Utility of the Social Responsiveness Scale- Parent Report (SRS-Parent) As a Diagnostic Tool for Autism Identification

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A dissertation submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Washington

2016

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Program Authorized to Offer Degree:

Education

University of Washington

Abstract

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Rating scales are often used as part of the evaluation process to diagnose autism spectrum disorder (ASD). Rating scales that are modeled after the experiences and understanding of the Caucasian American race may not reflect the unique experiences of individuals from other races or ethnicities. If parent ratings do not uniformly identify the ASD symptoms of children from varying racial and ethnic backgrounds, it likely will impact the diagnostic process, which may contribute to the known disparity in identification rates by race and ethnicity. The Social Responsiveness Scale (SRS) is one rating scale that can be used by parents and teachers. Although there have been many studies addressing the reliability and validity of the SRS, there is a dearth of available research that conducted similar analyses by racial/ethnic group. This study endeavored to identify the appropriateness of using the Social Responsiveness Scale- Parent Form (SRS-P) by evaluating its reliability, criterion validity, and structural validity across racial and ethnic groups using children identified with ASD in the Simons Simplex Collection (SSC) dataset.

When analyzed independently, the Autistic Mannerisms and Social Communication scales were the only reliable scales found when using the total sample and when using the Caucasian

American, African American, and Asian American groups. For the Mixed Race and Hispanic groups, Social Communication was the only reliable scale. A linear regression found that only the total SRS-P score and the Autistic Mannerisms scale, which targets stereotypical behaviors and highly restricted interests, significantly predicted the ADOS-CSS. As a whole, the SRS-P does not appear to differ in its ability to identify severity of symptoms of ASD by racial/ethnic group. An exploratory factor analysis done by total SSC sample and by racial/ethnic groups within the sample suggests that the SRS-P is most appropriately considered as a single-factor instrument. Rather than use the treatment subscales, intervention goals may be best created based on the endorsement of individual items.

School psychologists need racially and ethnically fair instruments to use with their school populations. As the SRS-P performed similarly regardless of the race or ethnicity of the child/parent and the total score significantly predicted the ADOS-CSS, this particular instrument may be a valuable resource to use with children from diverse racial and ethnic backgrounds. Recommendations for use of the SRS-P and implications for future research are included.

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ACKNOWLEDGEMENTS

I would like to say thank you to a number of people who made this journey possible. My education professors at Luther College instilled in me an appreciation for diversity and an understanding of equity. Colleagues and students and their families in Yah-ta-hey, New Mexico and the district of Kona on the island of Hawai'i welcomed me into their respective cultural landscapes and extended my appreciation for rich diversity. I also wish to thank faculty members who have supported me along my journey. Specifically, thanks to Lois Yamauchi at the University of Hawai'i- Mānoa and Virginia Berninger at the University of Washington for providing me with research experience. I am also very thankful to my dissertation committee members, Janine Jones, Raphael Bernier, Felice Orlich, Ilene Schwartz, and Chantel Prat. They have generously given of their time and knowledge to support me. In particular, I wish to express my appreciation to Janine Jones for her incredible support and guidance throughout my participation in the School Psychology program at the University of Washington. I also wish to thank my supervisors and colleagues at the University of Washington Autism Center for providing me with wonderful experiences and supervision in working with families touched by ASD. I have learned so much through my interactions with all of these amazing professionals.

I am also grateful to all of the families at the participating Simons Simplex Collection (SSC) sites, as well as the principal investigators (A. Beaudet, R. Bernier, J. Constantino, E. Cook, E. Fombonne, D. Geschwind, R. Goin-Kochel, E. Hanson, D. Grice, A. Klin, D. Ledbetter, C. Lord, C. Martin, D. Martin, R. Maxim, J. Miles, O. Ousley, K. Pelphrey, B. Peterson, J. Piggot, C. Saulnier, M. State, W. Stone, J. Sutcliffe, C. Walsh, Z. Warren, E. Wijsman). I appreciate

obtaining access to phenotypic data on SFARI Base. Approved researchers can obtain the SSC population dataset described in this study by applying at https://base.sfari.org.

Finally, I wish to acknowledge my friends and family. Support of friends has meant so much to me. To my mother, Jane Alwin, whose unwavering belief in me has enabled me to push myself and take chances in life. She instilled in me a lifelong love of learning, which has served me well over the years. To my amazing husband, Chip, I offer my unending love and gratitude. I could not have followed this dream without your incredible support and encouragement. You have been with me for every step of the way!

DEDICATION

I wish to dedicate this dissertation to my children, Dakotah, Dallas, and Cheyenne, who allowed me to uproot them from their lives in sunny Hawai'i to move to rainy Seattle so I could follow my dreams. Words on a page cannot possibly express the love I have for you. I gain inspiration from you daily! May you always follow your own dreams, and support the dreams of others along the way.

CHAPTER 1: INTRODUCTION

Introduction

Autism spectrum disorder (ASD) rates have risen significantly over time, with the Center for Disease Control ([CDC] 2016) reporting the current ASD prevalence rate at 1 in 68 based on a data analysis of ASD prevalence in 8-year-olds from specific counties in 11 US states. The CDC prevalence rate in the 2014 report was also 1 in 68 (CDC, 2014), making the 2016 report the first time in a number of years that the prevalence rate has remained stable. The 2014 estimate was an increase of approximately 30% over what was reported by the CDC in 2012 (CDC, 2012). The current CDC report (2016) also found that Caucasians were 50% more likely to be identified with ASD than Hispanics, 40% more likely to be identified than Asians and Pacific Islanders, and 20% more likely to be identified than African Americans. These disparate rates are consistent with what has been found in previous literature (Sullivan, 2013; Travers, Tincani, & Krezmien, 2011). Not a new trend, this disparity has been noticed in previous research as well (Dyches, Sudweeks, Obiakor, & Algozzine, 2004). It is important to further study why certain racial or ethnic groups- particularly African American and Hispanic- are underrepresented in ASD categories (Tincani, Travers, & Boutot, 2009) and explore why this racial disparity continues to exist.

Problem Statement

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association, 2013) defines ASD as “persistent deficits in social communication and social interaction across multiple contexts” with “restricted, repetitive patterns of behavior, interests, or activities.” The definition itself tends to be of a qualitative nature, not as easily quantifiable as you might find in some other special education eligibility

categories (e.g., for Intellectual Disability, there are specific levels at which the cognitive and adaptive scores must fall below in order to qualify). Therefore, it is subject to some interpretation. A "persistent deficit in social communication and social interaction" may be seen differently in one cultural setting than it is in another, in accordance with expected behaviors for that context. Families attribute meaning to symptoms from within the context of cultural background, and may therefore interpret them according to their own cultural understanding (Bernier, Mao, & Yen, 2010; Mandell & Novak, 2005).

Disparity in Identification

ASD is a disorder that has specific, well-defined features, and therefore should be proportionally represented across racially and ethnically diverse groups in school settings; however, research suggests otherwise (Travers, Tincani & Krezmien, 2011). Although many of the assessment tools to diagnose ASD, such as rating scales and structured observations, use quantitative methods, the perception of the deficits inherent to ASD can be subject to interpretation. In particular, deficits in social communication and interaction may be seen differently in one racial or ethnic group as compared to another, in accordance with expected behaviors for that context. The literature has found Caucasian American individuals are identified with ASD at a higher rate than Native American, African American, and Hispanic populations (Dyches et al., 2004; Sullivan, 2013; Travers et al., 2011).

Needs in the Literature

Despite the established disparity in identification rates of ASD by race and ethnicity, the effectiveness of rating instruments in identifying individuals who may have autism across racial and ethnic groups is not adequately addressed in prior research. Nor has the literature adequately addressed how well rating scales predict the severity of ASD symptomology by racial and ethnic

groups. These exists literature that has studied select rating scales and their diagnostic efficacy (Aldridge, Gibbs, Schmidhofer, & Williams, 2012; Fombonne, Marcin, Bruno, Tinoco & Marquez, 2012; Kamio, Moriwaki, & Inada, 2013; Schanding, Nowell, & Goin-Kochel, 2012); however there is a dearth of literature to date that focuses on how well these rating scales identify ASD features and predict ASD severity by racial/ethnic group within the United States. As a significant portion of the diagnostic process for ASD involves parental report and ratings, it is important to explore whether there may be differences in the ability of these rating scales to identify and predict ASD severity by race/ethnicity.

Study Overview

Common to all ASD diagnoses are the assessment instruments used, which take into account clinicians' expertise along with parent and teacher understanding and interpretation of behaviors. As clinicians understand behaviors within the context of their professional training and experience and families understand behaviors within the context of the expectations within their communities (which may differ from the expectations in other contexts) the contributions of parents and clinicians may differ according to racial/ethnic background.

Rationale

Families attribute meaning to symptoms from within the context of cultural background, and may therefore interpret them according to their own cultural understanding (Bernier et al. 2010; Mandell & Novak, 2005). In this way, rating scales that are modeled after the experiences and understanding of the Caucasian American race may not reflect the unique experiences of individuals from other races or ethnicities. Rating scales completed by parents of varying racial and ethnic backgrounds reflect their own perspective and understanding. If parent ratings do not uniformly identify the ASD symptoms of children from varying racial and ethnic backgrounds, it

will likely impact the diagnostic process, which may contribute to the known disparity in identification rates by race and ethnicity.

Implications for School Psychologists

The disparity in access to services underscores the importance of school-based services for all children, and particularly those who may not receive services in a private setting. Siller, Reyes, Hotez, Hutman, and Sigman (2014) found that African-American students were more likely to receive services through school than Caucasian-American students, perhaps because of barriers to receiving services outside the school setting for minority populations. In a study looking children aged 3-10 in the Atlanta metropolitan area, Yeargin-Allsopp et al. (2003) found that a majority of children with autism were identified only through school sources (rather than clinical sources); particularly older, school-aged children whose symptoms may be less severe. More specifically, the study found that African American children, children who had mothers under 30 years old, and children who had less than a high school education were identified primarily at school sources. Schools settings are an important point of service for children with autism, particularly for those populations who are traditionally underserved and under-identified. Importantly, school psychologists need to be prepared to examine behaviors within the context of race, ethnicity and culture in order to provide the most effective services (Daley, 2002).

CHAPTER 2: LITERATURE REVIEW

In order to understand the context of this study, several areas need to be explored. It is important to explore the history of the diagnosis of ASD as well as the current definition. Additionally, understanding the core features of ASD and their role in typical development will provide additional context as to why individuals from different racial and ethnic groups may be identified at different rates. Understanding current theories in the literature about what may be contributing to the disparity in identification rates across racial and ethnic groups is essential for exploring what factors might be involved. Finally, it is important to recognize the role of school psychologists in the process of assessment and identification.

Autism Spectrum Disorder

The category of autism spectrum disorder (ASD) is new in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association [APA], 2013) and has subsumed the previous categories of Asperger's disorder, PDD-NOS, and autistic disorder. This new category encompasses the qualities that are similar amongst these previously recognized categories (Verhoeff, 2013). Although the term "autism" has been in use since the early 1900s, the understanding and conceptualization of this term has changed over the years.

Historical Perspective

In order to best understand the current conceptualization of ASD, the historical roots of the disorder should be explored. In 1910, Eugen Bleuler first used the Latin term "autismus," which referred to removing oneself from social interaction (Vatanoglu-Lutz, Ataman, & Bicer, 2014), to describe withdrawal from reality as a primary symptom of schizophrenia (Verhoeff, 2013). Leo Kanner later used case studies to identify a series of children who displayed

withdrawal from social interaction in the absence of other features of schizophrenia. His 1943 paper called this unique profile "infantile autism," and he identified two primary features: self-isolation/withdrawal from affection, and obsession with sameness and routine (Verhoeff, 2013). Kanner stressed that children with this disorder lacked the inclination to be social (Volkmar, Chawarska, & Klin, 2005). Language deficits were not identified as core features of autism at that time, but rather as side effects of the desire for isolation (Verhoeff, 2013). Initially, the term "autism" was often used interchangeably with childhood schizophrenia and childhood psychosis (Blacher & Christensen, 2011).

