

The Peers Intervention: Social Anxiety, Physiological Regulation, and Core Autistic Symptoms in Adolescents with Autism

Kirsten A. Schohl
Marquette University

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THE PEERS INTERVENTION: SOCIAL ANXIETY, PHYSIOLOGICAL
REGULATION, AND CORE AUTISTIC SYMPTOMS
IN ADOLESCENTS WITH AUTISM

by

Kirsten A. Schohl, B.A.

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ABSTRACT
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There have been very few effective interventions developed that have focused on improving social skills in adolescents with autism spectrum disorders (ASD), however, the need is persistent. This study aimed to evaluate the effectiveness of the Program for the Enrichment and Education of Relational Skills (PEERS: Laugeson, Frankel, Mogil, & Dillon, 2009).

PEERS focuses on improving friendship quality and social skills among adolescents, ages 11-15 years, with higher-functioning ASD. This study included 47 participants, who were randomly assigned to two groups. Assessment measures utilized parent report and adolescent self-report at pre- and post-treatment. In addition, respiratory sinus arrhythmia (RSA) was measured at both pre-and post-treatment in order to assess adolescents' physiological arousal.

Results revealed, in comparison to the waitlist control group, that the experimental treatment group significantly improved their knowledge of PEERS concepts and friendship skills, increased in their amount of get-togethers, and displayed less autistic symptoms as reported by parents, from pre-to post-PEERS. RSA was found to significantly decrease over time in both groups, contrary to expectations.

This study greatly adds to the minimal literature regarding social skills interventions for adolescents with ASD, as well as suggests further avenues for understanding the complex effect of intervention on physiology in ASD.

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INTRODUCTION

The number of youth diagnosed with Autism Spectrum Disorder (ASD) has increased dramatically over the past decade and currently affects approximately 1 in 88 children in the U.S. (Centers for Disease Control and Prevention, 2012). It has also been suggested by empirical and clinical evidence that those with Asperger's Syndrome (AS) or High Functioning Autism (HFA), terms which are often used interchangeably, may be the fastest growing segment of the autism population (Rao, Beidel, & Murray, 2008).

ASD symptoms are pervasive and vary greatly in severity. In general, those with ASD have numerous domains affected, including social and behavioral functioning and language development. They are also distinguished by the presence of a variety of circumscribed interests and stereotyped, repetitive behaviors. While those with AS/HFA usually function within the typical range with regard to language and intelligence, they display impairments in social skills, which is the hallmark feature of AS/HFA.

These marked social deficits are problematic, especially during adolescence, when the demands of peer relationships and social network affiliations become heightened (Mitchell, Regehr, Reaume & Feldman, 2010). In addition to these challenges of adolescence, those with AS/HFA are typically self-conscious of their differences in social functioning, and indicate that they experience stronger feelings of loneliness and poorer quality friendships than their typically developing peers (Bauminger & Kasari, 2000). As a result, a significant number of teens with AS/HFA are at an increased risk for a variety of secondary psychopathology, such as depression and anxiety, in addition to other negative outcomes both in adolescence and adulthood, including isolation,

rejection, teasing, bullying, low self-esteem, school dropout, and unemployment (Mitchell et al., 2010).

Unfortunately, there have been very few interventions developed that have focused on improving social adaptation among teenagers with AS/HFA. In response to this need, the Program for the Enrichment and Education of Relational Skills (PEERS) intervention was recently developed in order to teach teens with AS/HFA the skills necessary to make and keep friends (Laugeson, et al., 2009).

This paper will review specific deficits in adolescents with AS/HFA, social anxiety and physiological regulation, social skill interventions, and details regarding the PEERS intervention. The study was a replication and extension of the PEERS intervention in order to evaluate its effectiveness as well as assess changes in social anxiety, physiological regulation, and core autistic symptoms, as exhibited on the Social Responsiveness Scale (SRS: Constantino, 2005).

Core Deficits in Adolescents with AS/HFA

Teens with AS/HFA have significant difficulties with their social behavior. These deficits might include inadequate use of eye contact, problems initiating social interactions, and difficulty interpreting both verbal and nonverbal social cues such as tone of voice, facial expression, gesture, gaze, and posture (Weiss & Harris, 2001). Those with AS/HFA often have problems with pragmatics, which refers to the ability to use language to communicate effectively in social situations. For example, they display problems in understanding irony, jokes, lies, deception, or bullying (Grynszpan et al., 2011). Individuals with AS/HFA also experience difficulty with the social rules of conversation, such as taking turns, providing enough information to be clear without being verbose, and

selecting information that is relevant to the topic at hand (Krasny, Williams, Provencal, & Ozonoff, 2003). Furthermore, youth with AS/HFA have difficulty sharing affective experiences or understanding the perspective of others, and, as a result, they may come across as self-centered, controlling, and lacking emotion when conversing (Carrington, Templeton, & Papinczak, 2003; Rao et al., 2007).

These initial core deficits displayed in social situations can be exacerbated during adolescence, which is a time when identification with a peer group is common. Further, adolescence can be a distressing phase of life for many teens with AS/HFA due to their difficulty engaging socially with peers. Because teens with AS/HFA typically have normal to high intelligence and thus greater capacity for insight, they are often painfully aware of the difficulties they experience when interacting with peers (Grynszpan et al., 2011). In a research study, youth with AS/HFA rated themselves on average more than one standard deviation below the mean of typically developing children on social skills, such as joining groups, demonstrating social competence, and developing close friendships (Rao et al., 2007). These findings suggest that adolescents with AS/HFA are, in fact, cognizant of their social inabilities.

In addition to the increased awareness teens with AS/HFA may possess, adolescence is a time when “fitting in” with one’s classmates is of prime importance. Since the majority of today’s youth with AS/HFA are placed in regular education classrooms as opposed to special needs classrooms (Sofronoff, Dark, & Stone, 2010), presenting with social incompetence may lead to the opposite of “fitting in.” Despite the finding that regular education placement leads to increases in the complexity of interactions and decreases in nonsocial activity, teens with AS/HFA often report feeling

lonelier and having poorer quality friendships than their typically developing peers (Bauminger & Kasari, 2000). It has been suggested that having one or two best friends is of great importance to later adjustment. Specifically, having friends buffers the impact of stressful life events, correlates positively with self-esteem, and correlates negatively with anxious and depressive symptoms (Buhrmester, 1990). Unfortunately, these benefits are not possible for many teens with AS/HFA, as it has been found that nearly 50% of teenagers with ASD do not have a friend (Howlin, 2000).

In addition to being neglected by peers, teens with AS/HFA may also be actively rejected and victimized. One research study compared victimization rates in a regular school setting among typically developing teens and teens with AS. They found that victimization rates were four times higher in the AS sample, with up to 75% of adolescents with AS being victimized (Little, 2001). Furthermore, Little (2002) found that 94% of the children with either Asperger Syndrome or a nonverbal learning disability were victimized in the past year, as reported by their mothers. Victimization can compound the friendship-making difficulties teens with AS/HFA exhibit, and, thus, these teens again miss out on the positive aspects of social interactions and relationships with others.

Unfortunately, the idea that those with AS/HFA will simply “outgrow” their social skill deficits after adolescence is not supported by research. Instead, these difficulties persist into adulthood, where they continue to negatively impact social and occupational functioning. It has been found that adults with AS/HFA are more likely than the general population to be unemployed or underemployed, as well as less likely to have satisfying social relationships and community connections (Rao et al., 2007). As this

research demonstrates, understanding the social world is essential for those with AS/HFA to function properly and gain autonomy.

Social Anxiety and Physiological Regulation

In addition to displaying social skill deficits and dealing with the heightened social demands of adolescence, teens with AS/HFA may also present with anxiety, especially during social situations. Anxiety-related concerns are among the most common presenting problems for school-age children and adolescents with ASD, as 11% to 84% experience some degree of impairing anxiety (White et al., 2010). Furthermore, research indicates that anxiety is universally comorbid with ASD. There is evidence to suggest that anxiety difficulties occur more frequently in ASD populations, as compared to children with severe mental retardation, epilepsy, conduct disorder, and children who have a language disorder (Chalfant, Rapee, & Carroll, 2007).

Regarding social anxiety in particular, those with AS/HFA report significantly more social anxiety symptoms than their typically developing peers, and these symptoms increase as they get older, in contrast to the decreasing pattern often displayed in typically developing teens (Sebastian, Blakemore, & Charman, 2009). Moreover, one research study found that from a sample of 41 high-functioning adolescents with AS/HFA, 49% of the sample scored above the clinically significant level of social anxiety on a self-report measure (Bellini, 2004). Interestingly, 16 of the participants in this study were taking anxiolytics, which may have affected how they answered the anxiety related questions. Therefore, it may be that this finding was deflated.

Bellini's Developmental Pathway to Social Anxiety

There are different theories as to why social anxiety is so common among the AS/HFA population. Most of the theories, however, are encompassed in Bellini's (2006) developmental pathway to social anxiety. See Figure 1. According to Bellini, there is a feedback loop between physiological arousal, social anxiety, and social interaction. The pathway begins with the notion that individuals with AS/HFA present with a temperament that is marked by a high degree of physiological arousal. This physiological arousal may make it more likely that the individual will become overwhelmed by interactions with others and avoid later social interactions. This social withdrawal then limits the opportunity for the individual to develop and practice effective social skills by reducing interactions with peers. The impairment in social skill functioning then significantly increases the chances for negative peer interactions and social failure. To complete the pathway, the presence of physiological hyperarousal makes it more likely that the individual will be adversely conditioned by these negative social experiences, thus leading to increased social anxiety. To intensify the problem, the presence of social anxiety may lead to further social withdrawal, thus beginning the cycle again (Bellini, 2006).

