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Anxiety Symptoms in Individuals with High Functioning Autism

Jane Kelleher

Research indicates a complicated relationship between anxiety disorders and autism spectrum disorders (ASDs). The current study examined the relationship between anxiety symptoms and ASD in 30 Optimal Outcome (OO) individuals, 33 High Functioning Autism (HFA) individuals, and 34 Typically Developing (TD) individuals. The groups were compared on the K-SADS measure of anxiety symptoms. The HFA group presented greater anxiety than both the OO and TD groups, and the OO and TD groups only differed on one anxiety symptom. Across all three groups, there was a significant association between greater anxiety symptoms and a higher level of social and communicative impairment. Taken together, these results suggest some relationship between severity of ASD and level of anxiety.

Autism Spectrum Disorders (ASDs) are characterized by impaired social interaction skills, impaired communication skills, and restricted repetitive and stereotyped behaviors, interests, and activities. Children with autism often struggle with symbolic or imaginative play and with the use of language as a communicative tool. In order to be diagnosed with an ASD, a child must show these symptoms prior to age three. Over time, developmental gains in people with ASDs are not unusual - especially in those with stronger language and cognitive abilities. Autistic individuals with these strengths are referred to as having High-Functioning Autism, or HFA (APA, 1994; Rutter, Greenfield & Lockyer, 1967; Lopata, Volker, Putnam, Thomeer & Nida, 2008).

HFA individuals are expected to have an IQ in the normal intelligence range, which characterizes only 5-30% of individuals with autism (Freeman, Ritvo, Needleman, & Yokota, 1985; Yirmiya & Sigman, 1991). These individuals are likely to have higher performance IQs than verbal IQs (Lincoln, Courchesne, Kilman, Elmasian, & Allen 1988). Accordingly, HFA individuals are also expected to have problems in communication, adaptive behavior, and social functioning (Kelley et al., 2010;

Macdonald, Rutter, Howlin, Rios, Le Conteur, Evered, & Folstein, 1989; Rumsey, Andreasen, & Rapoport, 1986; Yirmiya & Sigman, 1991). However, these social deficits are not as extensive as those seen in low-functioning autistic individuals. Although HFA individuals are typically still sensitive to noise and exhibit ritualistic behaviors, they are less likely to engage in self-injurious behaviors, flicking, and they are less likely to present delays in motor and language development – behaviors commonly seen in individuals with low-functioning autism (Rutter & Lockyer, 1967; Bartak & Rutter, 1976).

By contrast, there are also individuals who were diagnosed with an ASD when they were younger who have improved to the extent that they no longer meet the criteria for diagnosis. They are referred to as Optimal Outcome (OO) individuals. OO individuals are expected to function in the normal range of cognitive, social, and adaptive skills (Helt et al., 2008; Kelley, Naigles, & Fein, 2010; Kelley, Paul & Fein, 2006; Sutera et al., 2007). In past research, to meet the criteria for OO, individuals must have previously been diagnosed with an ASD, be mainstreamed into regular classrooms, and have a full-scale IQ and adaptive skills in the average range.

Many studies have found an elevated rate of anxiety disorders in individuals with ASDs (Davis et al., 2011; Farrugia & Hudson, 2006; Gillott, Furniss, & Walter, 2001; Lopata et al., 2008; Kanne, Abbacchi, & Constantino, 2009; Muris, Steerneman, Merckelbach, Holdrinet, & Meesters, 1998). Anxiety disorders are characterized by marked periods of distress due to excessive worry and anxiety, as well as anxiety that is out of proportion to the likelihood or impact of the feared event (APA, 1994). Some

anxiety symptoms are behaviorally similar to core features of ASD, such as a “need for consistency, repetition, rituals, and predictability” (Lopata et al., 2008, p. 1866) (Gillberg & Billstedt, 2000). Because of this overlap, there has been controversy about whether ASD individuals can be diagnosed with comorbid anxiety disorders, or if their symptoms are related to their ASD (Matson & Nebel-Schwalm, 2006). In fact, the DSM-IV guidelines do not permit comorbid diagnosis of Generalized Anxiety Disorder (GAD), Separation Anxiety, or Social Phobia with a Pervasive Developmental Disorder (PDD) (De Bruin, Ferdinand, Meester, de Nijs, & Verjeij, 2007; Leyfer et al., 2006).