The definition of autism began to shift in the 1960s to identify language and cognitive/perceptual abnormalities as core features (Verhoeff, 2013), which helped distinguish it from other disabilities (Vatanoglu-Lutz, 2014). Research of the time supported a focus on the deficiencies of language, which included difficulty with symbols, gesture use, grammar, and semantics (Verhoeff, 2013). The definition of infantile autism expanded from its original focus on withdrawal to include a lack of responsiveness, deficits in language development, and bizarre responses to typical environmental experiences.

Michael Rutter presented a description of autism in 1978 that was similar to what Kanner had originally put forth, but with additional elucidation as to the behavioral manifestation of core symptoms. He also stressed the need for clear diagnostic criteria (Blacher & Christensen, 2011). The DSM-III (APA, 1980) formally recognized infantile autism as a new diagnostic category, with early onset specified and social communication deficits emphasized (Volkmar et al., 2005). The diagnosis of infantile autism was grouped with related disorders under the term "pervasive developmental disorders" (Blacher & Christensen). Importantly, there was a clear distinction made in criteria between autism and childhood schizophrenia (Blacher & Christensen).

In the 1980s, Lorna Wing studied children who exhibited a range of autism symptomology, from those who demonstrated full symptoms to those who showed only one or two of the core symptoms. From this research, she concluded that a deficit in reciprocal social interaction was a key component in autism (Blacher & Christensen, 2011), and expressed that there was not a clear division between the autism described by Kanner and other social impairments (Verhoeff, 2013). In the 1987 revision of the DSM-III (APA, 1987), the name of the diagnosis was changed to autistic disorder, with three primary symptoms listed: deficits in reciprocal social interaction, deficits in nonverbal and verbal communication, and stereotyped movements or restricted repertoire of activities and interests. This revision also saw the introduction of pervasive developmental disorder- not otherwise specified (PDD-NOS) as a category, which was intended for individuals who showed some characteristics of autistic disorder but did not demonstrate the full complement of symptoms (Volkmar et al., 2005). The research done during this decade really helped clarify the defining features of autism, which was pivotal in increasing the ability to identify ASD in young children (Dawson & Bernier, 2013).

Uta Frith translated Hans Asperger's work from the 1940s into English in the 1990s, introducing the concept of "Asperger's syndrome" to a wider, English-speaking audience. Asperger recognized that his syndrome was similar in many ways to the autism described by Kanner, but there were also significant differences that included higher intelligence and grammatical speech ability (Blacher & Christensen, 2011; Verhoeff, 2013). He further noted that many of the children with Asperger's syndrome had special talents they were able to later parlay into successful careers as adults (Vatanoglu-Lutz et al., 2014).

In the DSM-IV (APA, 1994) Asperger's disorder emerged as a separate category from autistic disorder, although the definitions had significant overlap. In fact, the definition for

Asperger's disorder included the caveat that criteria for autistic disorder not be completely met in order to meet for Asperger's disorder. Autistic disorder was defined by deficits in social development and communication and play, along with restricted and stereotyped interest, and the onset of at least one of these areas had to take place by age 3 (Volkmar et al., 2005). The next revision, DSM-IV-R (APA, 2000), maintained the categories of autistic disorder, Asperger's disorder, and PDD-NOS under the umbrella of pervasive developmental disorders.

Current Definition

The current DSM, DSM-5 (APA, 2013), combined Asperger's disorder, PDD-NOS and autistic disorder into one category labeled "autism spectrum disorder" (ASD). ASD is defined as "persistent deficits in social communication and social interaction across multiple contexts" with "restricted, repetitive patterns of behavior, interests, or activities" (APA, 2013). This is similar to the previous definition of autistic disorder, but it importantly conceptualizes autism as one core disorder rather than several similar disorders. Also new in this version of the DSM is the category of social communication disorder (SCD), which describes the social and pragmatic language deficits in ASD without the stereotypy. Verhoeff (2013) suggested that the category of SCD is reminiscent of Asperger's disorder and PDD-NOS in that it was meant to identify a rare subset of individuals who do not meet full criteria for ASD. While the terminology has varied and diagnostic criteria have become more specific over time, ASD has remained heterogeneous in its overall symptomology (Blacher & Christensen, 2011).

Deficits in Social Communication and Social Interaction

In order to meet criteria for ASD, individuals must demonstrate persistent deficits in social communication and interaction across multiple contexts. This must include deficits in each of the following three areas: social-emotional reciprocity (e.g., reduced sharing of interests,

failure to initiate or respond to social interactions); non-verbal communication used for social interaction (e.g., atypical eye contact and body language, difficulty understanding/using gestures); and developing, maintaining, and understanding relationships (e.g., difficulty sharing imaginative play, lack of interest in peers) (APA, 2013). Social communication, a term often used interchangeably with pragmatic language (Norbury, 2014), impacts overall functional skills in social settings. Deficits in pragmatic skills negatively impact the ability to contribute to social interactions. In this way, social communication skills are inextricably connected with the ability to appropriately participate in social interaction opportunities, and there is considerable overlap between them.

The Development of Social-Emotional Reciprocity

Social reciprocity forms the basis of social and emotional skill development. This experience of give and take between two or more people is the arena in which social and emotional skills develop and grow. From an early age, children naturally begin to engage in shared experiences that form the basis of social reciprocity and emotional engagement with others. This collaboration increases in complexity over the years, providing the foundation for quality reciprocal experiences that allow for positive social interactions. Successful reciprocal social experiences in childhood and adolescence contribute to the success of interactions with others in adulthood. In children with ASD, the development of social and emotional skills follows an atypical path that can negatively impact social relationships and other life experiences.

Joint engagement. Infants do not initially have a concept of other people, but develop this concept over time as they begin to understand others are having their own thoughts. Even before 12 months of age, infants begin to show an understanding of the goals of others in response to

social interactions (Hobson, Lee, & Hobson, 2007). Infants are motivated to engage with others, first through face-to-face interactions with adults and later through their attempts to engage others in play and offer help to others. By identifying with others' attitudes toward a shared experience, infants begin to understand the distinction between things, and thoughts about those things (Hobson et al., 2007). This tendency to identify with others is essential for development of emotional engagement with other people.

This basic level of joint engagement, built upon shared intentionality, expands to include collaboration with others and more advanced levels of reciprocity. After a year of age, children begin to show an understanding of an end goal, and may even begin to understand what others know and don't know (Carpenter, 2009). Between 12-18 months, toddlers become more advanced in the coordination of joint activity engagement through turn-taking and communication repair (Carpenter, 2009). Around age two, parallel activity emerges and toddlers begin to play near one another in the same type of activity. Rather than playing interactively, their attention is focused on the object of their own play (van Ommeren, Begeer, Scheeren, & Koot, 2012). By age three, children begin to demonstrate basic reciprocal behavior by sharing play and joining in on activities together, and they develop an emerging understanding that others have their own thoughts and intentions (van Ommeren et al., 2012).

Differences in social behaviors for children with ASD often emerge within the first year, signified by a lack of interest in the social environment and less social engagement and interaction than is seen in typically developing peers, in spite of other developmental areas being on target (Volkmar et al., 2005). Without intervention, this disparity expands as the expectations for social interaction become more advanced. In adolescence, youth are expected to navigate a

wider variety of social contexts, and the impairment in social reciprocity becomes more apparent (Carter et al., 2014).

Researchers are still developing an understanding of how reciprocal behaviors in natural settings evolve for individuals with autism (van Ommeren et al., 2012). This may depend, at least in part, on how individuals with ASD perceive the people in their environment. Children with ASD who focused on objects instead of faces of individuals when watching video clips demonstrated a higher level of social disability (Rice, Moriuchi, Jones, & Klin, 2012). While higher functioning individuals with ASD may show more developed basic social reciprocity and collaboration than children who are lower functioning, they still tend to collaborate based on their own initiative rather than following the lead of another. This control over collaboration does not require perspective shifting or attempting to understand the intentions another person (van Ommeren et al., 2012).

In a longitudinal study that followed children with ASD from childhood through early adulthood, McGovern and Sigman (2005) found that there was a positive relationship between engagement with peers and long-term social skills. Children with ASD who showed higher levels of engagement with peers at earlier ages displayed more positive social skills later in life, with early rates of social engagement predicting improvements in social skills. Increasing engagement skills may result in sustained improvements in social reciprocity (McGovern & Sigman, 2005). When individuals with ASD are engaged with peer in real-life situations, social skills are practiced in context.

Empathy. Individuals with ASD perceive and express emotion differently than their typically developing peers, impacting the way they relate to others (Hobson et al., 2007). Some studies have shown a lack of person-centered feelings in the reactions of individuals with autism,

which may be the key deficit in social emotional relationships (Hobson et al., 2007). Specifically, these individuals generally display deficits in empathy and the recognition and understanding of emotions (Hirvela & Helkama, 2011; Rueda, Fernandez-Berrocal, & Baron-Cohen, 2015), which impacts their ability to reciprocate emotional states of others.

Empathy is the ability to recognize others' mental states and respond to those states appropriately (Rueda et al. 2015). Empathy can be further divided into cognitive empathy and affective empathy. Cognitive empathy is the recognition and categorization of another's mental state while affective empathy denotes the actual emotional response based on the understanding of the other's mental state (Rueda et al., 2015). Individuals with ASD show some awareness of their own difficulty assessing the situation aptly (cognitive empathy) while demonstrating some proficiency in responding appropriately if the situation is understood (affective empathy) (Rueda et al., 2015).

In a study exploring empathy among adults with ASD, Hirvela and Helkama (2011) found significantly lower levels of perspective taking and empathic concern as compared to the control group without ASD. Similar to the findings of Rueda and colleagues (2015), they felt it was possible the lowered empathy was a result of an inability to recognize that another person was having concerns. Scores of empathy may therefore reflect a lack of awareness of the situation rather than a lack of empathetic feelings. If individuals with ASD are helped to read social situations correctly, their empathetic responses may be closer to what is expected from typical peers (Rueda et al., 2015). Interventions that focus on developing cognitive empathy along with reinforcing appropriate response patterns may offer the most positive outcome.

Nonverbal Communication in Social Interaction

Nonverbal indicators play an important role in social communication. Using language appropriately in the context of social situations involves understanding the uses and functions of language as part of the relationship between the speaker and the listener (Hyter, 2007). Words alone do not always convey the entire meaning of what is being said; the context of situation and prior knowledge also contribute to the meaning of utterances (Loukusa et al., 2007). In order to successfully communicate with others, children must use their knowledge and previous experiences to create meaning that extends beyond the literal words spoken (Norbury, 2014). The nonverbal relationship between individuals with ASD and their typically developing peers are notably different in terms of engagement, affect and gestures.

The basis for social interaction begins long before verbal language skills are established. Pre-linguistic social communication skills, such as joint attention, imitation, eye gaze, and interest in other people, are typically considered to be important foundational skills that foster language development and may predict later language ability in toddlers and preschoolers (Charman, Baron-Cohen, Baird, Drew, & Cox, 2003; Miniscalco, Ruding, Rastam, Gilberg, & Johnels, 2014). Specifically, joint attention, the coordination of two or more individuals' attention around a single object, is very important in communication for children and strengthens over the first few years. Toddlers also begin to use greeting, calling, negotiating, teasing, and commenting as part of their communication repertoire (Landa, 2005). Imitation is a vehicle for social learning. A deficit in imitation skills greatly impacts the ability to learn in a social sense in young children with autism (Dawson & Bernier, 2013).

Between the ages of three to five, there is a rapid increase in correct responses to contextually complex questions (Loukusa et al., 2007). During this time, children also begin to

develop presupposition skills, which allows them to regulate the type and amount of information shared, according to the context (Landa, 2005). Although this skill has its emergence in preschool, it continues to develop as the child gains cognitive maturity. Managing discourse includes carrying on a back and forth conversation, repairing breakdowns in communication, maintaining the topic, and initiation and transition of topics. It requires a number of different skills, including self-monitoring and monitoring the partner's understanding, as well as understanding and following the social rules in context (Landa, 2005; Young et al., 2005). Initiation and maintenance skills in conversation increase in the early years, with longer conversations and cooperative interaction. Effective use of context within language grows as young children become more social in nature (Naerland, 2011).