Heightened physiological arousal might help explain why profound anxiety in social situations occurs more frequently in people with ASD. The Polyvagal Theory (Porges, 1995) explains this connection between physiological state, specifically heart rate, and social behavior. Further, this theory suggests a neurobehavioral link between poor regulation of the heart and social engagement deficits. It states that the myelinated vagus nerve functions as a tightly regulated "vagal brake" in safe social situations to rapidly change visceral state by either slowing down or speeding up the heart (Porges,

Doussard-Roosevelt, Portales, & Greenspan, 1996). When the vagal brake is applied, one's heart rate is decreased to promote calm behavioral states and thus foster social interaction. The myelinated vagus, as a key contributor to the parasympathetic nervous system, can be monitored by measuring the amplitude of respiratory sinus arrhythmia (RSA). High amplitude RSA is evidence of a dampened sympathetic nervous system response, and, in turn, an increase in parasympathetic (vagal) control over physiological state (Porges, 2007). It has been theorized that an increase in parasympathetic control of heart rate provides a calm physiological state, which may promote initiation of social behavior (Porges, 2007).

Recent research has focused on heart rate regulation as well as its effect on social behavior in individuals with ASD. One study found that children with ASD have significantly lower levels of RSA than typically developing children, meaning that they experience more arousal at a resting state, which may serve as a foundation from which anxiety stems in social interchange (Vaughan Van Hecke et al., 2009). Similarly, Ming and colleagues (2005) demonstrated that autistic children with and without symptoms of autonomic dysfunction had lower cardiac vagal tone compared to typical children.

Another study compared children with ASD and typically developing children, ages 7-17 years. RSA was evaluated while participants viewed videos of faces showing various emotions. Researchers found that children with ASD had significantly lower amplitude RSA and faster heart rate than typically developing children at baseline, suggesting lower overall vagal regulation of heart rate (Bal, Harden, Lamb, Vaughan Van Hecke, Denver, & Porges, 2010). Moreover, in a study involving children with ASD, higher RSA was significantly correlated with better social functioning, as assessed by increased joint

attention and higher receptive vocabulary skills (Patriquin, Scarpa, Friedman, & Porges, 2011).

Another study focused on selective mutism, which is a disorder characterized by compromised social engagement behaviors and heightened states of social anxiety. This disorder presents some characteristics that are similar to autism. Researchers found that, as compared to typically developing children, individuals with selective mutism had dysregulation of activity of the vagus nerve during a social task with the researcher (Heilman et al., 2006).

These findings collectively point toward the idea that children with ASD may be in a “mobilized” physiological state. Thus, they are unable to promote calm behavioral states, decrease negative affect and, most importantly, engage in positive social engagement, which is the hallmark limitation in those with AS/HFA (Bal et al., 2010). Further, it may be that those with AS/HFA are doubly affected, in that the Polyvagal system that controls heart rate is not functioning properly, leading to less regulated heart rate and anxiety-like responses, and, also, that many of the behavior deficits observed in AS/HFA, such as poor eye gaze, low facial affect, and lack of prosody, are indicators of less adaptive functioning of the nervous system. The current research also suggests that RSA, as an index of myelinated vagus activity, reflects a unique neurophysiological gateway into the social functioning of individuals with ASD. While there are a handful of studies that have looked at RSA in children with ASD, there is a paucity of studies evaluating autonomic activity in adolescents with AS/HFA, as well as the effect that intervention may have on regulation of heart rate.

Social Skills Interventions for Teenagers with AS/HFA

Interventions that target improving social skills are essential for individuals with ASD. Given the pervasive impact and long-term nature of social skill deficits in AS/HFA, social skill training programs aimed at teens may prevent or at least lessen subsequent social dysfunction (Goldstein & McGinnis, 2000). Although there have been a minimal number of interventions developed and implemented aimed at teenagers with AS/HFA, there are a few programs that prove important and should be mentioned.

Ozonoff and Miller (1995) developed a 14-week social skills intervention, which focused on teaching teens basic interactional and conversational skills and how to infer the mental states of others, otherwise called Theory of Mind (ToM). The participants included five high-functioning adolescent boys with ASD. After the intervention, improvements on several perspective-taking ToM tasks were noted in the treatment group relative to the no-treatment control group. This suggests perspective taking abilities can in fact be improved with intervention. Post-treatment ratings completed by adolescents' parents and teachers, however, suggested that there were no improvements of teens' social competence skills or teens' generalization of skills to other settings.

Tse and colleagues (2007) conducted a social skills intervention for 46, 13-18-year-old teens for twelve weekly sessions. Many of the exercises used to teach new skills were adapted from a book titled, *Skillstreaming the Adolescent* (Goldstein & McGinnis, 2000). Skills were presented through didactic instruction and role plays. There was no control group, however, parent report measures showed significant gains in social competence and decreases in problem behaviors following the intervention. Adolescents reported more perceived skill improvements than did parents. Parent-reported

improvement suggests that the social skills learned in group sessions did apply to settings outside the treatment group.

Another study (Mitchell et al., 2010) focused on the generalization effects of a group social skills training program with parent training for three adolescents with AS/HFA. The social skills curriculum was adapted from “Navigating the Social World” (McAfee, 2002) and included topics such as privacy circles, offering and asking for help, giving and receiving compliments, resolving conflicts, and basic rules for initiating conversations. The adolescents met weekly for 12 training sessions, and parents attended separate, but concurrent, tri-weekly parent training sessions. Researchers found that group social skills training and parent training were associated with increased generalized targeted social skills across behavioral and social measures, and gains were maintained at 3-months follow-up. This study was limited, as it had a very small sample size, however, the utilization of parent sessions and focus on generalization of skills are two vital components that were incorporated (Mitchell et al., 2010).

PEERS

The Program for the Enrichment and Education of Relational Skills (PEERS: Laugeson et al., 2009), incorporates and builds upon many of the elements integral for social skills teaching success. PEERS content, as well as the lesson format, was adapted and modified from Children’s Friendship Training (CFT), an evidence-based parent-assisted social skills curriculum (Frankel & Myatt, 2003). CFT has been demonstrated to be successful for children with Attention-Deficit/Hyperactivity Disorder (Frankel et al., 1995, 1997), children with Fetal Alcohol Spectrum Disorders (O’Connor et al., 2006) and children, grades 2nd-7th, with ASD (Frankel & Myatt, 2007). These studies found that

social skills were generalized outside the treatment situation and were maintained for at least 3 months after treatment ended. The PEERS intervention modified the curriculum and methods of instruction, and added new modules, in order to be more applicable for teens with AS/HFA (Laugeson et al., 2009).

The most important aspects of the PEERS intervention are that it is empirically supported, is based on a large sample (compared to prior studies), and is a manualized treatment, which promotes replication. There are three other critical features of this intervention that should be mentioned, as each adds to the distinctiveness of the PEERS program.

First, teaching of social skills is conducted in a small group format, as this allows for a more personal experience for the teens. PEERS also utilizes many evidence-based strategies for teaching social skills to adolescents with AS/HFA, which include brief didactic instruction, role-playing, modeling, behavioral rehearsal, coaching with performance feedback, and weekly socialization assignments with consistent homework review (Gresham et al. 2001; Laugeson et al., 2009).

Second, PEERS allows the parents of the teen participants to play an integral part in the treatment process, as parents are required to engage in separate, concomitant sessions. Many previous programs have not incorporated parents into the treatment process. Research, however, suggests that parents can have a profound impact on their child's friendships (Frankel & Myatt, 2003). This may be through direct instruction, modeling appropriate social behavior, and supervision. By supporting their child's development of an appropriate peer network, learning to act as social coaches, and encouraging them to engage in social situations despite their struggles, parents can be

critical components of their teens' social development and retention of newly learned skills once the program has ended (Frankel & Myatt, 2003; Laugeson et al., 2009).

Third, PEERS focuses on teaching rules of social etiquette through the identification of common social situations using accompanying concrete rules and steps of appropriate social etiquette. This style of learning compliments those with AS/HFA, as they thrive on structure and concrete presentation of information (Carnahan, Hume, Clarke & Borders, 2009). Skills covered in PEERS include conversational skills, peer entry and exiting skills, expanding and developing friendship networks, how to handle teasing, bullying, and arguments with peers, practicing good sportsmanship, changing bad reputations, and good host behavior during get-togethers (Laugeson et al., 2009) (see Table 2).

The PEERS program was empirically supported with 33 teens, ages 13–17 years with AS/HFA (Laugeson et al., 2009). Results revealed that in comparison with the waitlist control group, the treatment group significantly improved their knowledge of social skills, increased frequency of hosted get-togethers, and improved overall social skills as reported by parents. Moreover, in a long term follow-up study of the PEERS participants, researchers found that the improvements made from baseline to post-intervention were maintained 5 years after treatment (Mandelberg, Laugeson, Frankel, Gantman, Cunningham, & Bates, 2011). Although PEERS has shown evidence of success in both the short and long term (Laugeson et al., 2009; Mandelberg et al., 2011), it has not been replicated outside of its site of development, nor have other domains been assessed.

Aims of the Current Study

Thus, the current study was an independent replication and extension of the PEERS intervention in order to evaluate the effectiveness of the program as well as to assess changes in social anxiety, physiological regulation, and core autistic symptoms. This PEERS extension was distinctive from the first PEERS trial (Laugeson et al., 2009). It addressed and resolved one of the shortcomings of the first implementation of PEERS, as it used more valid diagnostic screening. This study also expanded upon previous findings by assessing social anxiety both subjectively, by using a teen self-report anxiety questionnaire, and objectively, by measuring physiological regulation via RSA. In addition, this study assessed for core autistic symptom changes, as exhibited on the Social Responsiveness Scale (SRS; Constantino, 2005), which has not been done previously.

