, Panuzio, & Holtzworth-Munroe, 2008), though not to create the basic deficits in social information processing that are characteristic of autism. Stereotyped behaviors (e.g., rocking, hand movements) similar to those found in children with ASD have been observed in children adopted from orphanages who were exposed to severe early childhood neglect and abuse, though these behaviors were attributed to developmental delay, diminished over time, and have not been widely noted with less extreme abuse (MacLean, 2003). PTSD also has been associated with symptoms similar to autistic traits, including alexithymia, the inability to identify emotional states in self and others (Frewen, Dozois, Neufeld, & Lanius, 2008) and social anxiety (Hofmann, Litz, & Weathers, 2003). Prospective studies are required to better understand the mechanisms driving the associations we found.

Our study had several limitations. The NHSII cohort is comprised of registered nurses and is predominantly white, reflecting the racial/ethnic composition of the nursing profession at enrollment in 1989. Thus, our results may not apply to other racial/ethnic or occupational groups. Additionally, our sample was comprised of mothers. It is therefore possible that our findings do not apply to women without children. We used a validated measure of PTSD symptoms; although this is consistent with a large body of epidemiological literature it does not constitute a clinical diagnosis. Childhood abuse and trauma exposure were by self-report, which, like all measures of childhood abuse, is subject to error (Hardt & Rutter, 2004). If likelihood of reporting childhood abuse or traumatic events differs by autistic traits, our results may be biased. Prevalence of retrospectively reported childhood sexual abuse was somewhat higher in our sample than in a prior study in a large HMO (32% versus 24%)(Anda et al., 1999). The somewhat higher prevalence of abuse may relate to participants' willingness to disclose: participants were asked about sexual abuse in the 12th year of an ongoing longitudinal study, during which there have been no breaches of confidentiality.

Given the strong associations of autistic traits with trauma and PTSD symptoms, studies identifying causal mechanisms may improve efforts to prevent trauma and PTSD. Our findings suggest that children exhibiting even subtle deficits in social information processing may be at risk for childhood abuse. As autistic traits are observable behaviors, clinicians, teachers, and others who work with children should be aware that children exhibiting these deficits may be at risk for abuse. Improved identification of children at risk for abuse may help target provision of support to parents in order to prevent abuse, stop ongoing abuse, or facilitate treatment to prevent abuse sequelae. As we found that autistic traits were also associated with adulthood victimization, improving social information processing in persons with deficits in these areas may protect them from future trauma. We also found that women

with childhood abuse histories were more likely than those without such histories to exhibit high levels of autistic traits, indicating potential deficits in social awareness, cognition, communication and motivation that could be treated to improve the well-being of these women. Finally, the association we found between PTSD and autistic traits adds to evidence of substantial genetic and phenotypic overlap among psychiatric disorders, thus research aimed at understanding this overlap may be fruitful.

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Prevalence of childhood abuse, PTSD symptoms, trauma and covariates by quintile of autistic traits, Nurses' Health Study II, N=1077†

Table 1

		Autistic traits				
		Quintile 1: Fewest (N=211)	Quintile 2 (N=224)	Quintile 3 (N=220)	Quintile 4 (N=209)	Quintile 5: Most (N=213)
SRS score	Mean (SD)	3.5 (2.0)	9.6 (1.8)	16.0 (2.4)	25.5 (3.2)	46.2 (17.5)
	Range	0–6	7–12	13–20	21–31	32–164
Child is an ASD case	%	18.0	17.4	21.8	22.5	23.5
Childhood abuse						
Sexual abuse (any)	%	26.7	32.6	31.8	29.2	40.1
Physical/emotional abuse (top quintile)	%	14.3	21.4	21.4	23.0	23.9
PTSD (6–7 symptoms)	%	4.5	4.7	8.0	5.1	10.7
Traumatic event (any)	%	79.4	81.6	82.1	83.3	85.9
Interpersonal victimization	Mean (SD)	0.4 (0.7)	0.5 (0.9)	0.6 (0.9)	0.5 (0.8)	0.7 (0.9)
Physically injured by parent/caregiver in childhood	%	6.0	9.0	12.4	12.6	13.2
Attacked or mugged	%	10.1	9.9	9.0	6.1	17.1
Pressured into sexual contact	%	15.6	21.7	28.9	21.2	25.4
Sexual harassment at work	%	10.6	14.2	11.9	11.6	10.2
Non-interpersonal events	Mean (SD)	1.8 (1.5)	1.8 (1.7)	2.0 (1.6)	1.9 (1.5)	2.1 (1.6)
Serious accident	%	18.1	10.9	17.9	14.4	18.5
Disaster	%	9.1	11.3	11.9	11.6	14.6
Serious illness	%	8.5	9.9	10.9	12.6	9.3
Death of own child	%	1.5	3.3	3.0	2.0	1.5
Traumatic pregnancy complications	%	19.6	17.5	22.9	17.2	22.9
Miscarriage or stillbirth	%	37.2	34.0	38.8	32.3	37.1
Other situation with serious injury or risk of serious injury	%	6.5	11.8	6.0	5.6	9.3
Sudden death of close family member	%	17.1	16.0	21.4	21.2	21.0
Witnessed serious injury or death	%	16.6	16.0	18.9	18.2	20.0
Served in war zone	%	1.0	0.9	0.0	3.0	0.5
Treated civilians with traumatic injuries	%	24.6	32.1	29.9	29.8	31.7