Naerland (2011) describes three features of conversational competence in young children: focus of attention, reference of speech, and comprehensive speech. Focus of attention refers to whether children focus their attention towards themselves or their partners; reference of speech regards whether the topic is something physically present or not present; and comprehensive speech can be explicit or unclear. As children mature in age and pragmatic skill development, they become more capable of focusing on partners, and become more explicit in their communication. With a higher level of social-cognitive abilities, speakers are able to give the appropriate amount of information to make clear the topic. Pragmatic language skills involve the use and understanding of language in context, including inference and resolution of ambiguity (Norbury, 2014). Typical children show a developmental increase in narrative skills until around age 10 when these skills more closely resemble adult-like skills (Manolitsi & Botting, 2011).

Individuals with ASD have difficulty maintaining and developing topics, taking turns, initiating and responding to conversation, and demonstrate challenges with non-literal language

(Volden & Phillips, 2010). Although typically developing children generally gain an understanding of how to use language appropriately in the social context, children with ASD often require explicit instruction in order to make gains in this area (Naerland, 2011). They also have some difficulty with processing affective information, including recognizing emotions, which impacts the ability to successfully function in social situations (Young et al., 2005).

Adolescents with ASD may be less likely to identify with others and anchor to the orientation of others (Garcia-Perez, Lee, & Hobson, 2007). The quality of flow between partners is significantly different in individuals with ASD as compared to peers, with some differences in the nonverbal indicators of reciprocity, such as eye gaze, smiling and nodding (Garcia-Perez et al., 2007). Individuals with high functioning autism (HFA) generally have normal language structures with impairments in pragmatics as the only language deficit. Because of a relative strength in structural language, pragmatic difficulties may not be immediately obvious in structured language settings although they become more apparent in general conversation (Young et al., 2005). In other words, children with ASD have difficulty with the use of language rather than the language itself (Frith, 2012).

Theory of mind. There is a connection between the literal understanding of language and difficulty making inferences about other's state of mind (Martin & McDonald, 2004; Norbury & Bishop, 2002). As children age, they begin to develop Theory of Mind (ToM), which refers to the ability to recognize and infer the intentions, thoughts, emotions, and motivations of others that may not match the surface presentation (Colle, Baron-Cohen, & Hill, 2007; Martin & McDonald, 2006; Rueda et al., 2015). This understanding of the mental state of another can be used to comprehend and predict what others say and do (Martin & McDonald, 2004). Around the age of 4, children begin to understand what others who are not privy to the same information

might be thinking (Baron-Cohen, Leslie, & Frith, 1985). Increased levels of motivation to make joint efforts with common goals by sharing intentions with others become apparent (van Ommeren et al., 2012). This increase in joint skills involves both cognitive ability (interaction and negotiation) and emotional functioning (accepting the contributions of another), and provides the foundation for more complex social-emotional reciprocity skills (van Ommeren et al., 2012). In this way, ToM is related not only to nonverbal aspect of social communication, but also to social-emotional reciprocity.

Without an understanding of another's mental state (ToM), individuals with autism may find the behaviors of others to be confusing and unpredictable (Baron-Cohen, 2009). Several studies have looked at ToM in ASD. In one, adults with ASD showed significantly fewer pragmatic skills than adults without ASD when telling a story. For example, they used fewer personal pronouns, temporal expressions, and referential expressions, all of which can be related to ToM. Although their lexical knowledge was age-appropriate, when required to infer pragmatics, they lacked flexibility and had difficulty in appropriately satisfying ambiguous pronoun use (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008). The results of another study using a nonverbal version of a false-belief task found that syntactic development wasn't necessary for ToM competence (Colle et al., 2007). ToM was also correlated with narrative measure, and difficulties in narrative linked to how capable the subject was in understanding the minds of others. Subjects with lowered levels of ToM stayed on one topic or went into detail for too long, and changed the topic too frequently (Colle et al., 2008).

Discourse and conversation. Individuals with ASD experience difficulties in the initiation and maintenance of conversation, and communication in a variety of social contexts. In fact, conversation is one of the most challenging forms of discourse for those with ASD (Losh &

Gordon, 2014), particularly when high levels of comprehension are required (Loukusa et al., 2007). Conversational breakdown from distraction, noise, or another interruption can be very taxing when repair involves complex reasoning (Volden, 2004). Skill in conversation requires use and understanding of many nonverbal cues, such as eye contact, body language, gestures, and prosody, and understanding of the context of the conversation.

Although still challenged, older children with HFA demonstrate more competencies using context to interpret language than younger children, suggesting a decrease in difficulties using context to understand language as children age. Difficulties explaining their response choices may suggest children with HFA are not fully aware of the process a conversational partner has to undergo to comprehend the full meaning of the communication, and they may also develop contextual comprehension later than typically developing children. In structured settings, children with HFA showed some appropriate use of pragmatic language, so the issue may be inefficiency with this skill rather than a complete lack of ability (Loukusa et al., 2007).

Prosody involves the intonation and rhythm of speech, which holds additional information about the intent of the speaker. Individuals with ASD have been shown to have some difficulty producing expected speech prosody and interpreting the prosody of others (Colich et al., 2012; Grossman, Edelson, & Tager-Flusberg, 2013). By lacking the skills to produce and interpret appropriate prosody, individuals with ASD are missing important clues needed to infer the meaning of conversation. Difficulty with prosody has also been connected to inappropriate use of facial expressions (Grossman et al., 2013).

Irony and pronoun use are two language concepts that are notably difficult for individuals with ASD. In unpredictable conditions, ironic statements take longer for individuals with ASD to process (Spotorno & Noveck, 2014). When the intended meaning is different from the literal

meaning, such as is found in irony, difficulty with processing prosody and integrating voice tone and social cues may interfere with understanding (Colich et al., 2012). Inappropriate use of personal pronouns has also been noted in children with ASD, where lack of eye contact was linked with lowered use of personal pronouns (Hobson, Lee, & Hobson, 2010; Norbury & Bishop, 2003).

There are also distinct differences noted in the spontaneous nonverbal indicators of individuals with ASD as compared to typically developing peers (Garcia-Perez et al., 2007). Individuals on the spectrum do not appear as attuned to conversational partners, and this may impact the ability of the partner to identify and engage with the individual with ASD in a way that allows for reciprocity (Garcia-Perez et al., 2007). Less eye contact is noted in individuals with ASD (Hobson et al., 2010) as well as marked differences in facial expressions when compared to typically developing peers. Although they may generally demonstrate accurate facial expressions, adolescents with ASD were more awkward in the use of those expressions with higher rates of awkwardness corresponding to increased severity on the Autism Diagnostic Observation Schedule ([ADOS] Lord, Rutter, DiLavore, & Risi, 1999) social communication score (Grossman et al., 2013).

Not a heterogeneous group to begin with, pragmatic ability differs amongst individuals with ASD. It is likely that individual differences in abilities correspond to the quality of friendships experienced by children with ASD, and those with stronger cognitive and language skills are better able to compensate for social communication difficulties (Calder, Hill & Pellicano, 2012; Young et al., 2005). Family traits may also contribute to individual differences. Children with ASD with at least one parent categorized as having the broader autism phenotype demonstrate higher levels of deficiency in pragmatic and structural language skills than children

with ASD whose parents are not categorized with broader autism phenotype (Taylor et al., 2013).

Developing, Maintaining, and Understanding Relationships

Social interactions with peers play a large role in the development of self-identity, and these interactions are complex and can be unpredictable (Bottema-Beutel & Smith, 2013). Establishing and maintaining friendships requires communication and self-regulation skills, as well as the ability to take perspective and read emotions effectively (Calder et al., 2012). Children spend a significant portion of their day in school settings, and friendships within school become important for promoting positive outcomes in both social and academic arenas (Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011). Friendships in the elementary school years often center on shared activities or games and proximity, and it is within these activities that children develop mastery in the unspoken rules of reciprocity in relationships.

During adolescence, relationships with peers typically take precedence over relationships with adults (Carter et al., 2014; Pearl, Murray, Smith, & Arnold, 2012). As adolescents begin spending more time with their peers, affiliations with those peers become increasingly more important. Friendships during adolescence are generally formed around shared interests and associations, and require an increasingly complex understanding of social rules, not all of which may be immediately apparent (Carter et al., 2014; Pearl et al., 2012). With increased peer socialization opportunities in a variety of activities and settings, adolescents must learn how to differentiate between the diverse behaviors and social rules required for interactions (Koegel et al., 2012). The expectation is that adolescents be able to function independently with established social interaction skills (Koegel et al., 2012). Adolescents are expected to develop the skills they

will need to effectively function in adult society, where accomplished social interactions are crucial to success in career and life.

While higher functioning individuals with ASD may demonstrate reciprocal social interaction with adults in structured settings, they may not display the same ability with peers, often having difficulties with social interactions in unstructured, naturalistic settings (van Ommeren et al., 2012). With peers, individuals with ASD demonstrate a lack of engagement, atypical behaviors, and restricted patterns of play (Gibson, Hussain, Holsgrove, Adams & Green, 2011).

Although many teens with ASD experience a desire for social relationships with peers, they report having fewer friends than typical peers, and limited social experiences (Bauminger & Kasari, 2000). While peers can define the qualities of friends, individuals with autism focus less on complex descriptions and more on physical companionship (Bauminger & Kasari, 2000). Adolescents may have more success describing what "not a friend" means (Carrington, Templeton, & Papinczak, 2003). When they did describe friendship, common thoughts revolved around having similar interests and shared activities. These friendships may differ in quality from friends of typically developing peers, and "rules" for choosing friendships may be based on inflexible ideas. Friendships may produce anxiety and students may lack the ability to cope effectively with deficiencies in skills. Adolescents with ASD tend to be on the outside of social networks within their classrooms (Calder et al., 2012; Chamberlain, Kasari & Rotheram-Fuller, 2007) or experience outright rejection by peers (Humphrey & Symes, 2011).

Adolescents must orient to what is important while understanding the situation within its context, which varies according to the setting and type of contact. This can be very challenging for individuals with ASD, as they may focus on objects or ideas that do not have shared

significance or relevance to the interaction (Bottema-Beutel & Smith, 2013). When adolescents with ASD are put in social situations, there are challenges to overcome. They do not tend to adjust language and actions to be appropriate for social needs of the situation, instead basing contributions solely on their own perspective without identifying with the experiences of others (Hobson, Lee, & Hobson, 2007). They may be confused by the social demands of the situation and misunderstand social expectations and communication (Chamberlain et al., 2007) and experience challenges adjusting to the needs of a conversational partner by providing sufficient, but not excessive, information (Adams et al., 2012).

Developing skills in social reciprocity requires social experiences. Adolescents with autism engage in more parallel and solitary experiences, share and cooperate less, and participate in fewer social interactions than their typically developing peers (Humphrey & Symes, 2011). The skills required to establish and maintain friendships are complex and include the ability to take perspective, regulate and read emotions, and communicate effectively (Calder et al., 2012). Parents may provide significant support to their children with ASD in an attempt to increase the quality of their social experiences, including offering explicit instructions on interaction techniques. Motivation for engaging with others varies in individuals with ASD, which also has an impact on the variability in the quality and amount of social experiences (Calder et al., 2012). In addition to appropriate levels of motivation, it is important for adolescents with ASD to learn to navigate complex social rules in order to benefit from the social experiences made available to them.

Restricted, Repetitive Patterns of Behavior

The presence of restricted and repetitive patterns of behavior, interests, or activities (RRBs) is a core feature of ASD (APA, 2013). For diagnostic ASD criteria to be met, individuals

must demonstrate at least two of the following: stereotyped or repetitive motor movements, use of objects, or speech (e.g., motor stereotypies, lining up toys, echolalia); insistence on sameness, adherence to routines, or ritualized behavior (e.g., rigid thinking, difficulty with transitions, greeting rituals); highly restricted interests that are abnormal in intensity or focus (e.g., preoccupation with unusual objects, perseverative interests); and/or hyper- or hypo-reactivity to sensory input or unusual sensory interests (e.g., adverse reaction to specific sounds or textures, excessive smelling or touching of objects) (APA, 2013). Previously, RRBs have been considered to be "by-products" of social and communicative deficits; however they may be separate from those core deficits. Children with disorders related to difficulties solely in social and/or language abilities generally do not engage in repetitive behaviors, and children can exhibit repetitive and restricted behaviors without a corresponding deficit in social or language skills (Richler, Huerta, & Bishop, 2010).