It was hypothesized that teens in PEERS will show evidence of PEERS' efficacy, as compared to the waitlist control group, from pre- to post-treatment. More specifically, (a) teens in PEERS will significantly gain knowledge of PEERS concepts and friendship skills, as compared to the waitlist control group, from pre- to post-treatment; (b) teens in PEERS will significantly increase in their amount of get-togethers, as compared to the waitlist control group, from pre- to post-treatment and (c) teens in PEERS will have significantly better quality friendships, as compared to the waitlist control group, from pre- to post-treatment. It was hypothesized that teens in PEERS will significantly decrease in their levels of social anxiety, as compared to the waitlist control group, from pre- to post-treatment. In addition, it was hypothesized that teens in PEERS will have significantly higher resting RSA, as compared to the waitlist control group, from pre-to post-treatment. It was hypothesized that teens in PEERS will significantly

decrease in their levels of autistic symptoms, including increases in social awareness and social information processing, and decreases in social anxiety/avoidance and autistic preoccupations/traits, as compared to the waitlist control group, from pre- to post-treatment.

METHODS

Participants

There were 47 teens between 11 and 15 years of age with ASD who participated in and completed this study with their parents. All participants had a previous and current diagnosis of ASD. 38 participants were male and 9 were female. The average age of participants was approximately 13.15-years-old. It was found that 42 of the participants identified themselves as Caucasian; 2 as African American; 1 as Asian; and 2 chose not to answer.

Recruitment and eligibility. Participants were recruited through the greater Milwaukee area school system, as well as sites offering treatment and support for teens with autism and their families (e.g., Easter Seals Disability Services, Autism Society of Southeastern Wisconsin). Relationships were established with these local organizations, and permission from the Institutional Review Board (IRB) was gained to advertise at these sites. A graduate research assistant conducted phone screenings with interested families. Phone screenings consisted of telling the family about the program, gauging if the adolescent meets the inclusion criteria (see below), and gaining a sense of the adolescent's interest in participating in the program. If the family passed the phone screening, then the graduate research assistant scheduled a 2.5 hour-long intake with the family.

Inclusion criteria for teens were: (a) chronological age is between 11 and 15 years; (b) social problems as reported by the parent; (c) English fluency for the teen; (d) having a parent or family member who is a fluent English speaker and who is willing to

participate in the study; (e) no history of major mental illness, such as bipolar disorder, schizophrenia, or psychosis; (f) no history of hearing, visual, or physical impairments which preclude the teen from participating in PEERS activities; (g) a previous and current diagnosis of either HFA, AS, or Pervasive Developmental Disorder—NOS assessed via the Autism Diagnostic Observation Schedule (ADOS: Lord, Rutter, Dilavore, & Risi, 2001); (h) a teen verbal IQ of 70 or above assessed via the Kaufman Brief Intelligence Test-Second Edition (Kaufman & Kaufman, 2005; Laugeson, et al., 2009). In order to gauge the teens' motivation for participating in the intervention, the study only included teens who verbally expressed an interest in learning how to make and keep friends.

Those who came to the intake visit and did not meet inclusion criteria were compensated with a \$30 Target gift card. For those who did meet criteria and choose to participate, incentives were provided in order to reduce attrition during the PEERS intervention. The incentives for parents included provision of the PEERS intervention free of charge, free parking during the duration of the study, and a brief diagnostic evaluation summary based on the baseline assessment. For the teens, incentives included light snacks provided each week during the social skills group session and a \$30 prize for the teen at the completion of PEERS.

After the intake was completed, eligible participants were randomly assigned to one of two conditions, either the experimental treatment group or the waitlist control group. Separate PEERS groups were conducted over the course of 18 months. Each cohort consisted of approximately five to ten participants (see Table 1). Once the PEERS

intervention was complete, the outtake was scheduled. During the outtake, all of the same measures, excluding the diagnostic test and cognitive test, were conducted.

Procedure

Data Collection. There were two events of the data collection process including (1) the intake that occurred before PEERS treatment and (2) the outtake that occurred after PEERS treatment. Both events took place at Marquette University's Center for Psychological Services facility and the Marquette Autism Project (MAP) laboratory.

If inclusion criteria were met during the intake, teens and parents continued the intake process by filling out assessment measures in the presence of the research team. Then, teens and parents were escorted to the MAP laboratory where the teen's heart rate was measured. The teens' baseline heart rate was taken by applying three self-adhering electrode stickers to the teen's chest area and was measured while they were seated in a comfortable chair and still for a total of three minutes.

A Biopac ambulatory heart rate monitor (Biopac Systems, Inc.: Goleta, CA.) was used for the collection of heart rate data using self-adhering electrodes in a standard three-lead configuration. The Biopac detected the peak of the R-wave, the upward deflection or peak of the heartbeat, to the nearest millisecond. It also measured the sequential R-R intervals (i.e., heart periods) to the nearest millisecond. Data was stored for off-line analysis (Bal et., 2010; Porges, 1985).

Participants in the experimental treatment group completed measures just prior to receiving the intervention and then within the last two weeks of the intervention. The waitlist control group participants completed measures during the intake procedures and just prior to the time that the experimental treatment group ended the intervention. Pre-

and post-assessments were compared at week 1 and week 14 for both groups. This design allowed an examination of differences between these two groups over a 14-week period in which the experimental treatment group received the intervention, while the waitlist control group had not yet received the intervention.

Treatment. The PEERS intervention consists of 90-minute sessions, delivered once a week over the course of 14-weeks. Parents and teens attended separate, concurrent sessions where they learned how to make and maintain friends and implement the rules taught. The group leaders were a developmental psychologist and clinical psychology doctoral graduate students with at least a Master's degree in Clinical Psychology; all of whom specialized or are specializing in autism. In addition, PEERS intervention training was conducted by Dr. Van Hecke, who was trained and certified at the official PEERS training program at UCLA.

Research assistants acted as “coaches” in the teen sessions with at least one coach in each session. Coaches helped with role-play activities, behavioral rehearsal, and behavioral management. These coaches were undergraduate students in psychology and were trained in all aspects of the PEERS intervention.

The PEERS teen group always began with a homework review of the assignment from the previous week. They were then taught specific social skills for the week. Regarding the teen group's didactic lessons, they were enhanced by demonstrations in which the group leaders modeled the appropriate social skill being taught through role-play exercises. The newly learned skills and rules for that week were then rehearsed by the teens in the session, while receiving feedback from the group leader and coaches.

In the parent session, time was devoted to troubleshooting any problems that may have occurred due to the incompleteness of homework. Next, a didactic lesson, which was outlined in a handout given in the parent group, was conducted (see Table 2). Parents were given instruction on ways in which they could help their teen overcome hindrances to weekly socialization homework assignments.

At the end of group, either parent or teen, homework was assigned for the coming week, allowing time to troubleshoot potential obstacles to homework completion. Multiple homework assignments were given on a weekly basis, and typically corresponded to the current didactic lesson. The sessions concluded with parents and teens reuniting in the same room, where the teens provided a brief review of the lesson for parents, and homework assignments were finalized. In order to minimize parent-teen conflict during the completion of these assignments, the level of parental involvement as well as teen refusal to do the homework was individually negotiated at the end of the session with the help of group leaders (Laugeson et al., 2009).

Treatment fidelity. The treatment protocol was monitored for adherence in the teen sessions by trained research assistants through completion of weekly fidelity check sheets covering all elements of the intervention. Their role was to view the session outline and follow along with the group leader. Further, if the group leader missed a main point of the session, the research assistant would politely interrupt the leader and remind them to discuss a missed point.

Measures

Verbal intellectual functioning.

Kaufman Brief Intelligence Test-Second Edition. Verbal intellectual functioning was assessed using the verbal subscale of the Kaufman Brief Intelligence Test-Second Edition (KBIT-2; Kaufman & Kaufman, 2005), which takes approximately 25 minutes to administer. Normative data is available and expressed as standard scores with a mean of 100 and a standard deviation of 15. The KBIT-2 demonstrates good psychometric estimates, including an internal reliability for the IQ composite of 0.93, a test–retest reliability range of 0.88–0.89, and a standard error of the measurement of 4.3 points (Kaufman & Kaufman, 2005). The KBIT-2 has also been shown to be comparable to the Wechsler Intelligence Scale for Children-fourth edition (WISC-IV), in terms of acceptable correlations with the WISC-IV for diverse populations (Walters & Weaver, 2003).

Autism diagnosis.

Autism Diagnostic Observation Schedule. The Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2001) is a structured, interview-based observational assessment conducted with the teen. The teen is presented with activities and questions which aim to elicit communicative and social behaviors that are typically difficult for individuals with ASD. Algorithm scores for communication and socialization are calculated to support the likelihood, or lack thereof, of ASD diagnosis. The ADOS typically takes 30–45 min to complete and has excellent test–retest reliability (.82) and inter-rater reliability (.92) (Lord et al., 2001). All participants enrolled in the study

obtained combined scores (communication and social interaction) above the algorithm diagnostic threshold for ASD, thus confirming their previous ASD diagnosis.

Questionnaire measures.

Test of Adolescent Social Skills Knowledge. In order to assess PEERS efficacy, the Test of Adolescent Social Skills Knowledge (TASSK; Laugeson & Frankel, 2006) was used. The TASSK consists of 22-items that assess the teen's knowledge about the specific social skills taught during the intervention. Two items were derived from each of the 11 didactic lessons. The TASSK is comprised of sentence stems and two possible answers. Total scores range from 0 to 22, with higher scores reflecting greater knowledge of the taught social skills. According to Laugeson et al. (2009), coefficient alpha for the TASSK was 0.56. However, they asserted that this was acceptable, given the large domain of questions on the scale. In the current study, the TASSK coefficient alpha was similarly very low, as the questions on the TASSK were not expected to cohere with one another.

Quality of Socialization Questionnaire – Adolescent. In order to assess PEERS efficacy, the Quality of Socialization Questionnaire – Adolescent (QSQ-A-R; Frankel & Mintz, 2008) was used. The QSQ-A-R is comprised of 12 items that are administered to parents and teens independently to assess the frequency of get-togethers with peers, number of friends involved, and the level of conflict during these get-togethers. In this study, only the teens' responses were used. Two items ask for an estimate of the number of hosted and invited get-togethers the teen has had over the previous month, and this sum total of invited and hosted get-togethers was used in this study. The QSQ-A-R was developed through factor analysis of 175 boys and girls

(Laugeson et al., 2009). Given that the total get-togethers variable consists of only two question items, coefficient alpha was not provided by the developer of the instrument and was not calculated in the current study.