The confusion surrounding autism and anxiety disorders has prompted a sizeable body of research. As mentioned, studies show that anxiety disorders are more frequent in children with autism than typically developing (TD) children and adolescents. A study by Muris et al. (1998) found that 84.1% of children in a sample of children with autistic disorder and PDD-NOS met criteria for at least one anxiety disorder. Studies have also shown that anxiety disorders in children with autism are qualitatively different from anxiety disorders in typically developing children (Cath, Ran, Smit, van Balkom, & Comijs, 2008; Evans, Canavera, Kleinpeter, Maccubbin, & Taga, 2005; Gillott et al., 2001; Leyfer et al., 2006). Unfortunately, the methods used to assess anxiety in many of these studies have some drawbacks. Some studies require inferring anxiety from atypical behaviors. In children with ASD, these behaviors may not actually represent anxiety. Many studies use parent reports to measure child anxiety, which do not always correlate with children’s self-reports (Farrugia & Hudson, 2006; Muris et al., 1998). Parents may have a hard time assessing their children’s internal states, and may focus too much on behavioral rather than emotional symptoms of anxiety (Evans et al., 2005; Helvershou &

Martinsen, 2011; Muris et al., 1998; Strang et al., 2012). Some studies try to compensate for this problem by utilizing self-report anxiety measures. Self-reports also present problems, because children with ASD have a hard time recognizing their own internal states and do not always possess the skills necessary to complete self-reports, such as language skills and perception of others (Farrugia & Hudson, 2006; Gillott, Furniss & Walter, 2001). Research suggests that anxiety needs to be assessed more comprehensively through a variety of measures, including direct observation if possible (Helvershou & Martinsen, 2011; Kanne et al., 2009; Leyfer et al., 2006; Lopata et al., 2010). Despite these flaws, however, many studies have successfully studied anxiety in children with autism.

Current research methods suggest that the anxiety disorder diagnoses most common in children with autism differ from those most common in children without developmental disabilities (Evans et al., 2005). Research shows that the most frequently diagnosed comorbid anxiety disorders in individuals with ASDs are Specific Phobia (Chalfant, Rapee, & Carroll, 2007; Muris et al., 1998; Leyfer et al., 2006; Rumsey, Rapoport, & Sceery, 1985), Obsessive-Compulsive Disorder (OCD) (Leyfer et al., 2006; Rumsey et al., 1985), Separation Anxiety (Gillott et al., 2001; Rumsey et al., 1985), and Social Anxiety Disorder (Gillott et al., 2001; Simonoff et al., 2008). This makes sense, as the symptoms of these specific disorders – such as a fear of harmless objects, compulsions or repetitive behaviors, and a need for sameness – are similar to features of autism. Rates of comorbid social anxiety and social phobia disorders are especially high in ASD individuals. There are a couple potential explanations for this overlap. First, HFA individuals have the ability to recognize their differences from TD individuals, and

seeing those differences makes them anxious. Alternatively, the behaviors seen in social anxiety and social phobia look similar to those in ASD, so the behaviors may represent either an underlying ASD or underlying anxiety disorder.

A number of studies suggest that HFA individuals may experience greater anxiety than those with more severe autism (Settipani, Puleo, Conner, & Kendall, 2012; Strang et al., 2012), especially social anxiety and social phobia (Gillott et al., 2001; Kuusikko et al., 2008). This could be because people with HFA have the cognitive capability to recognize their own social deficits and social failures, which makes them more anxious in social situations (Lopata et al., 2010; Wing, Schopler, & Mesibov, 1992). The absence of Intellectual Disability (ID) in some individuals with ASD may present an increased risk for anxiety (Strang et al., 2012), especially social anxiety symptoms (Kuusikko et al., 2008). These findings suggest that HFA individuals may have higher anxiety because they understand their own limitations. On the other hand, in a 1996 review of the literature concerning disorders comorbid with autism, Tsai suggests that anxiety may not actually differ across functional levels of ASD. He claims that the only difference in anxiety disorders between functional levels of autism is a greater ability to express anxiety in people with HFA, which leads to more diagnoses. Tsai claims that although people with lower functioning autism cannot sufficiently communicate their feelings of anxiety, anxiety symptoms may still be present.

Individuals with autism have difficulty describing their mental states and internal experiences, which makes identifying any type of anxiety disorder very challenging for evaluators (Helvershou & Martinsen, 2011; Leyfer et al., 2006). Anxiety symptoms are

often misconstrued as exacerbated symptoms of ASD (Davis et al., 2011). Additionally, physical symptoms of anxiety are harder to recognize in people with ASD than in the typical population, which further complicates diagnosis (Helveshou & Martinsen, 2011). Despite these challenges, the relationship between anxiety and autism is important to study. Anxiety disorders are the most common childhood psychiatric disorder in the typically developing population (Davis et al., 2011; Settiani et al., 2012). In the typically developing population, anxiety disorders that are not identified and treated early in life may become more severe over time, and the same could be true for individuals with ASDs (Davis et al., 2011).

Anxiety symptoms present additional handicaps for autistic children and autistic children with anxiety symptoms require specialized treatment (Muris et al., 1998). It is important to know how prevalent anxiety symptoms are in the autistic population so that individuals with ASD are appropriately diagnosed and treated (Kanne et al., 2009; Leyfer et al., 2006). In fact, comorbidities – such as anxiety disorders - are frequently thought to be more responsive to treatment than core symptoms of ASDs (DeBruin et al., 2007). Appropriate treatment could significantly improve quality of life and independence of ASD individuals. From an academic perspective, identifying which comorbid anxiety disorders exist in the context of ASD can help define future research (Leyfer et al., 2006).