Turner (1999) divided RRBs into two categories: "lower-level" behaviors that include repetitive object manipulation and simple motor stereotypies, and "higher-level" behaviors that include insistence on sameness, repetitive language, and circumscribed interests. She also noted that repetitive stereotyped movements are associated with developmental level. Early diagnosis may not effectively predict trajectories of RRB behaviors, however behaviors that increase in intensity may suggest a more severe diagnosis (Richler et al., 2010).

Stereotyped and Repetitive Behaviors

Perhaps the most noticeable of the RRBs, stereotyped or repetitive movements may relate to the use of objects or speech, and can present as simple motor stereotypies, including the lining up or flipping of objects, or engaging in echolalia or idiosyncratic phrases (APA, 2013). Stereotypic behaviors include repetitive movements that provide their own reinforcement

without regard for social consequences, and thus are maintained by "automatic" positive reinforcement. They may be reduced by increased engagement in environmental stimuli providing different automatic reinforcement (Rapp & Vollmer, 2005). In order to identify whether a behavior is actually stereotypy, a functional assessment is typically used (Enloe & Rapp, 2014). This addresses the function of a behavior and will serve to identify the reinforcer, whether automatic or something in the environment, that is maintaining the behavior.

Motor stereotypy. Just as with social communication deficits, stereotypic behaviors appear to be present from very early age and may be an early behavioral marker of ASD. Elison and colleagues (2014) found that repetitive object manipulation was associated in infants at high risk for ASD (having an older sibling identified with ASD) regardless of whether they themselves went on to be diagnosed with ASD, while repetitive body movement was associated with infants who went on to be diagnosed with ASD, regardless of risk level. Parent report of restricted and repetitive behaviors at one year of age may therefore potentially be an important early indicator for ASD.

Much research has been done with children in their second year of life. Morgan, Wetherby, and Barber (2008) found that children aged 18 to 24 months who were later identified with ASD exhibited significantly higher rates of restricted and stereotypic behaviors with both body and objects than children who were identified with a developmental disability or those who were typically developing. They also found that repetitive and stereotyped behaviors with objects during the second year of life were negatively correlated and significantly predictive of nonverbal and verbal developmental quotient scores; a finding also seen by Watt, Wetherby, Barber, and Morgan (2008). Furthermore, repetitive stereotypy with the body was significantly predictive of the Social Affect and Repetitive and Restricted Behavior scores as measured by the

ADOS during the fourth year; however, this effect appeared to be mediated by cognitive level. In general, the presence of repetitive and stereotyped movements in children under 2 years of age appears to reliably differentiate between children later diagnosed with ASD. For children later identified with ASD or Developmental Delay (DD), repetitive and stereotyped movements in the second year were predictive of both nonverbal and verbal developmental levels (Morgan et al., 2008; Watt et al., 2008), making it important to differentiate between stereotyped movements that are related to symptoms of autism and those that correspond to general developmental level (Watt et al., 2008).

Vocal stereotypy. Vocal stereotypy refers to immediate (repeating others' speech immediately afterwards) and delayed (repeating speech previously spoken and no longer appropriate for the current context) echolalia, babbling, repetitive noises and any other repetitive utterances (Ahearn, Clark, MacDonald, & Chung, 2007). As with motor stereotypy, vocal stereotypy occurs independently of social consequences (Colon, Ahearn, Clark, & Masalsky, 2012). In the DSM-IV (APA, 1994), vocal stereotypy was considered together with communication skills; however the DSM-5 (APA, 2013) recognizes it as more similar to the stereotypy that is seen with objects and movements.

Insistence on Sameness, Restricted Interests, and Sensory Interests and Reactivity

The second and third types of RRBs, insistence on sameness and restricted interests, are related and both are considered higher-level behaviors (Turner, 1999). Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behaviors may manifest as difficulties with transitions, rigid thinking patterns, rituals for greetings or eating, resistance to small changes or a need to do things in the same manner every time (APA, 2013). Highly restricted, fixated interests that are abnormal in intensity or focus, can be demonstrated

by excessively circumscribed or perseverative interests or strong attachments or preoccupation with unusual objects (APA, 2013).

Insistence on sameness was not related to cognitive level at age 2, but was negatively associated with social and communicative impairments in that milder social/communicative impairments were related to more severe behaviors related to insistence on sameness. Additionally, while other stereotyped behaviors persisted or improved over time, sameness behaviors tended to be milder initially and were shown to worsen over time (Richler et al., 2010).

Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment is the final type of RRB. This may include an adverse response to specific sounds or textures, extreme interest in smelling or touching of objects, or visual fascination with lights or movement (APA, 2013). Richler and colleagues (2010) found that milder repetitive sensory motor behaviors were associated with higher cognitive ability at age 2, but were not associated with social and communicative impairments.

Morgan and colleagues (2008) found that motor stereotypies, such as object manipulation, at age 2 might be a precursor to higher order repetitive behaviors such as insistence on sameness and restricted interests. They are also related in that stereotypy with objects can be divided into two types of behaviors: restricted, which refers to an intense and preoccupied focus with the objects, and sameness, reflected by difficulty transitioning from engagement with specific objects. In this way, the first three types of RRBs (stereotypy, insistence on sameness, and restricted interests) are related to one another. In fact, there is significant overlap in the various types of RRBs, and behaviors may be therefore be interpreted under more than one type (Richler et al., 2010).

Relationship to Development

RRBs interfere with the ability of individuals to attend to and participate in their surroundings. In this way, RRBs also interfere with the development of typical social and communication skills normally learned through participation in the world around them. Differentiating between repetitive and stereotypic behaviors typical in early development and those that are unusual and perhaps indicative of ASD is important. Studies addressing differences between the repetitive and stereotyped behaviors typical of children with ASD and those typically seen in children who are developmentally delayed have shown conflicting evidence (Watt et al., 2008). Some studies have found an association between challenging and repetitive behaviors and the severity of ASD symptoms (Matson & Rivet, 2007; Richler et al., 2010). Furthermore, repetitive and restricted behaviors do not appear to be associated with overall developmental level in children younger than 36 months; therefore the presence of those behaviors may indicate concern in children that age (Bishop, Richler, & Lord, 2006; Mooney, Gray, & Tonge, 2006).

Younger siblings of children with ASD demonstrated a significantly higher rate of object and body repetitive and stereotyped movements as compared to younger siblings of typically developing children, but this did not necessarily suggest a higher rate of developing ASD (Damiano, Nahmias, Hogan-Brown, & Stone, 2013). Specifically, Morgan and colleagues (2008) found that the inventory of repetitive and sensory motor behaviors in younger siblings of children with ASD was more predictive of future ASD diagnosis than the rate alone. In this way, higher rates of RRBs may reflect familiar risk in younger siblings of children with ASD, but they suggested that higher rates of RRBs in the general population may have implications for future diagnosis.

Relationship to Learning

Stereotypic behavior can interfere with learning (Lee, Odom, & Loftin, 2007). It's important to reduce stereotypy as it can potentially interfere with the development of appropriate skills. One study has found an association between cognitive levels under 70 with higher levels of stereotyped behaviors (Itzchak, Lahat, Burgin, & Zachor, 2008). They found that early, intensive intervention significantly reduced the severity of autism symptoms and increased cognitive levels; perhaps because the lowered severity of symptoms allowed for more accurate cognitive assessment.

ASD Identification Across Racial and Ethnic Groups

ASD is identified based on observed behaviors that include deficits in social communication and social interactions, and the presence of restricted and repetitive patterns of behavior (APA, 2013). On the surface, ASD symptomology presents similarly across racial and ethnic groups, however there is wide variation in how families interpret those symptoms across those groups (Bernier et al., 2010). There is ample data to indicate that diverse groups are not proportionally represented in ASD identification rates (CDC, 2014; Sullivan, 2013; Travers, Tincani, & Krezmien, 2011).

Social Communication/Interaction and Restricted/Repetitive Behaviors

Communication styles differ amongst distinct groups, according to social expectations and norms (Banks, 2006). Communication skills, and the perception of these skills, are impacted by diversity in languages and linguistic skill (Daley, 2002). Social interaction and communication skills, expression of emotions, typical eye contact, aggression levels, and levels of attachment are all behaviors that may have cultural norms (Wilder, Dyches, Obiakor, & Algozzine, 2004).

Reciprocal social interaction may also be interpreted differently in diverse racial and ethnic groups. For example, appropriate eye contact is part of the scoring system on the ADOS (Lord et al., 1999) and the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005), but appropriateness of this skill varies widely across racial and ethnic boundaries (Norbury & Sparks, 2013). While studying the process of evaluation for ASD in India, Daley (2004) found that Indian parents often identified concerns in social behaviors first, possibly as a result of the social expectations in traditional Indian culture. Overall, however, parents in India notice differences in their children 6-10 months later than what is reported for US parents. Mandell, Listerud, Levy, and Pinto-Martin (2002) also felt diagnoses may depend in part on the way unusual behaviors were viewed and labeled by parents and clinicians. Behavioral symptoms in general may be perceived differently across diverse contexts (Daley, 2002; Wilder et al., 2004), and this may have significant impact on identification rates.

Understanding and identifying differences in how symptoms manifest and are interpreted across racial and ethnic groups is paramount to the identification process (Kreiser & White, 2014). It is imperative to effectively diagnose affected children from all racial and ethnic groups at the earliest age possible, as there is ample research that shows early identification and servicing of children with ASD leads to more positive outcomes (Gwynne, Blick & Duffy, 2009; Reichow, 2012; MacDonald, Parry-Cruwys, Dupere, & Ahearn, 2014; Talay-Ongan, 2001; Tincani et al., 2009). Symptoms must be considered within cultural context when making decisions for diagnosis and intervention (Mandell & Novak, 2005; Ouellette-Kuntz et al., 2006). As part of this, it is essential to consider how families interpret the presence of ASD behaviors in their children, and whether they view these behaviors as acceptable within the boundaries of their cultural context, or view these behaviors as problem in need of remediation (Tincani, et al.,

2009). By understanding how families prioritize and attribute these behaviors, interventions can be more successfully designed. Pragmatic language also has a significant cultural component, particularly with regards to such things as eye contact, rules for turn-taking, and the ability to ask challenging questions (Hyter, 2007; Norbury, 2014; Norbury & Sparks, 2012; Young, Diehl, Morris, Hyman, & Bennetto, 2005). Communicative behaviors such as these may vary between cultures; therefore the expectations vary.

Mass screening of infants in Peru using veteran parents (highly trained and experienced) to do the screening interview was very effective for identifying at-risk aggression, self-injurious, and stereotypic behavior in infants and toddlers (Mayo-Ortega et al., 2012). Using these veteran parents allowed for instant credibility and empathy and hope for the other parents, which they felt was a huge part of the success.

Barriers to Diagnosis and Treatment

While exploring racially and ethnically diverse representation in ASD diagnoses in public schools between the years of 1998 and 2006, Travers et al. (2011) found risk indices increased for all racial groups, although Caucasian American students were up to twice as likely to be identified with ASD as compared to Hispanic/Latino and Native American students. Specifically, Caucasian American students' risk indices increased to a number four times as great during the time period studied. African American students' risk indices were initially greater than those of Caucasian Americans in the late 90s, however the risk indices decreased and the gap grew larger over time. Sullivan (2013) found these disparities to exist between individual states as well, and the CDC (2016) noted in its most recent prevalence estimate that the ASD identification rate varied from 1 in 81 (South Carolina) to 1 in 41 (New Jersey).

Travers et al. (2011) suggest two possible reasons for the underrepresentation of some racial groups. The first is that this is the direct result of a later diagnosis, which has been documented in other literature as well (Mandell et al., 2002; Mandell et al., 2009; Rosenberg, Landa, Law, Stuart, & Law, 2011). A second possible reason is that students may initially be misidentified, a phenomenon also seen by Roy and Balaratnasingam (2010). When Roy and Balaratnasingam (2010) reevaluated a number of adult psychiatric patients of indigenous heritage in Australia, they found many of them had been misdiagnosed with schizophrenia when ASD was the correct diagnosis. Mandell et al. (2009) found that when some populations were diagnosed with intellectual or attention disabilities, concerted efforts for further evaluation weren't made which may have missed the presence of ASD as a co-morbid diagnosis. Bernier and colleagues (2010) suggest the need for more research to help identify the barriers to service so they can be eliminated, allowing racial minority children in need of diagnosis and treatment to access services at an earlier age.