Friendship Qualities Scale. In order to assess PEERS efficacy, the Friendship Qualities Scale (FQS; Bukowski et al., 1994) was used. The FQS assesses the teen's perceptions of the quality of his/her best friendships. It has 23 items, each on a scale from 1-5, where 1 means not true and 5 means really true. It consists of five different subscales (Companionship, Closeness, Help, Security, and Conflict) and takes approximately 10 minutes to complete. Teens are instructed to identify their best friend and keep this friendship in mind when completing this measure. An example of an item is, "My friend and I spend all of our free time together." The Total score ranges from 23 to 115, with higher scores reflecting better quality friendships. Previous research has noted that coefficient alphas for subscales range from 0.71 to 0.86. Confirmatory factor analysis supported the factor structure of the subscales, and comparisons between ratings by reciprocated versus non-reciprocated friends supported the discriminant validity of the scales (Bukowski et al., 1994). In the current study, the coefficient alphas were acceptable (Total score = .89, Companionship = .69, Closeness = .77, Help = .85, Security = .76, and Conflict = .74).

Social Anxiety Scale-Adolescent. In order to assess teens' social anxiety the Social Anxiety Scale-Adolescent (SAS-A; La Greca & Lopez, 1998) was used. The SAS-A consists of 22 (4 are filler items) items divided into three subscales. The first subscale, Fear of Negative Evaluation (FNE), reflects fears, concerns, or worries regarding negative evaluations from peers; it includes eight items (e.g., "I worry about

what other kids think of me"). In addition, there are two subscales for Social Avoidance and Distress: SAD-New and SAD-General. SAD-New reflects social avoidance and distress with new social situations or unfamiliar peers; it includes six items (e.g., "I get nervous when I meet new kids"). SAD-General reflects more generalized or pervasive social distress, discomfort, and inhibition; it includes four items (e.g., "I feel shy even with kids I know well"). Each item is rated on a 5-point scale according to how much the item "is true for you" (1 = not at all, 5 = all the time). Each subscale is scored in such a way that high scores reflect greater social anxiety. Scores from the three subscales are summed to form a Total score. The SAS-A is psychometrically sound and has excellent construct validity. Research has found that the internal consistencies for the subscales range from .69 (SAD-General) to .78 (SAD-New) to .86 (FNE) (Inderbitzen-Nolan & Walters, 2000). In the current study, the coefficient alphas were acceptable (Total score = .89, FNE = .92, SAD-New = .86, and SAD-General = .69).

Social Responsiveness Scale. In order to assess teens' core autistic symptomatology the Social Responsiveness Scale (SRS; Constantino, 2005) was used. The parent form of this measure was used in this study. The SRS is a 65-item rating scale that measures the severity of autism spectrum symptoms as they occur in natural social settings and takes approximately 15 to 20 minutes to complete. It is appropriate for use with children through adolescents from 4 to 18 years of age. Each item is rated on a scale from "0" (never true) to "3" (almost always true). The SRS includes items that ascertain social awareness (e.g., "Knows when he/she is too close to someone or invading someone's space"), social information processing (e.g., "Concentrates too much on parts of things rather than 'seeing the whole picture' for patterns of behavior"), social

anxiety/avoidance (e.g., “Does not join group activities unless told to do so”), and characteristic autistic preoccupations/traits (e.g., “Has repetitive, odd behaviors, such as hand flapping or rocking”). The SRS generates a Total scale score that serves as an index of severity of social deficits in the autism spectrum. Higher scores on the SRS indicate greater severity of social impairment. The SRS also produces 5 subscale scores. The psychometric properties of the SRS have been previously tested in studies involving over 1,900 children ages 4–15 years and have yielded good reliability and have demonstrated good validity. Specifically, previous research has found that the test-retest reliability coefficient was .88 for the Total scaled score (Constantino et al., 2000; Constantino & Todd, 2003). In the current study, the coefficient alphas were acceptable (Total score = .84, Social Awareness = .58, Social Cognition = .73, Social Communication = .76, Social Motivation = .69, and Autistic Mannerisms = .78).

RESULTS

Data analysis and screening

Regarding the analysis process, heart rate data was edited to remove R-wave detection artifact via the CardioEdit program (Porges, Chicago, IL). RSA was quantified following Porges' (Porges, 1985; Porges & Bohrer, 1990) technique, which uses the natural logarithm of the variance of the band pass series as RSA (Rinolo & Porges, 1997), via the CardioBatch program. RSA was assessed during sequential 30-sec periods and was averaged over a period of three minutes.

There were 24 teens assigned to the experimental treatment group and 23 teens that were assigned to the waitlist control group. Chi square analyses for gender and race were not significant. T-tests for group differences in KBIT-2 Verbal IQ and ADOS total score both failed to reach significance as well. A t-test conducted for age, however, produced a significant difference between the two groups, $t(46) = 3.54, p < .05$. Specifically, the experimental treatment group ($M = 13.83, SD = 1.43$) comprised older teens than the waitlist control group ($M = 12.48, SD = 1.16$). Age was not used as a covariate in analyses conducted because it was not expected to affect most variables (Tabachnik & Fidell, 2007). However, age was examined as a covariate for the analysis of RSA since RSA tends to increase across age (Alkon, Goldstein, Smider, Essex, Kupfer, & Boyce, 2003).

Most of the baseline variable comparisons of the experimental treatment group and the waitlist control group did not reach statistical significance. The only exception to this was the QSQ-A-R scores, $t(46) = -2.26, p < .05$, meaning that the waitlist control

group had significantly more get-togethers at pre-PEERS than the experimental treatment group. Upon further examination of the QSQ-A-R data, it became evident that there was one outlier score of 90 get-togethers in the pre-intervention waitlist control group; this dataset had great variability. This data point was replaced with the next highest score in the dataset, which was 35 get-togethers, as recommended (Tabachnik & Fidell, 2007, p.77). The Levene's Test of Equality of Error Variances was violated, $F(1,45) = 20.20, p < .05$, for the pre-intervention QSQ-A-R scores both before and after this outlier was altered. Multiple attempts were made to transform the QSQ-A-R data, however, none of the strategies were successful in producing an insignificant Levene's Test. Therefore, the raw data was used for further data analysis. See Table 3 for the means of the baseline variables.

Effectiveness of the PEERS intervention

To examine the effectiveness of the PEERS intervention, three separate 2 x 2 mixed model repeated measures analyses of variance (ANOVA) were conducted. In all of the following analyses, the between groups factor was group (experimental or waitlist control) and the within groups factor was time (pre-treatment or post-treatment). See Table 4 for the ANOVA results.

A mixed model repeated measures ANOVA was conducted to assess whether teens learned the concepts presented in PEERS, via the TASSK total score. There was a significant main effect for group, $F(1, 45) = 49.21, p = .001$. There was also a significant main effect for time, Wilks Lambda = .19, $F(1, 45) = 189.10, p = .00$. However, both of these main effects were qualified by a significant Group by Time interaction, Wilks Lambda = .27, $F(1, 45) = 119.74, p = .00$, meaning that from pre- to post-treatment the

experimental treatment group showed a significant increase in their knowledge of PEERS concepts and friendship skills, as compared to the waitlist control group (see Figure 2).

A mixed model repeated measures ANOVA was conducted to assess whether teens in PEERS experienced more get-togethers with friends, via QSQ-A-R scores (sum of invited and hosted get-togethers). The main effects of Group and Time were not significant. However, the Group by Time interaction was significant, Wilks Lambda = .89, $F(1, 45) = 5.67$, $p = .02$, meaning that the experimental treatment group showed a significant increase in their number of hosted and invited get-togethers, as compared to the waitlist control group, from pre- to post-treatment (see Figure 3).

A mixed model repeated measures ANOVA was conducted to assess whether teens in PEERS experienced better friendship quality, via FQS scores. The main effects of Group and Time were not significant. The Group by Time interaction also did not reach significance.

Social Anxiety and RSA

The effects of PEERS on social anxiety and RSA was evaluated by conducting two separate 2 x 2 mixed model repeated measures analyses of variance (ANOVA). See Table 4 for these ANOVA results. First, a mixed model repeated measures ANOVA assessed the impact of PEERS on teens' social anxiety, via SAS-A Total scores. The main effects of Group and Time were not significant. The Group by Time interaction also did not reach significance, meaning that the teens in PEERS did not significantly decrease in their levels of social anxiety, as compared to the waitlist control group, from pre- to post-treatment.

A mixed model repeated measures ANOVA was also conducted to assess the impact of PEERS on teens' regulation of heart rate, which was measured via RSA. In addition, age was examined as a covariate. Age was found to be nonsignificant, thus, it was removed from the analysis and not considered further. The main effect of Group was not significant. However, there was a significant main effect for time, Wilks Lambda = .73, $F(1, 38) = 14.13$, $p = .001$, with both groups showing a decrease in RSA across time. The Group by Time interaction did not reach significance.

Core autistic symptoms

A mixed model repeated measures ANOVA assessed the impact of PEERS on teens' core autistic symptoms, which were measured via parents' ratings on the SRS. See Table 4 for ANOVA statistics. The main effect of Group was significant, $F(1, 43) = 5.94$, $p = .02$. The main effect for Time was also significant, Wilks Lambda = .69, $F(1, 43) = 18.98$, $p = .001$. However, both of these main effects were qualified by a significant Group by Time interaction, Wilks Lambda = .88, $F(1, 43) = 6.15$, $p = .02$, meaning that the experimental treatment group showed a significant decrease in their core autistic symptoms, as compared to the waitlist control group, from pre- to post-treatment (see Figure 4).

DISCUSSION

This replication and extension of the PEERS intervention aimed to address three specific domains. The study examined whether teens who participated in PEERS would show evidence of the effectiveness of the intervention, as well as a decrease in social anxiety, more adaptive RSA, and a decrease in core autistic symptoms, as compared to the waitlist control group. Results were encouraging, but mixed, in that some hypotheses were found to be supported, while others were not.