It is also important to understand the prevalence and source of anxiety symptoms in OO individuals. There are two possible outcomes for the presentation of anxiety symptoms in OO individuals. The first potential outcome is based on the idea that ASD and anxiety symptoms are inherently related in some way. If this relationship exists, then

the reason autistic individuals present anxiety symptoms may simply be because they have an ASD; that is, their anxiety is somehow due to the symptoms of ASD. For example, individuals with HFA may be aware of their deficits in social skills, and therefore become anxious in social situations. OO individuals may not present the same social deficits, and therefore would not be as anxious in social situations. In other words, when OO individuals lose the core features of autism they may also lose the features of comorbid anxiety disorders. In the context of this study, this would mean that the OO group would present fewer anxiety symptoms than the HFA group. It would also mean that the OO group and TD group would present similar levels of anxiety symptoms.

The second possible outcome for OO individuals is based on the idea that ASD and anxiety are truly comorbid disorders, and something may make an individual more susceptible to both disorders. For this reason, the OO individuals are more susceptible to comorbid anxiety disorders than the TD population. This may be because the changes in the brain that lead to autism also increase an autistic individual's likelihood of developing other psychiatric disorders. When the OO individuals undergo treatment for ASD, their comorbid anxiety disorders are not effectively treated. As a result, these OO individuals may present residual anxiety symptoms even after they lose their autism diagnosis. In the context of this study, this would mean that OO individuals would present elevated rates of anxiety symptoms compared to the TD group. In addition, the OO and HFA groups would be expected to present similar levels of anxiety symptoms. In light of these two potential outcomes, the results of this study may shed light on whether or not ASD and anxiety symptoms are inherently related or if some third characteristic makes individuals more susceptible to both ASD and anxiety disorders.

To date, no study has compared the rates of different types of anxiety symptoms in HFA individuals with those in optimal outcome (OO) individuals. The goal of the current study is to compare rates of anxiety symptoms between three groups of children and adolescents: individuals with High-Functioning Autism (HFA), those who attain an Optimal Outcome (OO), and Typically Developing children (TD). The HFA group will serve as the focus of this study. The OO and TD groups will serve as comparison groups. I will compare rates of each symptom of six anxiety disorders (Separation Anxiety, Social Phobia, Specific Phobia, Generalized Anxiety Disorder, Obsessive-Compulsive Disorder, and Panic Disorder) in the HFA, OO, and TD groups. I will be looking at symptoms of these disorders, and whether or not a participant met full criteria for any anxiety disorders. Information about symptoms comes from a parent interview of DSM-IV diagnoses. Comparing which anxiety symptoms are most common for HFA, OO, and TD individuals will allow me to see whether these groups have different anxiety presentations from each other.

It is hypothesized that the HFA group will present higher levels of anxiety symptoms than the TD group, because anxiety disorders are more prevalent in the HFA population than the TD population (Chalfant et al., 2006; Gillottt et al., 2001; Lopata et al., 2010; Kuusikko et al., 2008; Strang et al., 2012). Of the six disorders being examined, it is expected that the HFA group will have more symptoms of Social Phobia, Specific Phobia, and OCD than the TD group. Symptoms of Social Phobia (Gillottt et al., 2001; Lopata et al., 2008; Simonoff et al., 2008), Specific Phobia (Evans et al., 2005; Leyfer et al., 2006; Muris et al., 1998), and OCD (Gillottt et al., 2001, Leyfer et al., 2006) share some overlap with symptoms of autism, which the HFA individuals will present. As

discussed, the OO group may closely resemble either the HFA or the TD group with regard to anxiety presentation.

To further examine the relationship between ASD and anxiety symptoms, the current study will also assess the relationship between IQ, social and communicative impairment, and anxiety symptoms. As mentioned, individuals with ASD and without intellectual disability may be at increased risk for anxiety compared to individuals with low-functioning ASD. This is likely because anxiety disorders are very cognitive disorders, and to some extent require high intellectual functioning. For this reason, it is expected that higher IQ will be related to greater anxiety symptoms. It is also expected that greater social and communicative impairment will be related to greater anxiety symptoms. Individuals with impairment in the social and communication domains may be more anxious about their limitations, and therefore may present higher levels of anxiety.

Methods

Participants

Participants included 30 Optimal Outcome (OO) individuals, 33 High Functioning Autism (HFA) individuals, and 34 Typically Developing (TD) individuals. Participants ranged in age from 8 years, 6 months to 21 years, 8 months. All three groups were matched on age, gender, and nonverbal IQ. However, the OO and TD groups had a verbal IQ (VIQ) about nine points higher than the HFA group. The majority of participants tested at the University of Connecticut were from the northeast US. Participants were predominantly Caucasian. The study was approved by the Institutional Review Boards of the University of Connecticut, the Institute of Living Hartford Hospital, and Children's Hospital of Philadelphia. Participants were recruited through private practices, clinic referrals, and media outlets (newspaper stories, radio interviews). Some participants' parents saw media reports and contacted the investigators. In some other cases, therapists contacted parents of children known to have optimal outcomes and asked them to participate.