Access to services. Although ASD symptomology manifests similarly across racial and ethnic groups, the ability to seek help and select available treatment options is not the same for all (Bernier et al., 2010). Families from racial minority backgrounds may have less access to care than other families (Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007). Using data from the Interactive Autism Network, a large online open national registry containing a dataset of individuals diagnosed with ASD, Rosenberg and colleagues (2011) found disparities in the age children were given their first diagnosis of ASD by race and geographic region. An earlier study by Mandell et al. (2002) had similar findings. They used linear regression on available Medicaid data from Philadelphia and found that African American children were diagnosed at a later age, generally spending more time than Caucasian American children in mental health treatment

before a diagnosis was made. Although Caucasian American children generally entered treatment before their African American peers, that alone did not account for the difference in age at diagnosis. Mandell et al. (2002) felt their research suggested no differences in the epidemiology or phenotype of autism, but rather that sociocultural factors, including general access to mental health services and participation in these services, play a part in the noted disparity. Conversely, a few studies have found no racial or ethnic differences in age of diagnosis (Williams, Matson, Beighley, & Konst, 2015) or in age of first concern (Jang, Matson, Cervantes, & Konst, 2014).

Siller and colleagues (2014) found several demographic variables that predicted a family's use of services, including family structure, (e.g., siblings, household members, age of the parents), ethnicity/race, and socioeconomic status (SES; e.g., annual household income, rental or ownership of home, parental education level). They also found parents' understanding of typical development and their sense of parenting efficacy was directly related to weekly hours of services utilized. Also studying SES and diagnostic rates, Durkin et al. (2010) found that children who came from lower SES were under-identified and underserved when compared to those who came from higher SES backgrounds. However, when they looked at individuals with a pre-existing diagnosis and compared to those without, it was determined that physical and social environmental factors could not be completely discounted.

It is essential to increase awareness of available services and the importance of accessing those services as early as possible in underrepresented groups (Kang-Yi, Grinker, & Mandress, 2013; Tincani et al., 2009). Access to programs that can provide diagnostic and treatment services is dependent to some extent on proximity factors and financial ability to travel and secure services. For example, indigenous populations living in remote areas further from

treatment facilities may receive fewer diagnoses, resulting in lower rates of autism diagnoses for that population (Leonard et al., 2011).

Racial or ethnic mismatch. With regards to services in school, educators currently working with students identified with ASD are predominantly of the Caucasian American culture (Jegatheesan, Miller, & Fowler, 2010). Morrier, Hess and Heflin (2008) assert that a mismatch between the racial background of the school staff and its students appears to be a factor in the disproportionate representation of children from racially diverse backgrounds in special education services. Their research supported previous findings that racially diverse students were underrepresented in the autism eligibility category as compared to the rates of Caucasian American children, whom they felt were overrepresented. They suggest that a better racial match between school staff and students, along with better system of information dissemination to diverse families (including details about early indicators of autism and services), would result in more appropriate and proportionate identification of ASD. Providing appropriate training in working with families from diverse racial and ethnic backgrounds, as well as increasing the racial and ethnic backgrounds of educators would benefit the field (Jegatheesan et al., 2010).

Racially and ethnically diverse students demonstrate more difficulty with the academic and behavioral expectations of the school culture than do Caucasian American children, which may suggest that racially and ethnically diverse students with a diagnosis of ASD actually experience more difficulty in the classroom than their Caucasian American peers with a diagnosis of ASD (Dyches et al., 2004). When Tasby (2008) studied the factors influencing diagnostic decisions of school psychologists tasked with identifying symptoms associated with autism in children from diverse racial backgrounds, she concluded that the race of the child might influence the decision-making of the clinicians. She recommended that school psychologists seek to understand their

own racial and cultural biases- a practice also endorsed by Bernier and colleagues (2010)- or seek consultation when dealing with children from racially or ethnically diverse backgrounds.

In addition to the issue of culture mismatch between students and staff, there is also the component of how this mismatch impacts the ability of professionals to work directly with the families of children with ASD. When working with Korean families, Kang-Yi and colleagues (2013) found it essential to understand the culturally based coping strategies of the family in order to identify and implement effective interventions. They assert the importance of increasing family awareness of available services and accessing those services as early as possible in underrepresented groups. Increasing culturally relevant services for students from racially or ethnically diverse groups is essential for effective treatment.

Clinicians' level of knowledge may also be a factor in disparate identification rates (Mandell et al., 2009). Families are eager for assistance, so it is essential that health care providers are aware of ASD and what impact it has on family and individual functioning in order to plan interventions, share resources, and collaborate to provide appropriate services for adolescents and their families (Strunk, Pickler, McCain, Ameringer, & Myers, 2014). In order to provide appropriate services, clinicians must take into account the families, and how they perceive and understand ASD within their own cultural context. Treatment goals must then be developed within the framework of the cultural background of families in order to be effective (Bernier et al., 2010).

ASD Within Context

The practical implications of ASD concern deficits and how they impact functioning in educational, social, and adaptive domains (Tincani et al, 2009). Some behaviors considered atypical in a middle class, mainstream culture may be perfectly acceptable and even functional in

another racial or cultural context, so a diagnostic category based on what is atypical in one group of people may not transfer equally to another group. Therefore, a diagnostic category that was developed from a mainstream, middle class population may not be appropriate for children from diverse cultural and economic backgrounds (Norbury & Sparks, 2013).

When behaviors are not consistent with what is expected from the cultural values of families, they may be concerned, as Eh-Ghouroury & Krackow (2012) found in their study with a child of Puerto Rican background. It is important to look beyond what the parent is reporting as a problem and consider the behavior within the context of the culture as well as the context of the diagnosis of ASD is necessary.

Neurodiversity (Tincani et al., 2009) is a concept that has emerged to suggest that ASD behaviors are part of a continuum of human behaviors. These behaviors may be different from what is typical, but not necessarily deficits. This approach builds on individual strengths in order to develop the functional behaviors of children with ASD. The cultural background and beliefs of the family are integral to how the family understands and responds to the behaviors present in children diagnosed with ASD. Additionally, the religious beliefs of a family can significantly impact how they understand and respond to a diagnosis of autism (Jegatheesan et al., 2010). It is essential to understand the family's point of view in order to avoid making generalizations and preconceptions about a child based solely on a disability category (Tincani et al., 2009).

Functional behaviors. All individuals serve a purpose and a place in their respective societies, according to the concept of functional diversity (Patson, 2007). Therefore, the concept of "disability" may not apply equally across racial and ethnic boundaries. Individual differences are often accepted in Native American families, for example, because families focus on the abilities of their children rather than on their deficits (Dyches et al., 2004). Regarding the Navajo

culture, Kapp (2011) explained that the notion of "disability" is not a traditional one, and therefore behaviors that are consistent with ASD are not necessarily seen as problematic or of concern. Kapp considers this part of the cultural concept of "*Hozho*," that of believing in a spiritual connectedness. Principals of *Hozho* stress acceptance of differences, which leads to recognition of the value inherent in each person. With regards to ASD behaviors, Kapp found that what is seen as a disability or a behavior of concern in the mainstream population may not be seen as such with regards to the Navajo population. Similarly, in studying families in India, Daley (2004) found that Indian families might accept a wider variety of behaviors that deviate from the norm than Caucasian American families. The concept of autism may not even exist in some languages, and therefore the families of those languages may not understand what such a diagnosis may mean (Wilder et al., 2004).

Neurodiversity of language. Norbury and Sparks (2013) reiterate that diagnosing ASD requires understanding and accounting for linguistic differences, because what is developmentally appropriate in the first language of a child may be different than what is expected on assessments. It is necessary to understand the cultural norms and expectations for children being assessed with regards to the tasks being asked of the child (Daley, 2004; Norbury & Sparks, 2013). Pragmatic language, for example, has a significant cultural component, particularly with regards to such things as eye contact and other nonverbal strategies, rules for turn-taking, and ability to ask challenging questions (Norbury & Sparks, 2013). Therefore, the case of underrepresentation may actually be highly related to differences in racial, ethnic, and cultural norms for language, and the level of acceptance for unexpected or atypical communication strategies.

Gathering a thorough developmental history about when problems first presented and putting them in the context of the family situation is important. For example, in the case of a multilingual child with a reported language delay, it is important to know the details of the delay-whether it occurs in both languages or prior to learning a second language or whether it was new after the second language (El-Ghoroury & Krackow, 2012). A thorough interview is important in helping with differential diagnosis as well. Children who meet family and school expectations may not be brought up as a concern, so a thorough review of educational records is important.It is also important to separate issues of delayed language and those of behavior (El-Ghoroury & Krackow, 2012). Using an FBA is important in this case, as well as using an interpreter when necessary. Parents may not have a concern of ASD when they seek assistance with behavior or language issues, so it is important that clinicians are aware of the possibility of ASD.

Role of the School Psychologist

It is clear from this research that the boundary between difference and disorder is not firmly drawn in all contexts. As a result, school psychologists should pay close attention to racial, ethnic, cultural, and linguistic factors when working with diverse families. Cultural context has a significant impact on how a child participates in society (Norbury & Sparks, 2013). The structure and expectations in the school setting may be different from the situation in the home, which would further impact perception of deficits in behaviors. Supporting families by focusing on children's strengths, rather than their deficits, may offer the most success. In order to provide the most effective and successful diagnostic and intervention services in the school setting, school psychologists must be trained in best practices for assessment and interventions with students with ASD (Renshaw & Kuriakose, 2011; Sansosti & Sansosti, 2013). School psychologists are in prime position to service students with ASD, and attention to essential

factors such as culture, language, and symptomology will lead to successful outcomes for students and their families.

Training

With school being, for many children, the only route to diagnosis and services, the importance of school psychologists being trained in the behavioral patterns of ASD is clear. ASD prevalence rates are currently 1 in 68 and have increased significantly over the course of many years (CDC, 2016) so more attention needs to be focused on teaching school psychologist trainees effective techniques to use in the diagnosis of and intervention for students with ASD. Collaboration is also a key skill, as school psychologists need to work effectively with school-based evaluation teams and the families of students in order to provide the best services to students with ASD (Schwartz & Davis, 2014). With the current prevalence rate, it is extremely likely that educators will work with one or more students with ASD. School psychologists therefore need access to explicit and current training regarding assessment and intervention for children with autism (Renshaw & Kuriakose, 2011).

School psychologists are uniquely situated to have expertise in both the identification of social needs in children and the ability to seek out and support appropriate intervention services. They are in a prime position to serve as a bridge between school and families, and between service providers and individual students. However, the skill level of the school psychologist is reliant on adequate training aligned with best practices in ASD. In a study designed to determine the match between best practices in ASD diagnosis and intervention and school psychologist trainees, Sansosti and Sansosti (2013) found that typical training programs lacked effective instruction practices specifically focused on students with ASD. In fact, the majority of training for school psychologists regarding children with ASD is delivered within generalized

coursework rather than in courses that specifically address the ASD population, which may not provide the best background information for actual practice.

Knowledge

In order to work effectively with students who have, or are suspected to have, ASD, school psychologists need four areas of knowledge (Schwartz & Davis, 2014). First, knowledge of the deficits and challenges students with ASD face, and how those challenges impact learning in the school setting is necessary. School psychologists should also have a good understanding of the differences between a medical diagnosis of ASD based on the DSM-5 and an educational determination of autism based on the Individual with Disabilities Education Act (IDEA). A licensed psychologist or physician is necessary to make the medical diagnosis of ASD while the educational determination of autism is made by a multidisciplinary team in a school setting based on an evaluation by team members, including the school psychologist. Third, school psychologists should possess a basic understanding of the principles of applied behavior analysis (ABA) and how to translate those principles to a school setting. Specifically, they need to understand that all behavior serves a function, know how to use positive reinforcement to increase desired behaviors, and how to collect data for use in making decisions. Finally, school psychologists need to have a general familiarity with the efficacy of early intervention for students with ASD (Schwartz & Davis, 2014).