The first main hypothesis revolved around the effectiveness of the PEERS intervention, which was tested using three different teen report measures, namely the TASSK (PEERS knowledge), QSQ-A-R (number of get-togethers), and FQS (friendship quality). The first hypothesis was supported, as teens in the experimental treatment group demonstrated improved knowledge of PEERS concepts and friendship skills on the TASSK, as compared to the waitlist control group, from pre- to post-treatment. This finding replicates past results of the first study published by the developer of PEERS (Laugeson et al., 2009). Although it is not completely unexpected that teens displayed retention of learned information, this finding does point to the effectiveness of PEERS in teaching social skills.

Despite the violation of homogeneity of variances for the QSQ-A-R, the interaction was robust enough to overcome this violation and its accompanying risk of increased Type II error. Thus, the second hypothesis was supported, as it was found that teens in the experimental treatment group engaged in a significant increase of hosted and invited get-togethers combined, as compared to the waitlist control group, on the QSQ-A-

R, from pre- to post-treatment. The study conducted by the developer of PEERS found similar results (Laugeson et al., 2009). This overall finding is important as get-togethers provide an opportunity for teens to practice their social skills and develop meaningful friendships.

The third hypothesis, which involved the FQS scores, was not supported. It was predicted that teens in PEERS would have significantly better quality friendships, as compared to the waitlist control group, from pre- to post-treatment; however, this was not found. Rather, both the experimental treatment and waitlist control groups had very similar friendship quality ratings at both time points, which suggests that PEERS did not seem to significantly affect teens' perceptions of their personal friendships. In the original PEERS study, researchers found that the teens who participated in PEERS had significantly better quality friendships compared to the waitlist control group (Laugeson et al., 2009). In comparison, in the present study, both pre- and post-intervention scores trended in the predicted direction for both groups. Specifically, the experimental treatment groups' friendship scores somewhat increased and the waitlist control groups' FQS scores somewhat decreased over the course of the intervention/waiting period. This finding clearly demonstrates that PEERS may actually be helpful in teens' friendship quality, however, the difference noted may not be large enough to reach traditional levels of significance. One reason why significant results were not produced may be because compared to the other measures, the FQS measure had a smaller sample size and less power. This was due to the fact that some teens could not reference a "best friend" while filling out the measure at both pre- and post-PEERS, which was a requirement. This

decrease in sample size may have had an effect on the results. Therefore, if a larger sample size was attained, potentially significant differences may have resulted.

Taking into account all three measures used in order to test PEERS' effectiveness, it can be concluded that PEERS shows evidence of being an effective intervention for teens with AS/HFA. It was found that teens in PEERS showed more knowledge of PEERS concepts and friendship skills as well as participated in more get-togethers at the end of treatment compared to the waitlist control group. Although it was not found that teens' friendship quality improved significantly due to participation in PEERS, the experimental treatment group displayed a slight increase in their rating of friendship quality. Most findings in this study, besides the friendship quality ratings, were consistent with the first study published on PEERS by the developer (Laugeson et al., 2009). Overall, these findings conclude that PEERS is effective at other sites, in addition to its' site of development.

As this study aimed to extend current findings relating to PEERS, potential changes in social anxiety and physiological regulation were assessed. Regarding self-report anxiety via SAS-A scores, it was hypothesized that teens in PEERS would significantly decrease in their levels of social anxiety, as compared to the waitlist control group, from pre- to post-treatment. This hypothesis was not supported. Results suggested that there was no significant difference in the levels of social anxiety between groups after treatment. There was, however, a trend noted in social anxiety scores. More specifically, the experimental treatment group reported a larger decrease in social anxiety compared to the waitlist control group, from pre- to post-treatment. The waitlist control

group displayed a decrease as well, although it was minimal. As this trend did not reach statistical significance, this can be attributed to a few different reasons.

One reason might be the lack of power, as there may in fact be a true difference which may be significant with a larger sample. Thus, the observed trend would then be significant, and show that participating in the PEERS intervention may decrease social anxiety in teens with ASD. However, participation in PEERS may not necessarily decrease social anxiety, at least in the short-term. As participants are asked to interact with new potential friends and increase their social activity, this can in turn be anxiety-provoking for adolescents with ASD and therefore, increase their social anxiety, or mitigate any decreases observed. Further, as PEERS is only a 14-week long intervention, this may not be enough time for teens to feel fully confident and relaxed in social situations. Most of what they experienced during PEERS was trial-and-error in practicing the skills. Therefore, they may not have had enough positive social interactions to produce lessened social anxiety.

It is also possible that adolescents with ASD are less able to accurately self-report their emotional states. The literature regarding this topic, however, is largely divided. Some studies have found that self-report measures of anxiety in higher functioning youth with ASD correlate with parent report data, while others have found that parent-reports may be more accurate (White & Roberson-Nay, 2009). Regardless, it is commonly thought that internalizing problems are best reported by the individual, whereas externalizing behaviors are best reported by the parent. Taking the current findings into account, it is currently unclear as to whether or not PEERS lessens social anxiety, as future research in this area is needed.

Regarding RSA, results were highly inconclusive and did not support predictions made. Results suggested that there was no significant difference in the levels of RSA between the experimental treatment and waitlist control groups, from pre- to post- treatment. Interestingly, both groups showed a significant decrease in RSA across time, meaning that teens were experiencing more arousal at a resting state at post-intervention compared to pre-intervention. Due to this finding, it does not seem that the PEERS intervention changed teens' RSA to become more adaptive; in contrast, children with ASD exhibited more mobilization over time. Some of the potential reasons for this finding are a lack of literature surrounding intervention effects on RSA, an RSA deterioration in individuals with ASD, and a developmental age effect of RSA.

Little is known about whether or how RSA and physiology might respond to intervention. There have been a handful of RSA biofeedback studies that have found positive intervention effects. Specifically, one study used patients who were preparing for a serious medical surgery. They engaged in RSA biofeedback training the day before their surgery. Results suggested that the group of patients that engaged in RSA biofeedback training had less anxiety symptoms compared to a control group, although they did not measure changes in RSA (Mikosh, Hadrawa, Laubreiter, Brandl, Pilz, Stettner, & Grimm, 2009). This study demonstrates that RSA may be changeable and the physiological changes can have a positive effect on one's internal state. As the present study is the first of its kind to look at a social skills intervention effects on RSA in teens with ASD, there is still much that remains unknown.

Another reason for the outcome is that the RSA fluctuation found may or may not be indicative of normal development. It could be that the fluctuation in teens' RSA is

normal or perhaps something that happens in adolescence, given increased social demands. On the other hand, this decrease in teens' RSA may be the result of a potential deterioration of RSA in individuals with ASD. Moreover, it may be that the RSA of individuals with ASD decreases with time, thus they may be unable to promote calm behavioral states, and engage in positive social interaction. This hypothesis is supported by previous findings in that many past studies have found that children with ASD have significantly lower levels of RSA than typically developing children (Vaughan Van Hecke et al., 2009; Ming et al., 2005; Bal, et al., 2010). It may be that their RSA levels start out lower than typically developing children and over time stay lower.

An additional reason for the findings revolves around the development of RSA. In this study, teens' age was found to be a marginal covariate, suggesting that the experimental treatment group had marginally higher RSA than the waitlist control group. As the experimental treatment group was comprised of older adolescents than the waitlist control group, it may be that there is a developmental age effect of RSA. In other words, older teens may have higher RSA than younger teens. Most research on the development of RSA has been conducted with typically developing children. In these studies, RSA has been shown to exhibit significant increases over time and is relatively stable through infancy and early childhood. The continuity in RSA for children is less evident with some studies indicating increases in RSA in children up to 7 years of age, while others have shown decreases or no change in RSA in children and adolescents ages 8 and older (Alkon, Goldstein, Smider, Essex, Kupfer, & Boyce, 2003). Recently, research with older children and adolescents supports the continued stability of RSA. Therefore, developmental change in RSA seems to level off by late childhood or early adolescence

and has significant stability during these developmental periods (Hinnant, Elmore-Staton, & El-Sheikh, 2011). The developmental trajectory of RSA seen in those with ASD, however, has been largely overlooked in the literature. Thus, it is unknown whether or not the current findings are consistent with other individuals with ASD.

Due to the marginally significant age effect, it could be that the age difference in the groups eclipsed any significant change due to intervention. However, given that the typical pattern of development of RSA would suggest increases over time, which would not normally occur in adolescence, it seems the most likely explanation for the results found here is that the adolescents in this study exhibited more mobilization, and thus poorer physiological control of heart rate, over time, contrary to expectations. Thus, it is unclear whether the PEERS intervention positively affects physiological regulation, and, indeed, it may be that the increased social stress of the intervention results in poorer regulation in the short-term. It will be important in the future to determine whether, in the long term, more adaptive RSA would be attained for teens with AS/HFA as they become more comfortable with social interactions.

The third hypothesis was supported, as teens in PEERS significantly decreased in their levels of autistic symptoms, including increases in social awareness and social information processing, and decreases in social anxiety/avoidance and autistic preoccupations/traits, as compared to the waitlist control group, from pre- to post-treatment. This suggests that participation in the PEERS intervention causes decreases in core autistic symptoms. This decrease in symptoms might allow teens who participated in PEERS to better function in day to day life in addition to being more successful in social interactions. This finding has not been previously found in relation to the PEERS

intervention. In addition, core autistic symptoms reduction is not targeted in the PEERS intervention, which makes this finding even more significant. The fact that PEERS caused teens' autistic symptomatology to nearly drop from the "severe" level to the "moderate" severity level gives additional support to utilization of the PEERS intervention with teens with AS/HFA.

Limitations of the present study

There were some limitations to the present study. First, the sample was limited, which affected power. In addition, the sample included mostly males who were Caucasian. This lack of diversity in the sample caused the findings to be less generalizable. In addition, the experimental treatment group and waitlist control group had a significant age difference and this may have affected the evaluation of group differences. In the future, a larger and more diverse sample should be included. In addition, attention should be paid to accurately randomizing the groups according to age.