Inclusion Criteria. All participants had verbal, nonverbal, and full-scale IQ standard scores greater than 77, which place them within 1.5 SD of the average of 100.

Additional OO criteria were:

1. Participants had a documented ASD diagnosis made by a psychologist specializing in autism or a physician before the age of 5. This diagnosis must have been verified in a written diagnostic report provided by parents. It was required that an early language delay (no words by 18 months or no phrases by 24 months) be documented in the diagnostic report. To confirm past diagnosis, the report was edited to provide only descriptions of behavior – information about diagnosis, summary, and recommendations was removed. One of the co-investigators (MB), an expert in diagnosis of ASD and Director of the University of Connecticut Psychological Services Clinic, reviewed these reports, blind to early diagnosis and current group membership. In addition to potential OO participants, she reviewed 24 "foil" reports for children with non-ASD diagnoses, such as global delay or language disorder. Four potential OO participants were rejected for insufficient early documentation, and were dropped from the study. All 24 foils were correctly rejected.
2. Participants could not currently meet criteria for any ASD according to the Autism Diagnostic Observation Schedule (ADOS) administered by a research-reliable interviewer. In addition, the ADOS of all potential OO cases was reviewed by a clinician with more than 15 years of autism diagnostic experience (IME, MB, or DF) who confirmed that ADOS scores were below ASD thresholds and that in their expert clinical judgment, an ASD was not present.

3. Participants' scores on the Communication and Socialization domains of the Vineland Adaptive Behavior Scales (Vineland) had to be greater than 77 (within 1.5 SDs of the mean of 100).
4. Participants had to be fully included in regular education classrooms with no one-on-one assistance and no special education services to address autism deficits (e.g., no social skills training). However, participants could be receiving limited special education services or psychological support to address impairments not specific to ASDs, such as attention or academic difficulties. In addition, to screen out participants with significant current social disability, the participant had to have, by parent report, a best friend or group of friends.

To be included in the HFA group:

1. Participants had to meet criteria for ASD on the ADOS. They also had to meet criteria for an ASD diagnosis according to best estimate clinical judgment. These requirements follow the Collaborative Program of Excellence in Autism diagnostic guidelines.

To be included in the TD group:

1. Participants could not meet criteria for any ASD at any point in their development, by parent report.
2. Participants could not have a first-degree relative with an ASD diagnosis
3. Participants could not meet current diagnostic criteria for an ASD on the ADOS, or by clinical judgment. There was no attempt to exclude TD children for other learning or psychiatric disorders (but see general exclusion criteria).

4. Scores on the Communication and Socialization domains of the Vineland had to be greater than 77.

Exclusion Criteria. Potential participants for any of the three groups were excluded from the study if (1) at the time of the telephone screening they exhibited symptoms of major psychopathology (e.g., active psychotic disorder) that would impede full participation, (2) they had severe visual or hearing impairments, or (3) they had a history of seizure disorder, Fragile X syndrome, or significant head trauma with loss of consciousness. Two TD individuals and two HFA individuals were excluded because of possible seizure disorder. None were excluded for other reasons.

Procedure

Phone screenings based on study criteria were conducted with parents of each potential participant. Those who passed screening were scheduled for an assessment. For participants under 18, parent consent and child assent was obtained prior to testing. For participants 18 and over, their informed consent was obtained. The evaluation was administered in a quiet room over the course of two or three testing sessions at the University of Connecticut, the Institute of Living of Hartford Hospital, or in the home. Testing lasted approximately six hours. In most cases, parent interviews were conducted concurrently by a second examiner and lasted approximately three hours for the OO and HFA groups and 1.5 hours for the TD group. Participants received a monetary incentive for participation, even if the testing could not be completed.

Measures

Wechsler Abbreviated Scale of Intelligence (WASI) was used to assess the verbal and nonverbal cognitive abilities of the participants.

Vineland Adaptive Behavior Scales (Vineland) assesses an individual's adaptive functioning in Communication and Socialization through an interview with the primary caregiver about specific skills.

Autism Diagnostic Observation Schedule (ADOS) is a structured play and interview session designed to encourage communication, social interaction and imaginative use of materials. Module 3 or 4 was used, depending on the age and developmental level of each participant. The ADOS was used to assess for current symptoms of ASD across the three groups.

The *Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL; Kaufman, Birmaher, Brent, Rao, Flynn, & Moreci, et al., 1997)* is a semi-structured diagnostic interview schedule designed to assess symptoms of a variety of psychiatric disorders in children aged 6-18 years. For the current study, the K-SADS interview was administered to parents only. Both past and current symptoms were assessed for all disorders. However, the current study exclusively looked at current symptoms for anxiety disorders.

Data Analysis

To determine whether the frequency of each anxiety symptom varied between the HFA, OO, and TD groups, Chi-Square tests were conducted for each anxiety symptom listed in the K-SADS screener interview. If there was a significant difference in the frequency of a symptom between the three groups, post-hoc tests were run to determine which groups differed from each other. To determine if there was a relationship between

autism severity, IQ, and anxiety, correlations were run between IQ scores, level of social and communication skills, and number of anxiety symptoms presented.