Identification and Intervention Services

In order to accurately identify students who may fit the educational criteria for autism, school psychologists should actively engage in four steps: awareness, screening, high-quality assessment, and initiation of effective intervention (Schwartz & Davis, 2014). In terms of awareness, disseminating resources to school staff and parents about symptoms of ASD, such as

lack of coordinated gaze, lack of shared enjoyment, decreased use of gestures, or speech delays, is an important step.

Sharing information about screening opportunities and empowering families by helping them share any concerns with appropriate care providers is another step (Schwartz & Davis, 2014). Although screening can take place in a variety of settings, such as clinic settings and doctors' offices, school psychologists trained in ASD are in a prime position to provide initial screening services. When children struggle with behavior and socialization in the classroom setting, school psychologists are often called upon for consultation or to provide counseling services. Understanding how to conduct functional behavior analyses to identify the function of problem behaviors can help identify the cause of concern. One early indication of challenge may be a lack of comprehension of social signals from others, which makes a child more likely to have difficulty with basic pragmatic rules (Landa, 2005). For example, children who are challenged in relationships with peers and pro-social responsiveness to others may actually have deficits in pragmatic language competence; effective coping and communication are core skills for success in school (Farmer & Oliver, 2005). Although students with ASD who are more heavily impacted and display greater deficits in language skills may be identified at an early age, those with milder presentations may not display marked deficits until an older age, and their language needs are initially unclear (Farmer & Oliver, 2005). The behaviors that first bring the child to the teacher's attention might not instantly suggest communication difficulties; general difficulties with peers may be the first cue that teachers pick up on. Therefore, it is important that school psychologists are able to recognize when behavioral and social difficulties may be the result of social communication and interaction difficulties.

If screening suggests risk factors for ASD, helping families access an evaluation in a timely manner is the next step. The distinction between the two types of determination (i.e., medical, educational) may be confusing for parents, and school psychologists are key personnel able to assist parents in understanding the differences (Schwartz & Davis, 2014). This may entail evaluating for an educational qualification of autism even while the families await a medical evaluation of ASD in order to provide appropriate services at the school level. Children spend a good number of waking hours in the school setting and some studies have shown that access to services may be a limiting factor for certain populations, which underscores the importance of school-based evaluations (Yeargin-Allsopp et al., 2003). During the assessment process, it also may be important to assist families in understanding the vocabulary used in rating scales and questionnaires; particularly when the family's second language is English. Evaluating parent responses for fit to the questions can also help ensure parental understanding (El-Ghoroury & Krackow, 2012).

Included in a comprehensive and systematic evaluation of skill level, ratings from parents, teachers, and the student may offer quality information (Rotheram-Fuller et al., 2013), however, these reports may differ from information gathered through direct observation. For example, parents may become more acclimated to their children's unique social functioning as they age, and may therefore rate social behaviors as less severe as the child becomes older (McGovern & Sigman, 2005). Direct observation is an important tool to assess social interaction ability, as it is difficult to self-evaluate skills in this area (Pickles et al., 2013), and parent perspective may differ from that of a clinician. Parents view their children's behaviors in the context of the family unit, and behaviors exhibited in the social context of school may differ. While teacher report can provide information about social functioning in a structured class setting, it may lack information

related to behavior in unstructured settings. For these reasons, it is important to include objective observations within unstructured settings as part of an overall assessment of social skill level.

The school setting provides an ideal opportunity to observe children in interactions with peers. Schools contain a variety of children with a range of behaviors, so it is easy to compare behaviors with a normative group in the classroom (Rowe, Rivers, & Kamphaus, 2012). Observations of behavior do have the potential to be influenced by subjectivity and interpretation bias (Falkmer, Anderson, Falkmer, & Horlin, 2013), and behavior can vary day by day, so interpretation by a qualified and knowledgeable school psychologist is integral to the analysis. From this analysis, school psychologists can offer insight into the student's skill level and behavioral challenges.

Evaluators and researchers need to take into account cultural expectations when considering a diagnosis of ASD in children from racially and ethnically diverse backgrounds (Roy & Balaratnasingam, 2010), as assessments currently used are highly influenced by the Caucasian American experience. Culturally sensitive tools are essential for diagnosis in order to plan for appropriate and effective interventions (Lindblom, 2014). A reliable diagnosis of ASD should be made using a combination of interview data, direct assessment and structured observation, an adaptive behavior measure and rating scales (Tomanik, Pearson, Loveland, Lane, & Shaw, 2007) and there is considerable value in experienced clinical judgment (Volkmar, Chawarska, & Sline, 2005). Although direct assessment and structured observations are filtered through a clinician's expertise, interview responses, adaptive behavior information, and completion of rating scales rely heavily on the experiences and observations of families, teachers, and other non-clinicians who are most familiar with the child.

Finally, if the child is shown to have a diagnosis of ASD or an educational determination of autism, access to evidence-based intervention services should be arranged as soon as possible, both in the school setting, and also outside the school setting (Schwartz & Davis, 2014). School psychologists should be aware of outside services from which students may benefit and be able to direct parents to these resources. Additionally, students with ASD may display behavioral problems that interfere with learning, and the school psychologist may be asked to provide interventions to minimize these behaviors (Williams, Johnson, & Sukhodolsky, 2005). Parents and teachers may be more inclined to prioritize academic and behavioral issues over issues with friendships and socialization (Calder et al., 2012), and one of the most challenging behaviors seen in school settings relates to emotional outbursts (Humphrey & Symes, 2011). Through an FBA, school psychologists can target problematic behaviors and make suggestions for adjustment of environment factors, or changes in the antecedents or consequences, in order to improve behaviors. School psychologists can identify reinforcers for students with ASD and provide explicit instruction to teachers and parents on how to use reinforcement techniques to increase desired behaviors (Williams et al., 2005).

Challenges in ASD Research

Conducting research with any disability population comes with its share of challenges (Stalker, 1998). Researching individuals with ASD comes with its own unique challenges related to the background demographics, ethical concerns and informed consent, and the abilities and needs of this heterogeneous population.

Cultural and Ethical Issues

It is essential to follow ethical guidelines when conducting research in order to afford each subject respect and privacy as well as establish a foundation of trust for the interpretation of

results. Historically, subjects with disabilities have been dehumanized to some extent, with the idea that those with disabilities, such as ASD, are well outside the range of normal (Waltz, 2007). It is important to afford the same rights to those with disabilities as is done for those without.

Researchers have an ethical responsibility to their subjects to protect privacy and confidentiality (Botkin, 2001; Chen, Miller, & Rosenstein, 2003). From a strict ethical viewpoint, as soon as private information regarding an individual is gathered, particularly identifiable information, that individual has become a research subject and privacy rights apply (Cook-Deegan, 2001). Storage of any private data must allow for complete confidentiality, and participants should be allowed to decide if they wish to withdraw their data at any time (provided it is identifiable and able to be withdrawn) (Chen et al., 2003).

Acquiring informed consent from individuals with autism can be challenging, in part because of the communication and social deficits inherent in the disorder (Jordan, 1999; Lloyd, 2012). It's important to tailor consent forms for the subject's level of understanding while still providing information about the study in a way that's not deceitful.

Research conducted should have the goal of benefitting the population studied, and the advantages to participation should outweigh any risks. Therefore, it is important to select specific subjects with care, affording a favorable risk-benefit ratio (Chen et al., 2003). Subjects must feel free from coercion or undue influence when consenting to participate and must also be allowed to withdraw from a study with no repercussions.

Recently, researchers have become interested in family dynamics and genetics. With family research, the child is no longer the sole focus of study. When material is requested about the subject's family, ethical responsibilities are less clear (Botkin, 2001). Informed consent is

essential for subjects, but is not always simple to determine who should be giving consent when families are involved (Chen et al., 2003; Cook-Deegan, 2001). A rule of thumb may be that when information collected from other family members results in data that will be used in research analyses, those family members become subjects themselves and must give informed consent. Sometimes, however, there is a fine line between a family member who is actually a research subject, and one who is ancillary to the research process (Chen et al., 2003).

Not just a local endeavor, research into ASD is taking part in a number of countries across the world (Daley, 2004; Daley, Singhal, & Krishnamurthy, 2013; Fombonne et al., 2012; Kamio et al., 2013; Kang-Yi et al., 2013; Lindblom, 2014; Ouellette-Kuntz et al., 2006; Roy & Balaratnasingam, 2010); however the ethics governing research in some countries may differ from those in the United States (Daley et al., 2013; Sarrett, 2014). Suspending assumptions that originate from the researcher's own culture, while being flexible and accepting the new context, is one approach that offers respect (Sarrett, 2014).

Heterogeneity of ASD

Although ASD has specific criteria that have evolved to become clearer over time, it remains heterogeneous in its presentation and symptomology (Blacher & Christensen, 2011). It is challenging to conduct research and make claims about a population that is not homogenous, because of the difficulty in ruling out the effect of individual differences.

Studying language impairments in autism is particularly challenging because of the heterogeneity of language abilities in individuals with ASD. Even individuals with similar intellectual functioning can show extreme variability in language ability. Although language skills are often studied with a cross-sectional matched group design, it may not be the most appropriate due to this significant variation in skills (Tager-Flusberg, 2004). As another

disadvantage to this design, Seltzer, Abbeduto, Krauss, Greenberg, and Swe (2004) point out that differences between comparison groups can be confounded by differences in characteristics of the child, sociodemographic factors, and biological or psychological vulnerabilities of the family members. The broader autism phenotype may contribute unintended confounds when looking at coping styles of families, making it difficult to separate out genetic disposition and the actual psychological effects of having a child with ASD (Seltzer et al., 2004).

To alleviate the confounding effect in using comparison groups, Tager-Flusberg (2004) suggests using a within-group individual approach. By investigating the heterogeneity present in the core deficits in ASD, similar subtypes can be identified for study (Tager-Flusberg, 2004). For this reason, single subject studies have been used (Williams et al., 2005), many with a multiple baseline approach where subjects are used as their own controls (Jordan, 1999). Both of these designs compare the subject with ASD to him or herself rather than to a comparison subject and allow for the heterogeneity inherent in an ASD population.

In spite of the disadvantages, there can be value in using comparison groups in that they grant the opportunity to compare family influences. By comparing individuals with autism to typically developing peers, group strengths and weaknesses in functioning and family dynamics can be revealed (Seltzer et al., 2004). Confounds may also be controlled, in part, by matching on specific features or using statistical controls in the analysis process, depending on the research question and situation. Carefully choosing the factors to match is essential in order to control for that variability. Matching by child's age and gender or other child characteristics is common, but family sociodemographic characteristics, such as socioeconomic status and race, can also be used (Seltzer et al., 2004).

One relatively uncommon approach to data gathering that may add a unique perspective as to the needs of this heterogeneous population is to gather perceptions from individuals with ASD (Hill, 2014; McLaughlin & Rafferty, 2014). Although several studies have sought the perspective of individuals with ASD, very few gather information solely from that perspective. Rather, the tendency is to compare and contrast the perceptions of the individuals with ASD with those of their parents and teachers, often focusing more on the contributions of the adult (Hill, 2014; McLaughlin & Rafferty, 2014). Gathering data from individuals with ASD and interpreting them in isolation may offer additional knowledge that can be used to plan effective interventions.

Methodological Challenges in ASD Research

NIH funding for autism research has shown a drastic increase from $22 million in 1997 (Singh, Illes, Lazzeroni, & Hallmayer, 2009) to an estimated $190 million expected in 2014 (NIH, 2014). There are challenges associated with conducting research with individuals with ASD, including cultural and societal influences, ethical issues, and the issues associated with the heterogeneity of ASD symptomology. Researchers need to be aware of the advantages and disadvantages of their chosen methodological design with regard to the target population and chosen focus of study. A single approach, such as using comparison groups, may not work for all research questions. Longitudinal studies that can combine individual difference approaches as well as comparative approaches may further the understanding of language development in this population (Tager-Flusberg, 2004). By focusing on dimensions of ASD instead of categorical differences, more useful data may be gathered about continuities and discontinuities of the spectrum (Rutter, 2013). No matter which methodology is preferred, research must be conducted with integrity and fidelity to treatment (Jordan, 1999).