Another limitation was that the parent ratings on the SRS may have been biased due to the parent involvement in the intervention. In the future, capturing teacher report might be beneficial, as teachers are not directly involved in treatment. Another limitation might have been the pitfalls inherent in gathering RSA data in an unfamiliar setting. The teen may have felt some anxiety, as they were in an unknown laboratory with researchers applying electrodes to their chest. This atmosphere may have negatively affected their "true" resting RSA.

In addition, the QSQ-A-R scores had wide variability. In following studies, researchers should try to gain more accurate reporting of get-togethers in order to decrease outliers and variability among the participants.

Future Directions and Conclusions

One future direction of the current study includes gathering data at a long-term follow-up. This would yield useful information toward determining the durability of the findings as well as assess for any changes that occur during the months following PEERS. For example, perhaps once teens have had some time outside of PEERS, their social anxiety may decrease as they gain confidence and practice in the skills they have learned. Additionally, it will be important to assess whether these long-term changes in anxiety affect physiological regulation. The author is currently collecting data at a 6-month follow-up for all participants of PEERS. Heart rate could also be measured more frequently throughout the intervention in order to gain a more robust measure of RSA or to more accurately pinpoint changes in RSA that could co-occur with demands of the intervention.

Social anxiety and social skills are highly correlated with one another (Bellini, 2004). In addition, those with AS/HFA have been found to significantly report more social anxiety symptoms than their typically developing peers (Sebastian, Blakemore, & Charman, 2009). Thus, it is highly important to focus on social anxiety in treatment with individuals with AS/HFA. Future social skills interventions, including PEERS, should aim to teach teens with AS/HFA how to handle social anxiety in addition to providing social skills training.

This is the first study to look at RSA changes due to intervention in teens with ASD. Due to the fact that current results were inconclusive, further research will need to be conducted in order to establish whether or not RSA is “plastic” and can be affected by intervention. In addition, more of an emphasis needs to be placed on understanding the

development of RSA in individuals with ASD in comparison to those who are typically developing.

Recent statistics have estimated that 1 in 88 children in the U.S. are affected by autism (Centers for Disease Control and Prevention, 2012). It has also been suggested that those with AS/HFA, who have marked social impairments, may be the fastest growing segment of the autism population (Rao, Beidel, & Murray, 2008). Fortunately, the PEERS intervention was recently developed in order to teach teens with AS/HFA the skills necessary to make and keep friends (Laugeson, et al., 2009). The present study was a replication and extension of the PEERS intervention and greatly adds to the minimal literature regarding social skill interventions for teens with AS/HFA. In addition, the current study supported previously found positive outcomes of participation in PEERS as well as found that involvement in PEERS decreases autistic symptomology. These findings suggest that PEERS is an appropriate intervention for widespread national use. Overall, this study adds to the minimal literature regarding the plasticity of social skills, RSA and social anxiety, and symptoms of autism in adolescents with ASD who complete social skills intervention.

BIBLIOGRAPHY

- Bal, E., Harden, E., Lamb, D., Vaughan Van Hecke, A., Denver, J., & Porges, S. (2010). Emotion recognition in children with autism spectrum disorders: Relations to eye gaze and autonomic state. *Journal of Autism and Developmental Disorders, 40*, 358-370.
- Barry, T., Klinger, L., Lee, J., Palardy, N., Gilmore, T & Bodin, S. (2003). Examining the effectiveness of an outpatient clinic-based social skills group for high-functioning children with autism. *Journal of Autism and Developmental Disorders, 33* (6), 686-701.
- Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development, 71*(2), 447-456.
- Bellini, S. (2004). Social skill deficits and anxiety in high-functioning adolescents with Autism Spectrum Disorders. *Focus on Autism and other Developmental Disabilities, 19* (2), 78-85.
- Bellini, S. (2006). The development of social anxiety in adolescents with Autism Spectrum Disorders. *Focus on Autism and other Developmental Disabilities, 21* (3), 138-145.
- Biopac Systems, Inc. Goleta, CA.
- Buhrmester, D. (1990). Intimacy of friendship, interpersonal competence, and adjustment during preadolescence and adolescence. *Child Development, 61*(4), 1101-1111.
- Bukowski, W. M., Hoza, B., & Boivin, M. (1994). Measuring friendship quality during pre- and early adolescence: the development and psychometric properties of the Friendship Qualities Scale. *Journal of Social and Personal Relationships, 11*(3), 471-484.
- Carnahan, C., Hume, K., Clarke, L., & Borders, C. (2009). Using structured work systems to promote independence and engagement for students with Autism Spectrum Disorders. *Teaching Exceptional Children, 41* (4), 6-14.
- Centers for Disease Control and Prevention. (2012). *Autism Spectrum Disorders*. Atlanta, Georgia: Department of Health and Human Services.
- Chalfant, A., Rapee, R., & Carroll, L. (2007). Treating anxiety disorders in children with high functioning Autism Spectrum Disorders: A controlled trial. *Journal of Autism and Developmental Disorders, 37*(10), 1842-1857.

- Constantino, J. N. (2005). *Social responsiveness scale*. Los Angeles: Western Psychological Services.
- Constantino, J. N., & Todd, R. D. (2000). Genetic structure of reciprocal social behavior. *American Journal of Psychiatry*, *157*, 2043–2045.
- Constantino, J. N., & Todd, R. D. (2003). Autistic traits in the general population: A twin study. *Archives of General Psychiatry*, *60*(5), 524–530.
- Frankel, F. & Mintz, J. (2008). Measuring the quality of play dates. Available from UCLA Parenting and Children's Friendship Program, 300 Medical Plaza, Los Angeles.
- Frankel, F., Myatt, R., & Cantwell, D. P. (1995). Training outpatient boys to conform with the social ecology of popular peers: Effects on parent and teacher ratings. *Journal of Clinical Child Psychology*, *24*(3), 300-310.
- Frankel, F., Myatt, R., Cantwell, D. P., & Feinberg, D. T. (1997). Parent assisted children's social skills training: Effects on children with and without attention-deficit hyperactivity disorder. *Journal of the Academy of Child and Adolescent Psychiatry*, *36*(8), 1056–1064.
- Frankel, F. & Myatt, R. (2003). *Children's friendship training*. New York: Brunner-Routledge.
- Frankel, F. & Myatt, R. (2007). Parent-assisted friendship training for children with autism spectrum disorders: effects associated with psychotropic medication. *Child Psychiatry and Human Development*, *37*, 337-346.
- Goldstein, P. & McGinnis, E. (2000). *Skillstreaming the adolescent: New strategies and perspectives for teaching prosocial skills*. Champaign: Research Press.
- Gresham, F. M., Sugai, G., & Horner, R. H. (2001). Interpreting outcomes of social skills training for students with high incidence disabilities. *Exceptional Children*, *67*(3), 331–345.
- Grynszpan, O., Nadel, J., Constant, J., Le Barillier, , Florence, Carbonell, N., Simonin, J. & Courgeon, M. (2011). A new virtual environment paradigm for high-functioning autism intended to help attentional disengagement in a social context. *Journal of Physical Therapy Education*, *25*(1), 42-47.
- Heilman, K. (2006). *Neurobiology of social behavior in individuals with selective mutism*. (Doctoral dissertation, University of Illinois at Chicago). Retrieved from <http://proquest.umi.com/pqdlink?Ver=1&Exp=08-29-2016&FMT=7&DID=1221677941&RQT=309&attempt=1&cfc=1>

- Howlin, P. (2000). Autism and developmental receptive language disorder-a follow-up comparison in early adult life II: Social behavioral and psychiatric outcomes. *Journal of Psychology and Psychiatry and Allied Disciplines*, 41, 561-578.
- Inderbitzen-Nolan, H. & Walters, K. (2000). Social Anxiety Scale for Adolescents: Normative data and further evidence of construct validity. *Journal of Clinical Child Psychology*, 29(3), 360–371.
- Kaufman, A. S., & Kaufman, N. L. (2005). *Kaufman Brief Intelligence Test (K-BIT)*. Circle Pines, MN: American Guidance Service.
- Krasny, L., Williams, B. J., Provencal, S., & Ozonoff, S. (2003). Social skills interventions for the autism spectrum: Essential ingredients and a model curriculum. *Child and Adolescent Psychiatric Clinics of North America*, 12(1), 107-122.
- La Greca, A. & Lopez, N. (1998). Social anxiety among adolescents: Linkages with peer relations and friendships. *Journal of Abnormal Child Psychology*, 26(2), 83-94.
- Laugeson, E. A., Frankel, F., Mogil, C., & Dillon, A. R. (2009). Parent-assisted social skills training to improve friendships in teens with autism spectrum disorders. *Journal of Autism & Developmental Disorders*, 39(4), 596-606.
- Laugeson, E. A., Frankel, F. (2006). Test of Adolescent Social Skills Knowledge. Available from UCLA Parenting and Children's Friendship Program, 300 Medical Plaza, Los Angeles.
- Little L. (2001). Peer victimization of children with Asperger Spectrum Disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, 40(9), 995–996.
- Little L. (2002). Middle-class mother's perceptions of peer and sibling victimization among children with Asperger's syndrome and nonverbal learning disorders. *Issues in Comprehensive Pediatric Nursing*, 25(1), 43–57.
- Lord, C., Rutter, M., DiLavore, P. C., & Risi, S. (2001). Autism Diagnostic Observation Schedule-WPS (ADOS-WPS), Los Angeles, CA: Western Psychological Services.
- Mandelberg, J., Laugeson, E., Frankel, F., Gantman, A., Cunningham, T., & Bates, S. (2011). Long term outcomes of a parent-assisted social skills intervention for adolescents with Autism: The UCLA PEERS program. Poster presented at the International Meeting for Autism Research.
- McAfee, J. (2002). Navigating the social world: A curriculum for individuals with Asperger syndrome, high functioning autism and related disorders. Arlington, TX: Future Horizons, Inc.