Results

Anxiety Symptom Presentation.

The current analysis examined if the frequency of individual anxiety symptoms varied between the HFA, OO, and TD groups. Symptoms of six anxiety disorders were examined. The disorders included separation anxiety, social phobia, specific phobia, generalized anxiety disorder, obsessive-compulsive disorder, and panic disorder. The frequency of participants who met the full criteria for diagnosis of each disorder is presented in Table 3.

Separation Anxiety.

The K-SADS screener examines five symptoms of separation anxiety. A Chi-Square test was run to examine group differences on each of these five symptoms. There were no group differences for four of the five symptoms (See Table 2). There was a significant difference between groups for one symptom, which was “fears harm befalling

attachment figure,” $\chi^2 = 6.336, p = .042$ (see Table 2). Post hoc Chi-Square tests revealed that a significantly larger proportion of HFA individuals presented this symptom than individuals in the TD group.

Social Phobia.

The K-SADS screener measures social phobia in terms of two symptoms. Chi-Square tests revealed a significant between-group difference on the first symptom, which was “shrinks from contact,” $\chi^2 = 2.991, p < .001$ (see Table 2). Post hoc Chi-Square tests revealed that the HFA individuals presented the “shrinks from contact” symptom more often than the OO individuals. The HFA individuals also presented this symptom more often than the TD individuals. There were no significant between-group differences for the second symptom of social phobia, which was “fear of social situations” (see Table 2).

Specific Phobias.

The K-SADS examines two symptoms for specific phobias, distress and avoidance. Chi-Square tests revealed no significant between-group differences for either symptom (see Table 2).

Generalized Anxiety Disorder (GAD).

The K-SADS examines four symptoms of GAD. Chi-Square tests for three of these symptoms revealed no significant between-group differences (see Table 2). A Chi-Square test for one symptom, “unrealistic worry about future,” showed significant between-group differences, $\chi^2 = 20.294, p < .001$ (see Table 2). Post hoc Chi-Square tests revealed

that the HFA individuals were more likely to present the “unrealistic worry” symptom than both the OO individuals and the TD individuals. In addition, the OO group was more likely to present this symptom than the TD group. This was the only way in which the OO group significantly differed from the TD group.

Obsessive-Compulsive Disorder (OCD).

The K-SADS measures OCD in terms of two symptoms: obsessions and compulsions. Chi-Square tests did not reveal significant between-group differences for either of these symptoms (see Table 2).

Panic Disorder.

The K-SADS measures panic disorder in terms of one symptom: panic attacks. There were no significant between-group differences for this symptom (see Table 2).

Autism Severity and Anxiety Symptoms.

The current analysis also examined whether or not autism severity or IQ was related to number of anxiety symptoms. Correlations were run between WASI Performance IQ, WASI Verbal IQ, ADOS scores for Communication and Social skills, and Vineland scores for parent-reported Communication and Socialization behaviors. This analysis was done across all cases rather than within individual groups to allow for a greater range in scores on all measures.

There was a positive correlation between total number of anxiety symptoms (across all disorders) and both the ADOS Communication and Social scores (see Table

4). Since higher ADOS scores indicate more symptoms in the domain, this correlation suggests that greater levels of anxiety are associated with greater autism symptoms in the communication and social domains. There was a negative correlation between the total number of symptoms and both the Vineland Communication and Socialization scores (see Table 4). In the current sample, individuals with more anxiety symptoms had poorer communication and social skills. Correlations were also conducted for each anxiety disorder individually, which generally showed the same pattern of results (see Table 4). Across all anxiety disorders, there was no correlation between IQ score and number of anxiety symptoms (see Table 4).

Table 1: *Participant Characteristics*

Mean (SD) Range	HFA	OO	TD	F/χ^2	p	Tukey/ Games-Howell
	N=33	N=30	N=34			
Gender (male:female)	30:3	23:7	31:3	3.69	.16	
Age	13.3 (2.8) 8.63-20.04	12.8 (3.5) 8.47-21.24	13.9 (2.6) 9.93-21.72	.927	.40	
WASI VIQ	103.2 (12.5) 81-133	111.9 (13.9) 80-137	112.0 (11.2) 93-138	5.33	.01	HFA<OO, TD
WASI NVIQ	111.6 (13.4) 78-147	112.2 (14.5) 87-142	112.8 (11.3) 89-139	0.07	.94	
Vineland— Communication	83.9 (14.2) 42-108	98.3 (12.6) 79-122	93.4 (9.1) 78-119	11.5	<.001	HFA<OO,TD
Vineland— Social	76.5 (16.1) 46-109	102.5 (8.1) 80-118	101.7 (8.6) 86-120	53.3	<.001	HFA<OO,TD
ADOS— Communication	3.48 (1.35) 2-6	0.47 (0.63) 0-2	0.41 (0.56) 0-1	118.9	<.001	HFA>OO,TD
ADOS— Social	6.82 (2.33) 4-13	1.07 (1.26) 0-4	0.50 (0.75) 0-2	159.0	<.001	HFA>OO,TD