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Autistic traits					
	Quintile 1: Fewest (N=211)	Quintile 2 (N=224)	Quintile 3 (N=220)	Quintile 4 (N=209)	Quintile 5: Most (N=213)
Other serious traumatic event	16.6	20.3	15.9	20.2	19.0
Birth year	1958	1957	1958	1958	1958
Maximum of parent's education in childhood (college or more)	27.2	30.6	28.6	26.8	28.8

Table 2

Women's autistic traits and her experience of abuse in childhood, Nurses' Health Study II (N=1077)[†]

	Sexual abuse (any)	Physical/emotional abuse
	Odds ratio (95% confidence interval)	
Women's autistic traits		
Lowest quintile	1.0 [reference]	1.0 [reference]
2 nd quintile	1.35 (0.89, 2.05)	1.74 (1.05, 2.89) [*]
3 rd quintile	1.28 (0.84, 1.95)	1.70 (1.02, 2.82) [*]
4 th quintile	1.14 (0.74, 1.76)	1.85 (1.11, 3.08) [*]
Highest quintile	1.81 (1.20, 2.74) ^{**}	1.89 (1.14, 3.13) [*]

[†] All models adjusted for women's childhood socioeconomic status and birth year. Odds ratios were estimated using generalized estimating equations with a logit link and a binomial distribution.

Wald chi-square

^{*} P<0.05,

^{**} P<0.01

Table 3

Women's autistic traits and PTSD symptoms, with and without adjustment for childhood abuse, Nurses' Health Study II (N=1013)[†]

	Model 1: PTSD symptoms	Model 2: Further adjusted for childhood abuse
Odds ratio (95% Confidence Interval)		
Women's autistic traits		
Lowest quintile	1.0 [reference]	1.0 [reference]
2 nd quintile	1.20 (0.85, 1.69)	1.10 (0.77, 1.57)
3 rd quintile	1.57 (1.10, 2.24) *	1.42 (0.99, 2.04)
4 th quintile	1.44 (1.01, 2.05) *	1.34 (0.93, 1.93)
Highest quintile	1.91 (1.34, 2.73) ***	1.68 (1.17, 2.42) **

[†] All models adjusted for women's childhood socioeconomic status and birth year and child's ASD case status. Odds ratios were estimated with ordered logistic regression using a cumulative logit link and a multinomial distribution.

* P<0.05,

** P<0.01,

P<0.001

Table 4

Women's autistic traits and PTSD symptoms, restricted to women exposed to a traumatic event, with and without adjustment for childhood abuse and worst trauma type, Nurses' Health Study II (N=835)[†]

	Model 1: PTSD symptoms	Model 2: Further adjusted for childhood abuse	Model 3: Further adjusted for worst trauma type
Odds ratio (95% Confidence Interval)			
Women's autistic traits			
Lowest quintile	1.0 [reference]	1.0 [reference]	1.0 [reference]
2 nd quintile	1.21 (0.80, 1.83)	1.09 (0.71, 1.66)	0.95 (0.61, 1.47)
3 rd quintile	1.88 (1.23, 2.85) **	1.73 (1.13, 2.65) *	1.60 (1.03, 2.47) *
4 th quintile	1.54 (1.02, 2.34) *	1.45 (0.95, 2.21)	1.46 (0.94, 2.27)
Highest quintile	2.26 (1.49, 3.43) ***	1.92 (1.26, 2.94) **	2.06 (1.33, 3.20) **

[†] All models adjusted for women's childhood socioeconomic status and birth year and child's ASD case status. Odds ratios were estimated with ordered logistic regression using a cumulative logit link and a multinomial distribution.

* P<0.05,

** P<0.01,

P<0.001