Historical perspective. In 1943, Leo Kanner published his foundational paper on autism, entitled "Autistic Disturbances of Affective Contact," in which he first identified autism apart from childhood psychosis (Blacher & Christensen, 2011). Methodologically, Kanner focused on case studies, inferring the primary features of the disorder from the clinical presentation (Blacher & Christensen, 2011). Other research studies of the time also focused on descriptions rather than a systematic approach, generally relying on clinical samples or single case studies (Tager-Flusberg, 2004). Although lacking in the standardization now commonplace, characteristics noted in those early case studies contributed significantly to growth in the field.

Controversial in the history of autism research has been the involvement of family. Stemming from Kanner's initial reported observations of family, some researchers began to look towards parental responsibility for autism, which led to destruction and was ultimately unsupported (Blacher & Christensen, 2011). Kanner's notes implied that parenting skills might have contributed to the desire of these individuals to be alone, commenting that parents were cold and mechanical towards their children (Blacher & Christensen, 2011). Bruno Bettelheim furthered this idea by suggesting mothers in particular had "caused" this withdrawal in their children (Blacher & Christensen, 2011).

Researchers then began to realize the need for a shift from diagnostics alone to address possible underlying deficits (Rutter, 2013). Studies underwent more careful design in the 1970s, following a similar methodology to what was used in developmental psycholinguistics at that time. This approach generally used comparison groups that were matched on some feature. These comparison groups typically consisted of typically developing peers, or children with other types of language disorders or intellectual disabilities (Tager-Flusberg, 2004). The research focus was on similarities and differences between the comparison group and the group with

autism, with an eye to understanding how these differences were mediated (Rutter, 2013). Cognitive studies of the time also began to look at possible genetic factors and brain pathology (Frith, 2012).

In spite of the new approach, these earlier studies were still wrought with methodological concerns, due in part to the change in diagnostic criteria over time (Tager-Flusberg, 2004). Criteria changes meant that autistic features and severity of symptoms of the children in the studies were likely not consistent across various research projects. Additionally, the lower prevalence rate in the 1970-1980s meant a lack of potential participants, which may have affected results (Tager-Flusberg, 2004). In spite of this, research in the 1980s was pivotal in identifying core features of autism at a young age so as to differentiate normal development from development of children with ASD (Dawson & Bernier, 2013). Specifically, Lovaas' (1987) seminal research during this era was pivotal in demonstrating that, with early intervention, children with ASD could make tremendous gain, and that ASD was not a condition from which there was no hope for behavioral improvement.

With the tremendous growth in autism prevalence in the 1990s and 2000s (CDC, 2012), there came considerable discussion as to the cause. While some used the word "epidemic" to describe the increase, Gernsbacher, Dawson and Goldsmith (2005) claimed that the increased prevalence rates were more likely an artifact of the changes in diagnostic criteria that allowed for a wider range of children to fit in the expanded criteria. When they looked at data representing children in California who had been classified under the 1980 criteria, and compared with those who were classified under the 1994 criteria, they found that the second group of children were less likely to be intellectually impaired and were less symptomatic, suggesting that the newer criteria had broadened the definition of who would qualify under this category. With the more

recent recognition of a broader autism phenotype, the umbrella may have expanded even more (Blacher & Christensen, 2011; Rutter, 2013). Research continued to focus on early identification, and the use of videotaping allowed researchers to clearly identify the presence or absence of social markers, such as imitation, joint attention, eye contact, orienting to name, and use of gestures, in infants to increase the ability to identify children with ASD at a much earlier age (Dawson & Bernier, 2013). The ability to identifying children n earlier also encouraged the development of screening tools to be used with children as young as 18 months (Dawson & Bernier, 2013).

Current approach. Kanner's influence can still be seen today. He originally used observation and parent report to develop the clinical description of autism, and these assessment techniques continue to provide key information for diagnostic and intervention purposes, although many of these techniques are now standardized (Blacher & Christensen, 2011). Kanner's initial observations regarding lack of play and interactions with peers, as well as the sensory differences noted in children with autism, have encouraged research in the areas of joint attention and neurological deficits. The concept of the broader autism phenotype, which may have been prompted by Kanner's observations of relatives' behaviors, has given new understanding to the etiology of autism, and some research now focuses on blood relations of individuals with ASD in order to explore possible genetic contributions. In particular, sibling studies, focused on infants and toddler siblings of individuals with ASD have broadened the understanding of differences in development between typically developing children, children who are later diagnosed with ASD, and those who display the broader autism phenotype (Dawson & Bernier, 2013).

Some methodological issues may have been mitigated to an extent by improvements in diagnostic methods and clarification of criteria; however the variability of the population with autism may still cause some challenges. For example, not controlling for co-morbid psychiatric issues can impact results (Tager-Flusberg, 2004). Variation in age can also impact results, particularly in skills that can vary significantly by developmental level, such as language skills. Adding to these challenges, autism began to be considered not as a single disorder with very specific behaviors distinctly different from typical development, but as part of a spectrum of impairments that overlapped with other disorders and syndromes (Blacher & Christensen, 2011; Rutter, 2013). Diagnostically teasing apart symptoms and disorders became a challenge.

In the 1990s, advocacy groups that took the perspective that autism was not truly a mental disorder began to challenge the stigma attached to ASD. Neurodiversity, the concept that autism is not a disorder but a variation from typical on the continuum of behavior, was a common theme of advocacy (Blacher & Christensen, 2011; Tincani et al., 2009). Large scale funding of autism research by some of these advocacy groups increased basic science and clinical research funding and, more recently, has funded translational research (Singh et al., 2009). This rise in parent organizations has also assisted in normalizing ASD and changing overall community perception (Vatanoglu-Lutz, Ataman, & Bicer, 2014).

Increases in funding sources, increased concern for individuals with ASD, and technological growth have all contributed to significant increases in research studies. Although Kanner saw autism as a single disorder, research now focused on expanding to best represent the variability present in ASD (Blacher & Christensen, 2011). This variability in functioning may suggest a variety of etiologies, and research seeks to explore those possible paths (Krahn & Fenton, 2012). In order to better understand possible etiologies and diverse behaviors, research

must focus not only on children who present with ASD, but also those who share similar presentations (Blacher & Christensen, 2011).

Krahn & Fenton (2012) noted that research in Canada, similar to international trends, emphasized biomedical and clinical research while other topics, such as health systems, services, population, and public health, have not seen the same increase. The money put towards the latter four research themes were not proportional in terms of total expenditures over the previous decade. In spite of public interest in the fields of services and public health, the least amount of research money was being focused on those areas. In particular, research that addresses service patterns across providers and sectors was lacking, but because of the increased numbers of children diagnosed with ASD, it is an important topic. In general, a more diverse focus is needed for autism research (Krahn & Fenton, 2012).

The United States has recently attempted a more diverse focus as well, with funding being more evenly distributed over the categories of study in recent years (Pellicano, Dinsmore, & Charman, 2014b). A survey of family members, practitioners, researchers, and adults with autism indicated that the distribution of funding across areas of autism research should find a better balance, specifically paying more attention to research identifying public services and evidence-based interventions, as well as other programs that would enhance life skills and work placement for adults (Pellicano et al., 2014b). There has been a recent trend of parent advocacy groups trying to build direct connections between families and researchers in order to bring new therapy and information to the autism community (Singh et al., 2009).

Future Directions

With increases in funding, ASD research will continue to grow in scope and focus. Current research will be continued, and new avenues explored as researchers attempt to solidify and replicate current knowledge, and gain new understandings.

Research Focus. Research in ASD requires a multidisciplinary approach because of the wide variety of psychological and biomedical symptoms. This multidisciplinary approach includes research from clinical, developmental, neurological, and cognitive perspectives (Damiano, Mazefsky, White, & Dichter, 2014). In particular, neuroimaging approaches and the application of genetic biomarkers will see an increased use (Dawson & Bernier, 2013). As the focus on early childhood continues, the use of electrophysiological techniques such as event-related potentials (ERPs) and electroencephalography (EEG) will likely grow. Because they do not require the use of language or demonstration of specific behaviors, they are ideal for use with infants, providing information about the activity of the brain (Dawson & Bernier, 2013). To gain additional understanding of the structure, circuitry, and connectivity of the brain, techniques such as magnetic resonance imaging (MRI) and diffusion tensor imaging (DTI) can be used with young children (Dawson & Bernier, 2013). These techniques can provide additional information about biomarkers for ASD. Significant genetic research has taken place and led to the collaborative efforts of several genetic databases, including the Autism Genetic Resource Exchange, the Simons Simplex Collection, and the Autism Genome Project, which, along with the NIMH's Autism Genetics Initiative allow for easier access that can increase the number of research projects studying genetic contributions to ASD (Dawson & Bernier, 2013).

In the future, research may be best focused on individual differences to provide more information about etiology and phenotypic heterogeneity, emphasis longitudinal trajectories of

development, understand comorbid disorders and overlapping features, integrate different research methodologies, and develop effective interventions that meet the needs of families while protecting unique qualities of individuals with ASD and improving overall community functioning (Damiano et al., 2014).

Translational research. Singh et al. (2009) analyzed funded autism research projects over the years and found that basic science research in autism was much greater than clinical research, with translational research just behind that. They coded funded research for themes of brain and behavior (including neurology, neuropsychology and behavioral manifestations), genetics (including gene expression and gene discovery), treatment (including psychoeducational treatment), environmental causes, epidemiology, and diagnosis (including development of tools, biological markers, and family and services). Their analysis found a dramatic increase in funding across all research categories, with NIH data demonstrating a significant increase in clinical research funding while private sponsors exhibited a significant increase in translational research funding (Singh et al., 2009). Translational research has become more of a priority, in order to apply scientific breakthroughs more quickly into actual practice. Although there has been considerable research done in the areas of neural and cognitive systems, genetics, and other "causal pathways," there lacks a translational aspect for this research (Pellicano et al., 2014b). It is important that research goes one step past the interpretation to focus on translating research that can provide information into practical application (Damiano et al., 2014).

Community involvement. Traditionally, research has focused on design, implementation, interpretation, and publication by researchers, without community involvement past the participation in the design (Pellicano, Dinsmore, & Charman, 2014a). With the increasing focus on translational research, however, community involvement will also need to

increase. Using an online questionnaire to gather perceptions, Pellicano et al. (2014a) conducted a study to assess the level of community involvement in autism research, and the extent of satisfaction. They found that researchers felt they were effectively engaged and partnered with the autism community, while community members did not feel the same way. Researchers felt comfortable and satisfied with their level of engagement while members of the autism community experienced less satisfaction. Adults with autism and families of autistic youth expressed some disappointment and frustration with their experience in autism research, feeling a lack of reciprocity with researchers.

McClimens and Evans (2013) suggest that individuals with autism may want to be more involved in the review or authoring of articles to which they have contributed extensive knowledge. Summary information and results should be shared with participants in a timely manner (Miller, Hayeems, Li, & Bytautas, 2011). Miller and colleagues (2011) surveyed CF (cystic fibrosis) and ASD genetics researchers from around the world and found the majority believed that reporting summary results to participants is a valid goal. They also felt that they should help participants of research learn about developments in the field. This is consistent with the ethics suggesting summary results should be offered to participants.

Using Secondary Data

Sharing primary research data sets with other researchers may result in increased sefficiency and quality of data by allowing for multiple perspectives and more efficient use of funding and populations (Piwowar, 2011). It also offers great potential for novice researchers because of ease of access and the ready availability of statistical packages (Smith, 2011). Because of these benefits, some funding agencies require researchers to share data in order to receive funding, and some journals require sharing in order to be published (Piwowar, 2011;

Savage & Vickers, 2009). The NIH considers data sharing to be essential for the translation of research into service, and requires all grant recipients of a certain funding level to include a data-sharing plan in their submissions (NIH, 2003). Other research institutes that encourage or require data sharing include, but are not limited to, the National Database for Autism Research (NDAR, http://ndar.nih.gov), Simons Simplex Collection ([SSC] Fishbach & Lord, 2010), and the Interactive Autism Network (IAN, http://www.iancommunity.org/data_services). Research organizations such as NDAR and the SSC use Global Unique Identifiers (GUIDs), de-identified identifiers that link anonymously to other databases, in order to make sharing easier while protecting confidentiality. Public Library of Science (PLoS) journals also have explicit data sharing rules, however, authors may not always comply with those rules (Savage & Vickers, 2009).