- Ming, X., Julu, P. O. O., Brimacombe, M., Connor, S., & Daniels, M. L. (2005). Reduced parasympathetic activity in children with autism. *Brain and Development*, 27, 509–516.
- Mitchell, K., Regehr, K., Reaume, J. & Feldman, M. (2010). Group social skills training for adolescents with asperger syndrome or high functioning autism. *Journal on Developmental Disabilities*, 16(2), 52-63.
- O'Connor, M. J., Frankel, F., Paley, B., Schonfeld, A. M., Carpenter, E., Laugeson, E., et al. (2006). A controlled social skills training for children with fetal alcohol spectrum disorders. *Journal of Consulting and Clinical Psychology*, 74(4), 639–648.
- Ozonoff, S., & Miller, J. N. (1995). Teaching theory of mind: A new approach to social skills training for individuals with autism. *Journal of Autism and Developmental Disorders*, 25(4), 415–433.
- Patriquin, M., Scarpa, A., Friedman, B., & Porges, S. (2011). Respiratory sinus arrhythmia: A marker of positive functioning in children with Autism Spectrum Disorders. Poster presented at International Meeting for Autism Research.
- Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, 74(2), 116–143.
- Porges, S.W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage. A polyvagal theory. *Psychophysiology*, 32, 301-318.
- Porges, S.W. (1985). Method and apparatus for evaluating rhythmic oscillations in aperiodic physiological response systems. United States Patent. No: 4, 510, 944.
- Porges, S., & Bohrer, R. (1990). The analysis of periodic processes in psychophysiological research. In J. Cacioppo & I. Tassinari (Eds.), *Principles of psychophysiology: Physical social and inferential elements* (pp. 708–753). New York: Cambridge University Press.
- Porges, S. W., Cohn, J. F., Bal, E., & Lamb, D. (2007). *The dynamic affect recognition evaluation [computer software]*. Chicago, IL.
- Porges, S. W., Doussard-Roosevelt, J. A., Portales, A. L., & Greenspan, S. I. (1996). Infant regulation of the vagal “brake” predicts child behavior problems: A psychobiological model of social behavior. *Developmental Psychobiology*, 29, 697–712.
- Rao, A. P., Beidel, C. D. & Murray, J. M. (2008). Social skills interventions for children with asperger’s syndrome or high-functioning autism: A review and recommendations. *Journal of Autism & Developmental Disorders*, 38(2), 353-361.

- Sebastian, C., Blakemore, S., & Charman, T. (2009). Reactions to ostracism in adolescents with autism spectrum conditions. *Journal of Autism & Developmental Disorders*, 39(8), 1122-1130.
- Sofronoff, K., Dark, E., & Stone, V. (2010). Social vulnerability and bullying in children with Asperger syndrome. *The National Autistic Society*, 1-18.
- SPSS, Inc., 2008.
- Tabachnik, B. & Fidell, L. (2007). *Using multivariate statistics*. Boston: Pearson Education.
- Tse, J., Strulovitch, J., Tagalakis, V., Meng, L., & Fombonne, E. (2007). Social skills training for adolescents with Asperger's syndrome and high functioning autism. *Journal of Autism and Developmental Disorders*, 37(10), 1960-1968.
- Vaughan Van Hecke, A., Lebow, J., Bal, E., Lamb, D., Harden, E., Kramer, A., et al. (2009). EEG and heart rate regulation to familiar and unfamiliar people in children with autism spectrum disorders. *Child Development*, 80(4), 1118-1133.
- Walters, S. & Weaver K. (2003). Relationships between the Kaufman Brief Intelligence Test and the Wechsler Adult Intelligence Scale-Third Edition. *Psychological reports*, 92(3), 1111-1115.
- Weiss, M. J. & Harris, L. S. (2001). Teaching social skills to people with autism. *Behavior Modification*, 25(5), 785-802.
- White, S., Albano, A., Johnson, C., Kasari, C., Ollendick, T., Klin, A. & Scahill, L. (2010). Development of a cognitive-behavioral intervention program to treat anxiety and social deficits in teens with high-functioning autism. *Clinical Child & Family Psychology Review*, 13(1), 77-90.
- White, S. W., & Roberson-Nay, R. (2009). Anxiety, social deficits, and loneliness in youth with autism spectrum disorders. *Journal of Autism & Developmental Disorders*, 39(7), 1006-1013.
- (2007). *Repeated Measures/Mixed-Model ANOVA [PowerPoint Slides]*. Retrieved from Kent State University website: www.personal.kent.edu/~mtmoore1/SPSSLab4.ppt.

FIGURES & TABLES

Figure 1
Bellini's Developmental Pathway to Social Anxiety in Teens with ASD

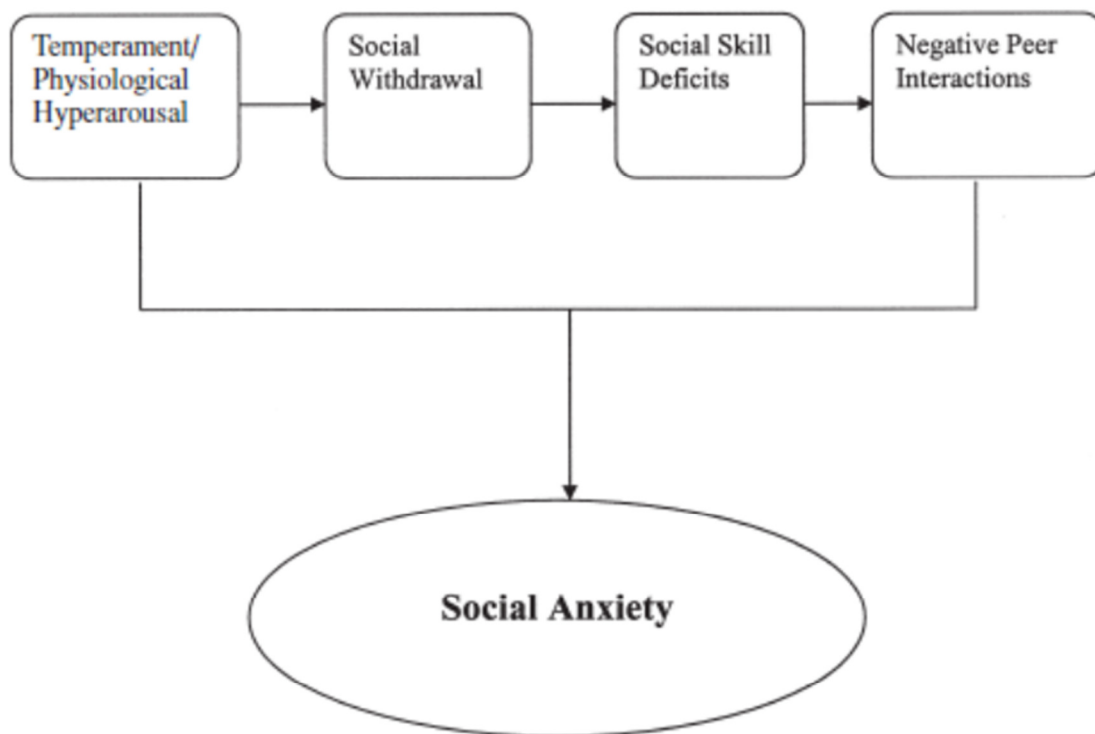


Table 1
Number of Participants

	Fall 2010, Experimental	Spring 2011, Experimental	Spring 2011, Waitlist	Fall 2011, Experimental	Fall 2011, Waitlist	Spring 2012, Experimental	Spring 2012, Waitlist	
Number of Participants	5	8	7	6	8	5	8	$N = 47$
								$n_{\text{EXP}} = 24$ $n_{\text{WL}} = 23$

Table 2
PEERS Sessions and Associated Content

Session	Didactic
1	Introduction & Conversational Skills I: Trading Information
2	Conversational Skills II: Two-way Conversations
3	Conversational Skills III: Electronic Communication
4	Choosing Appropriate Friends
5	Appropriate Use of Humor
6	Peer Entry I: Entering a Conversation
7	Peer Entry II: Exiting a Conversation
8	Get-togethers
9	Good Sportsmanship
10	Rejection I: Teasing and Embarrassing Feedback
11	Rejection II: Bullying & Bad Reputations
12	Handling Disagreements
13	Rumors & Gossip
14	Graduation & Termination

Table 3
Means and Standard Deviations for Baseline Variables for Experimental Treatment and Waitlist Control Groups

	Group (<i>n</i> = 47)		<i>t</i> -value or χ^2
	Experimental (<i>n</i> = 24)	Waitlist Control (<i>n</i> = 23)	
	Pre <i>M</i> (<i>SD</i>)	Pre <i>M</i> (<i>SD</i>)	
Age (years)	13.83 (1.43)	12.48 (1.16)	<i>t</i> = 3.55***
Gender (% Male)	79.2	82.6	χ^2 = .09
Race (% Caucasian)	87.5	91.3	χ^2 = 2.98
KBIT-2 Verbal IQ	103.04 (16.49)	98.22 (17.87)	<i>t</i> = .96
ADOS Total Score	10.67 (2.96)	11.17 (3.06)	<i>t</i> = -.58
School Type (% public school)	79.2	82.6	χ^2 = 32.86
Medication (% current usage)	75	65.2	χ^2 = 1.33

Note. KBIT-2 = Kaufman Brief Intelligence Test-Second Edition; ADOS = Autism Diagnostic Observation Schedule.

p* < .05. *p* < .01. *** *p* < .001

Table 4
Means and Standard Deviations for Outcome Variables for Experimental Treatment and Waitlist Control Groups