Table 2: *K-SADS Results*

	HFA	OO	TD	χ^2	p	Post hoc
Separation Anxiety						
Fears that calamitous event will cause separation	Not present: 93.9% Subthreshold: 6.0% Threshold: 0.0%	Not present: 96.7% Subthreshold: 3.3% Threshold: 0.0%	Not present: 100.0% Subthreshold: 0.0% Threshold: 0.0%	2.061	.357	
Fears harm befalling attachment figure	Not present: 75.8% Subthreshold: 24.2% Threshold: 0.0%	Not present: 82.8% Subthreshold: 17.2% Threshold: 0.0%	Not present: 97.1% Subthreshold: 2.9% Threshold: 0.0%	6.336	.042	HFA > TD
School reluctance/refusal	Not present: 97.0% Subthreshold: 0.0% Threshold: 0.0%	Not present: 100.0% Subthreshold: 0.0% Threshold: 0.0%	Not present: 94.1% Subthreshold: 5.9% Threshold: 0.0%	3.725	.155	
Fears sleeping away from home/sleeping alone	Not present: 90.1% Subthreshold: 3.0% Threshold: 6.0%	Not present: 90.0% Subthreshold: 6.7% Threshold: 3.3%	Not present: 97.1% Subthreshold: 0.0% Threshold: 2.9%	2.856	.582	
Fears being alone at home	Not present: 87.9% Subthreshold: 12.1% Threshold: 0.0%	Not present: 90.0% Subthreshold: 10.0% Threshold: 0.0%	Not present: 32 Subthreshold: 2 Threshold: 0	.801	.670	
Social Anxiety						
Shrinks from contact	Not present: 48.5% Subthreshold: 24.2% Threshold: 27.3%	Not present: 80.0% Subthreshold: 16.7% Threshold: 3.3%	Not present: 94.1% Subthreshold: 5.9% Threshold: 0.0%	20.991	.000	HFA > OO, HFA > TD
Fear of social situations	Not present: 63.6% Subthreshold: 21.2% Threshold: 15.2%	Not present: 79.3% Subthreshold: 17.2% Threshold: 3.4%	Not present: 85.3% Subthreshold: 14.7% Threshold: 0.0%	8.170	.086	
Specific Phobia						
Distress	Not present: 54.5% Subthreshold: 24.2% Threshold: 21.2%	Not present: 63.3% Subthreshold: 20% Threshold: 16.7%	Not present: 85.3% Subthreshold: 11.8% Threshold: 2.9%	8.439	.077	
Avoidance	Not present:	Not present:	Not present:	6.759	.149	

	66.7% Subthreshold: 15.2% Threshold: 18.2%	83.3% Subthreshold: 6.7% Threshold: 10.0%	91.2% Subthreshold: 2.9% Threshold: 5.8%			
Generalized Anxiety Disorder						
Unrealistic worry about future	Not present: 63.6% Subthreshold: 18.2% Threshold: 18.2%	Not present: 83.3% Subthreshold: 16.7% Threshold: 0.0%	Not present: 100.0% Subthreshold: 0.0% Threshold: 0.0%	20.294	.000	HFA > OO, HFA > TD, OO > TD
Somatic complaints	Not present: 93.9% Subthreshold: 6.1% Threshold: 0.0%	Not present: 100.0% Subthreshold: 0.0% Threshold: 0.0%	Not present: 97.1% Subthreshold: 2.9% Threshold: 0.0%	1.930	.381	
Marked self-consciousness	Not present: 69.7% Subthreshold: 18.2% Threshold: 12.1%	Not present: 73.3% Subthreshold: 23.3% Threshold: 3.3%	Not present: 88.2% Subthreshold: 8.8% Threshold: 2.9%	5.807	.214	
Marked feelings of tension/unable to relax	Not present: 72.7% Subthreshold: 21.2% Threshold: 6.1%	Not present: 90.0% Subthreshold: 10.0% Threshold: 0.0%	Not present: 94.1% Subthreshold: 5.9% Threshold: 0.0%	8.253	.083	
Obsessive-Compulsive Disorder						
Obsessions	Not present: 78.1% Subthreshold: 15.6% Threshold: 6.3%	Not present: 93.3% Subthreshold: 6.7% Threshold: 0.0%	Not present: 97.1% Subthreshold: 0.0% Threshold: 2.9%	8.212	.084	
Compulsions	Not present: 81.3% Subthreshold: 6.3% Threshold: 12.5%	Not present: 89.7% Subthreshold: 10.3% Threshold: 0.0%	Not present: 97.1% Subthreshold: 0.0% Threshold: 2.9%	8.791	.067	
Panic Disorder						
Panic attacks	Not present: 96.7% Subthreshold: 3.0% Threshold: 0.0%	Not present: 89.7% Subthreshold: 6.9% Threshold: 3.4%	Not present: 100.0% Subthreshold: 0.0% Threshold: 0.0%	4.875	.300	

Table 3: Current Anxiety Disorder Diagnoses

	HFA	OO	TD	Total
Separation Anxiety	0.0% (n=0)	0.0% (n=0)	0.0% (n=0)	0.0% (n=0)
Social Phobia	6.1% (n=2)	0.0% (n=0)	0.0% (n=0)	2.1% (n=2)
Specific Phobia	15.2% (n=5)	16.7% (n=5)	0.0% (n=0)	10.3% (n=10)
Generalized Anxiety Disorder	6.1% (n=2)	0.0% (n=0)	0.0% (n=0)	2.1% (n=2)
OCD	12.1% (n=4)	0.0% (n=0)	2.9% (n=1)	5.2% (n=5)
Panic Disorder	0/0% (n=0)	0.0% (n=0)	0.0% (n=0)	0.0% (n=0)

Table 4: Correlations

		WASI Performance IQ	WASI Verbal IQ	ADOS Communication Skills	ADOS Social Skills	Vineland Communication Skills	Vineland Social Skills
Separation Anxiety Disorder	Pearson Correlation	-.113	-.124	.069	.083	-.048	-.217*
	p values	.270	.226	.502	.422	.642	.032
Social Phobia	Pearson Correlation	-.004	-.018	.357**	.328**	-.202*	-.415**
	p values	.968	.865	.000	.001	.047	.000
Specific Phobia	Pearson Correlation	-.080	.008	.210*	.150	-.247*	-.296**
	p values	.434	.942	.039	.143	.015	.003
Generalized Anxiety Disorder	Pearson Correlation	-.129	-.104	.269**	.314**	-.116	-.220*
	p values	.208	.309	.008	.002	.257	.030
OCD	Pearson Correlation	-.006	-.175	.190	.274**	-.177	-.291**
	p values	.954	.086	.062	.007	.083	.004
Total Anxiety Disorders	Pearson Correlation	-.096	-.100	.348**	.359**	-.244*	-.451**
	p values	.350	.328	.000	.000	.016	.000

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Discussion

Broad Implications.

The current study examined rates of anxiety symptoms in three groups: HFA, OO, and TD individuals. The HFA group presented greater anxiety than both the OO and TD groups, and the OO and TD groups only differed on one anxiety symptom. Across all three groups, there was a significant association between greater anxiety symptoms and a higher level of social and communicative impairment. Taken together, these results suggest some relationship between severity of ASD and level of anxiety.

Group differences in Anxiety Symptoms.

Several of the differences between the HFA and TD groups' anxiety symptoms are consistent with the HFA group's relative difficulty with social interaction. First, HFA individuals were more likely than TD individuals to be afraid that their attachment figure would be harmed in some way, a symptom of separation anxiety. This could be because HFA individuals may be more dependent on their parent for care or in social situations than TD individuals. This could also be because parents may be less likely to attribute this symptom to their child's ASD, and may be more likely to acknowledge it as a symptom of anxiety (Gadow, DeVincent, Pomeroy, & Azizian, 2004). The HFA individuals were also more likely to pull away from physical contact, a symptom of social phobia, than TD individuals. This is consistent with HFA literature (Lopata et al., 2010; Wing, Schopler, & Mesibov, 1992), which suggests that HFA individuals are more likely to recognize their social deficits and therefore be more anxious in social situations. Because pulling away from contact is an overt symptom of anxiety, it may have been captured more easily by parent report than more internalized symptoms.

Additionally, the HFA individuals were significantly more likely than TD individuals to worry about the future, a symptom of Generalized Anxiety Disorder (GAD). Because HFA individuals likely have a greater desire for structure, routine, and predictability than TD individuals (Rutter & Lockyer, 1967; Bartak & Rutter, 1976), they may worry more than TD individuals about future uncertainties. This is consistent with HFA literature, which states that ASD individuals present higher rates of anxiety symptoms than TD individuals (Davis et al., 2011; Farrugia & Hudson, 2006; Gillott et al., 2001; Lopata et al., 2008; Kanne, et al., 2009; Muris et al., 1998).

The HFA group also differed from the OO group in some ways. As seen with the TD individuals, HFA individuals were more likely to pull away from physical contact than OO individuals. HFA individuals were also more likely to worry unrealistically about the future than OO individuals. Both of these findings provide support for the idea that the OO individuals differ in significant ways from individuals who still carry an ASD diagnosis.

While the HFA and OO groups presented different anxiety symptoms, the OO and TD groups presented anxiety symptoms very similarly. They only differed on one symptom: OO individuals were more likely to worry about the future than TD individuals. These results provide evidence for the idea that anxiety symptoms are a result of ASD, and that OO individuals lose their comorbid anxiety symptoms when they lose the core features of autism. Our results concerning symptoms of social phobia support this idea. HFA individuals were more likely than the OO individuals to present symptoms of social phobia. This may be because HFA individuals are aware of their social deficits, which leads them to be anxious in social situations. Because OO

individuals do not have the social deficits common to autism (Helt et al., 2008; Kelley et al., 2010; Kelley et al., 2006; Sutera et al., 2007), they may not be as anxious in social situations. Our results support this supposition: the OO individuals did not differ from the TD individuals in their presentation of social phobia symptoms. Therefore, there appears to be a relationship between social phobia and autism. Symptoms of social phobia that may have once been present in OO individuals may have been lost when they lost their autism diagnosis.