	Group (<i>n</i> = 47)				<i>F</i> - value
	Experimental (<i>n</i> = 24)		Waitlist Control (<i>n</i> = 23)		
	Pre <i>M</i> (<i>SD</i>)	Post <i>M</i> (<i>SD</i>)	Pre <i>M</i> (<i>SD</i>)	Post <i>M</i> (<i>SD</i>)	
Teen Measures					
TASSK	13.38 (2.68)	22.17 (2.71)	12.52 (2.76)	13.52 (2.29)	Group = $F(1,45) = 49.21^{**}$ ($\eta_p^2 = .52$) Time = $F(1,45) = 189.10^{**}$ ($\eta_p^2 = .81$) G x T = $F(1,45) = 119.74^{**}$ ($\eta_p^2 = .73$)
QSQ-A-R	1.63 (2.76)	5.13 (5.53)	7.26 (11.91)	4.30 (7.41)	Group = $F(1,45) = 1.88$ ($\eta_p^2 = .04$) Time = $F(1,45) = .04$ ($\eta_p^2 = .001$) G x T = $F(1,45) = 5.67^*$ ($\eta_p^2 = .11$)
FQS	82.00 (15.80)	82.75 (15.24)	85.71 (15.26)	82.00 (20.06)	Group = $F(1,41) = .06$ ($\eta_p^2 = .001$) Time = $F(1,41) = .41$ ($\eta_p^2 = .01$) G x T = $F(1,41) = 1.08$ ($\eta_p^2 = .03$)
SAS-A	49.21 (14.35)	45.13 (11.55)	48.57 (18.57)	47.74 (17.04)	Group = $F(1,45) = .06$ ($\eta_p^2 = .001$)

					Time = $F(1,45) = 1.56$ ($\eta_p^2 = .03$)
					G x T = $F(1,45) = .69$ ($\eta_p^2 = .02$)
RSA	7.06 (1.01)	6.66 (1.09)	7.05 (1.13)	6.29 (1.14)	Group = $F(1,38) = .73$ ($\eta_p^2 = .02$)
					Time = $F(1,38) = 14.13^{**}$ ($\eta_p^2 = .27$)
					G x T = $F(1,38) = 1.39$ ($\eta_p^2 = .04$)
Parent Measure					
SRS	101.67 (23.88)	80.50 (18.85)	108.61 (19.25)	102.81 (27.12)	Group = $F(1,43) = 5.94^*$ ($\eta_p^2 = .12$)
					Time = $F(1,43) = 18.98^{**}$ ($\eta_p^2 = .31$)
					G x T = $F(1,43) = 6.15^*$ ($\eta_p^2 = .13$)

Note. TASSK = Test of Adolescent Social Skills Knowledge; QSQ-A-R = Quality of Socialization Questionnaire – Adolescent; FQS = Friendship Quality Scale; SAS-A = Social Anxiety Scale – Adolescent; RSA = Respiratory Sinus Arrhythmia; SRS = Social Responsiveness Scale. The following measures had different *n*-values: Experimental FQS Pre (*n* = 22); Experimental RSA Pre (*n* = 23); Waitlist FQS Pre (*n* = 21); Waitlist FQS Post (*n* = 22); Waitlist RSA Post (*n* = 18); Waitlist SRS Post (*n* = 21).

p* < .05. *p* < .01. ****p* < .001

Figure 2
Mean TASSK Scores Among Experimental and Waitlist Control Groups

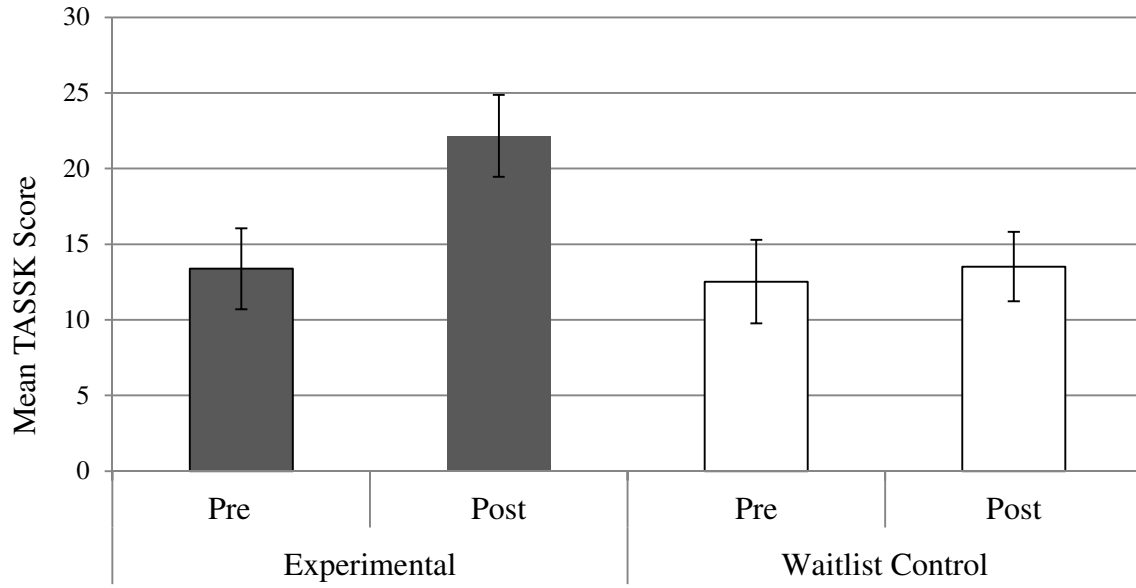


Figure 3
Mean QSQ-A-Revised Scores Among Experimental and Waitlist Control Groups

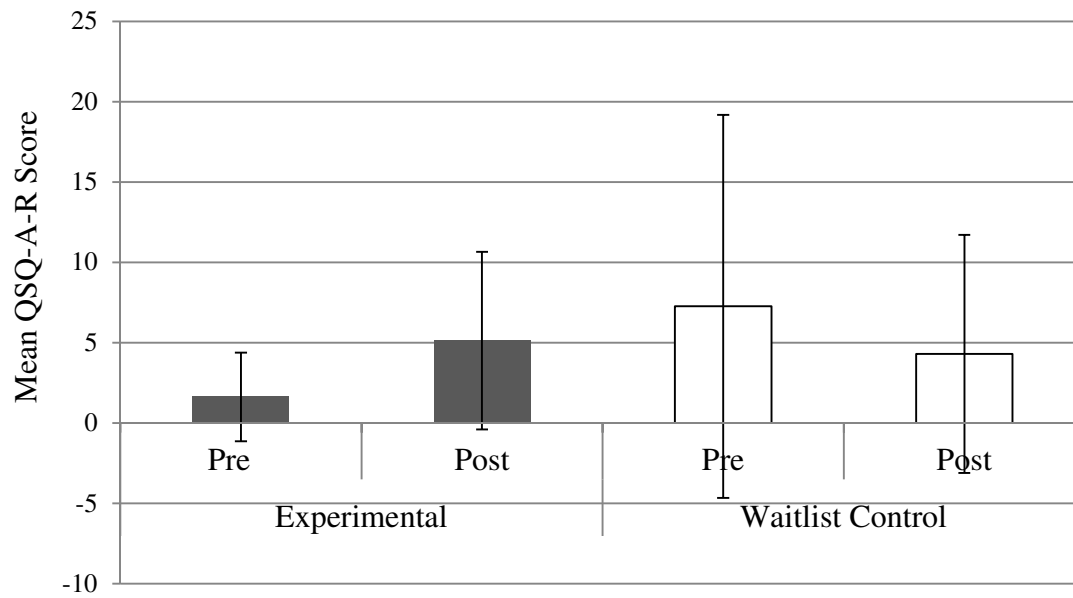
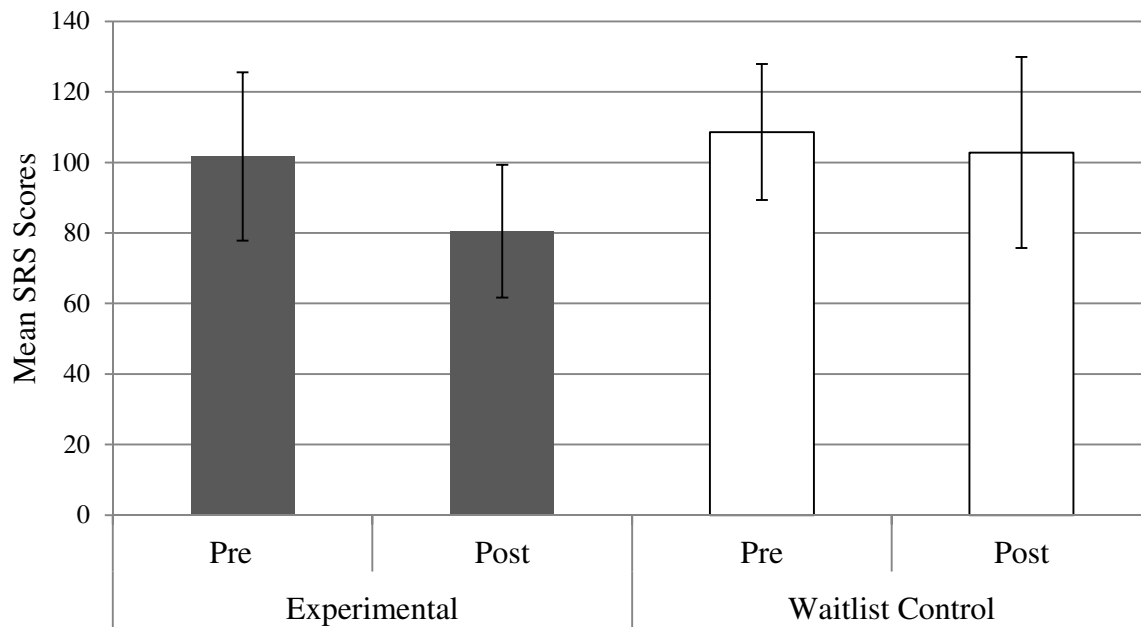


Figure 4
Mean SRS Scores Among Experimental and Waitlist Control Groups



Note. Higher scores indicate more autistic symptoms.