Autism Severity, IQ, and Anxiety Correlations.

The current study also examined the relationship between ADOS and Vineland social and communication symptoms, IQ, and anxiety symptoms in order to further examine the connection between ASD symptoms and anxiety symptoms. For the most part, the results were consistent with our hypotheses. Although we ran a correlation between IQ and symptoms of each anxiety disorder, the results were non-significant. This is likely because we had a very limited IQ range across all three groups; all of the participants in this study were very high functioning. However, there were a number of statistically significant correlations between anxiety symptoms and social and communication skills.

Total number of parent-reported anxiety symptoms was positively correlated with ADOS Communication and Social scores, and negatively correlated with Vineland Communication and Socialization scores. As mentioned, these correlations suggest an association between greater levels of anxiety and greater impairment in the communication and social domains. Causation cannot be determined from this association; however, there are a few potential explanations. First, greater anxiety may

lead to greater social and communicative impairment. This makes sense in terms of disorders such as social phobia, a disorder in which an individual's anxiety prevents them from functioning well socially. Alternatively, greater social and communicative impairment may lead to greater anxiety. This is consistent with the idea that ASD is somehow the cause of or inherently related to anxiety symptoms. Our results could support either explanation: the individuals with greater impairment, the HFA group, presented more anxiety symptoms than both the OO and TD groups.

At the level of individual anxiety disorders, there was also a significant association between social phobia and ADOS Communication scores, as well as social phobia and Vineland Communication and Socialization scores. This may suggest that impaired social and communicative functioning could lead to social phobia. This is consistent with HFA literature, which suggests that individuals with HFA may be more aware of their social deficits, which may lead them to be anxious in social situations and develop anxiety disorders such as social phobia (Lopata et al., 2010; Wing, Schopler, & Mesibov, 1992).

There was also a relationship between OCD and both the ADOS and Vineland Socialization scores. These correlations suggest that individuals with greater OCD symptoms have more impaired social functioning. This could be because individuals with OCD are too busy worrying about their obsessions and compulsions to think about or engage in social behaviors (Cath et al. 2006). In addition, compulsive and obsessive behavior may cause interruptions in social interaction. This is especially true of OCD symptoms that may overlap with ASD symptoms, such as repetitive behaviors. This may lead to social isolation. Interestingly, there was also a correlation between specific phobia

and both adaptive communication behaviors and adaptive socialization behaviors. This could be explained by phenomena similar to those occurring with OCD individuals: people with specific phobias may spend so much time organizing their lives around their phobias that they may not engage in communicative or social behaviors as they are supposed to.

Conclusion

HFA individuals present anxiety symptoms at a higher rate than both OO and TD individuals. OO individuals present anxiety symptoms at a rate similar to TD individuals, which suggests that ASD and anxiety may be related in some way, so that OO individuals lose their anxiety symptoms when they lose the core features of ASD. There is a relationship between ADOS- and Vineland evaluated autism symptoms and anxiety symptoms. Although causation cannot be determined, it appears as though individuals with more impaired social and communicative functioning present more anxiety symptoms. Future research should make use of multiple modalities of measurement of anxiety symptoms in order to gain a full diagnostic picture.

Limitations and Future Directions

The greatest limitation of this study is that the K-SADS, which measured anxiety symptoms in participants, relies on parent report. Because anxiety is an internalizing disorder, a parent may not understand the extent of their child's anxiety or underlying reasons for symptoms. Parents can only report the symptoms that they see and those symptoms that their child expresses verbally. A full psychological evaluation, including parent- and child-report of symptoms, would potentially provide a fuller picture of symptoms. Because children may have limited insight into their anxiety symptoms –

especially if they have ASD – it would also be valuable to observe anxiety in some non-structured tasks. Future research should incorporate these methods for determining anxiety symptoms.

For several reasons, this study's findings are difficult to generalize. Participants were drawn from a fairly homogeneous population, both racially and socioeconomically. The participants were all also very high functioning in terms of IQ. The TD group in particular displayed very few psychiatric symptoms, which does not necessarily represent the TD population at large. Future studies should include a more diverse sample of participants. In addition, the participants were from a wide age range. Although this was necessary to recruit enough OO individuals, it means that we had to compare participants across different developmental stages, which may have affected our results.

Another concern is that the inclusion cutoffs on the ADOS and Vineland, which were intended to clearly define the three groups, may have limited the potential for differences between the OO and TD groups. However, because the OO and TD groups were not intentionally matched on either ADOS or Vineland performance, there were still differences between groups.

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