Advantages. ASD is a heterogeneous disorder, and the data collected in studies of ASD are also heterogeneous, using various imaging modalities, genetic measures, and behavioral assessments from diverse clinical settings with varied protocols and instruments (Hall, Huerta, McAuliffe, & Farber, 2012). For example, the SSC collects information about intellectual ability, adaptive behavior, emotional and behavioral indicators, motor functioning, language, and information about core features of autism (Fishbach & Lord, 2010). With such a wide array of data available in these sets, researchers can focus on their research questions without losing time needed to find subjects and gather data. Complex analyses can be used, but a high level of skill in statistics is not required to engage with the data due to its accessibility. It can also be useful for engaging in mixed-methods research (Smith, 2011).

Research using secondary data sets is increasingly becoming more common (Frederick, Barnard-Brak, & Sulak, 2012). Data sharing can expedite research on various topics by having a

ready data set that can be mined for a variety of information (Hall et al., 2012). Secondary data allows researchers to investigate topics and theories with a larger data set than they would normally be able to access, allowing for more in-depth explorations. They can therefore extend research already in existence and advance knowledge based on what has already been done (Hall et al., 2012).

Disadvantages. Although there are benefits to data sharing, there are also some challenges. Sharing data requires a clean data set that is well annotated and ready to be shared. Researchers may lose track of data or move to new jobs where the data may not longer be accessible (Savage & Vickers, 2009). With heterogeneous data coming from different sources across the nation, there is a lack of standardization, which makes collaborations difficult between clinical research groups (Hall et al., 2012).

Large-scale sets are promoted as nationally representative, however they rely on weighting procedures that simulate representative estimates (Frederick et al., 2012). These data sets are available for a wide variety of research topics and collect a range of information. Full of potential, there are also potential risks to using these sets (Frederick et al., 2012). One such risk is the lack of the ability to select a simple random sample from a sampling frame. Another risk is that researchers have to ensure a sufficient representation of respondents from the target population (Frederick et al., 2012). To mitigate concerns, secondary data sets use stratified multi-stage cluster sampling, which reduces time and cost, but increases the potential of similarity in sampling units. There is also a risk of oversampling from certain populations and under-sampling from others (Frederick et al., 2012).

Frederick et al. (2012) studied five different secondary data sets to assess prevalence rates of ASD. They concluded that it was risky to make conclusions about sub-populations in the

sample without first confirming that the sub-population has satisfactory representation. When comparing the results from each data set with the CDC estimates, they found that children with ASD were under-represented in three data sets (severely so in one), poorly represented in one, and somewhat represented in the last set. In attempting to collect secondary data in order to ascertain a prevalence rate of autism in Australia, Williams, MacDermott, Ridley, Glasson, & Wray (2008) were largely unsuccessful at estimating an accurate rate as a result of the various data sources and differences in assessment techniques to validate a diagnosis. This underscores the need for consistency amongst public databases in terms of diagnostic criteria.

Secondary data sets should be chosen carefully with these challenges in mind, and the onus is on researchers to determine the value of the data set in question (e.g., acceptable data collection strategies, adequate representation of the target population). Care should be taken not to mislead others because of the limitations of the data set (Frederick et al., 2012).

Regardless of the type and focus of research conducted, it is essential to remember that research is intended to advance knowledge and benefit a population; in this case, the autism community. Quality research will offer direction to future researchers as well as provide useful information that can be translated into practice.

Purpose of this Dissertation

The ADOS is a clinician-administered, semi-structured assessment that allows for standardized comparison of ASD symptoms with a normative sample. The calibrated severity scores on the ADOS (ADOS-CSS) provides a uniformly distributed score representing severity of symptomology that is able to be used to compare assessments across modules and across time (Gotham, Pickles, & Lord, 2009). The SRS is commonly used to screen and support ASD diagnosis (Aldridge et al., 2012). Using a secondary dataset, the SRS- Parent was found to

accurately distinguish between individuals with ASD and individuals without ASD in 98.8% of cases (Schanding et al., 2012). Additionally, the SRS-Parent was significantly correlated with both the SRS-Teacher and the ADOS-CSS, although the correlation between the SRS-Teacher and the ADOS-CSS was stronger than the correlation between the SRS-Parent and the ADOS-CSS (Schanding et al., 2012). Although there is research addressing the general usefulness of the SRS and how the SRS relates to the ADOS-CSS, these ideas have largely been unaddressed with race and ethnicity in mind. Specifically, the correlation between the SRS-Parent and the ADOS-CSS, and the ability of the former to predict the latter, has not been calculated by race or ethnicity. In fact, there is very little literature addressing the utility of the SRS-Parent across racial and ethnic groups; particularly racial and ethnic groups in the United States. As there is a noted disparity in ADS identification between different racial and ethnic groups, it is important to identify the fit and appropriateness of the SRS-Parent as an aid to ASD diagnosis across race and ethnicity.

CHAPTER 3: RESEARCH METHODOLOGY

Study Design and Research Questions

Research Questions

This study aims to answer the following questions:

1. How reliable is the SRS-Parent across racial/ethnic groups?
    a. What is the reliability rate by subscales for the entire sample and across racial/ethnic groups?
    b. Are there significant differences between the reliability of the Caucasian American group as compared to each of the other racial/ethnic groups?
2. How well does the SRS-Parent predict ADOS-CSS by racial/ethnic group?
    a. What is the criterion validity for the SRS-Parent across racial/ethnic groups by total score and by subscales?
    b. Are there significant differences between the criterion validity of the Caucasian American group as compared to each of the other racial/ethnic groups?
3. What is the structural validity of SRS-Parent for each racial/ethnic group?
    a. What is the factorability of the SRS-Parent across racial/ethnic groups by subscales and total score?
    b. Are there significant differences between the factorability of the Caucasian American group SRS scores as compared to each of the other racial/ethnic groups?

Rationale and Hypotheses

Parent report is commonly used as part of a comprehensive diagnostic evaluation for ASD, and the SRS is a commonly used parent report, therefore it is important to understand whether it provides similar reliability across racial/ethnic groups. The first research question, which addresses the internal consistency of the SRS-Parent by racial/ethnic groups, will provide more information about the appropriateness of this measure for individuals from various racial/ethnic groups. If the internal consistency for one of the groups is significantly different from the other groups, it may speak to a bias inherent in the SRS-Parent. Addressing this question by subscale as well as total score may point out differences in the distinct scales that make up the total score. As families from different racial/ethnic backgrounds may contextualize the behavioral features of ASD according to their own context, it is anticipated that there will be significant differences in reliability in one or more of the SRS subscales, specified below.

The second question addresses the ability of the SRS-Parent to predict the ADOS-CSS. This is important because it will speak to the criterion validity of the instrument across racial/ethnic groups. Specifically, it will speak to how well parents, using the SRS, are able to identify the severity of symptoms inherent in ASD in comparison to the level of severity as identified by trained clinicians through direct assessment.

Finally, calculating the factorability of the SRS-Parent by racial/ethnic groups is essential for identifying the structural validity of the instrument in the different groups. This will address the utility of the SRS-Parent for different racial/ethnic groups. The results of this analysis are expected to show a difference between factorability in the different racial/ethnic groups, either in the total score or across one or more of the subscales, which would suggest the utility of the SRS may not be comparable across racial and/or ethnic groups (see figure 1).

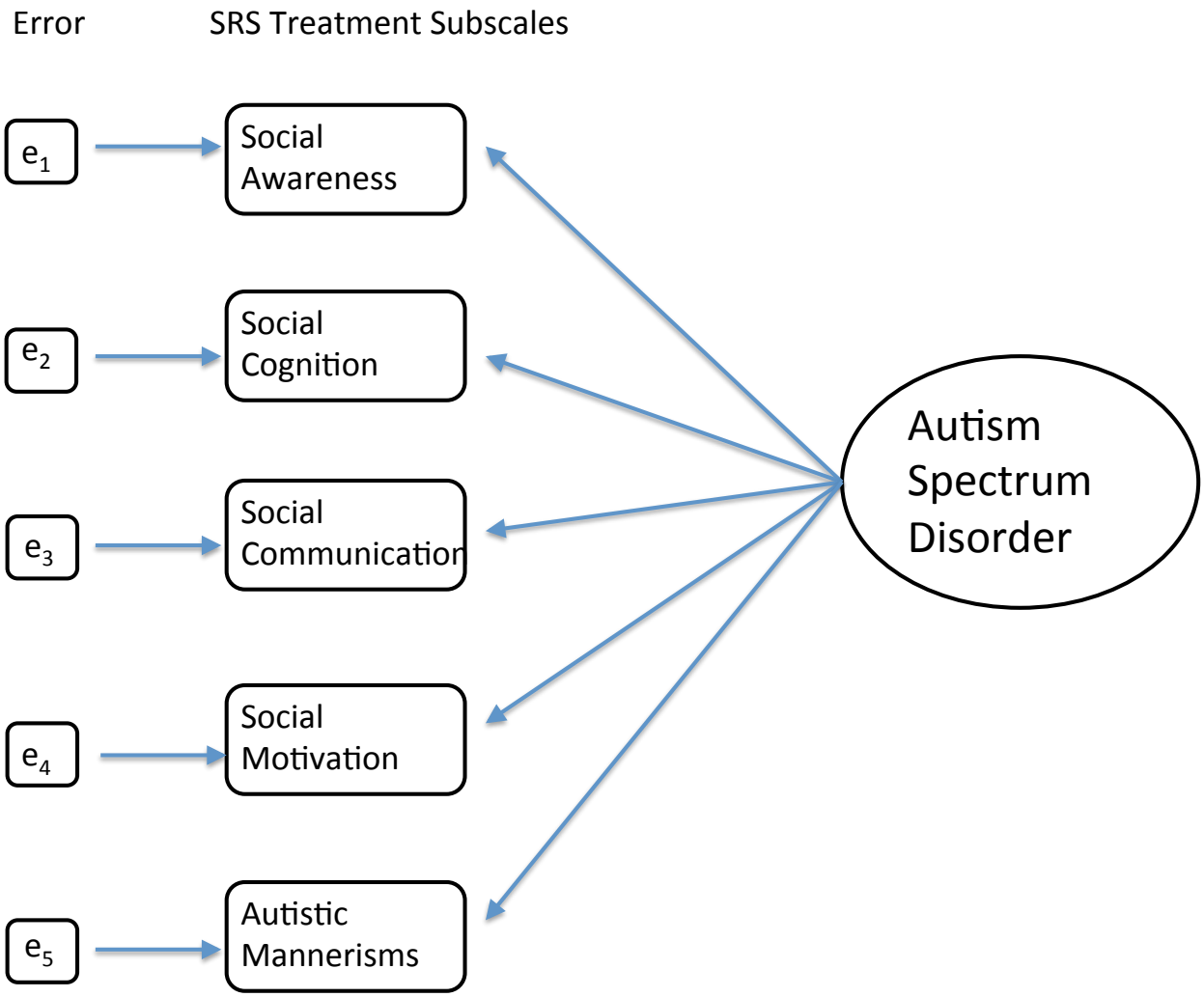

Figure 1. Exploratory factor analysis for the SRS-Parent.

Participants

The sample to be used in this study is drawn from the Simons Simplex Collection (SSC; http://sfari.org/resources/simons-simplex-collection). The SSC data is the result of the efforts of a coalition of 12 autism clinics from across the United States to gather data from families with one child diagnosed with ASD (Fishbach & Lord, 2010). Although the SSC currently contains

over 2,800 children diagnosed with ASD aged 4 to 18 (and an additional number of unaffected siblings), only subjects with a diagnosis of an autism spectrum disorder whose data included the SRS Parent Report and the Autism Diagnostic Observation Schedule Calibrated Severity Score (ADOS-CSS) were included in the analysis. For this design, children of Caucasian American (*N=2038*), Asian American (*N=112)*, African American (*N=110*) background, those who identified as mixed race (i.e., more than one race) (*N=213*), and those who identified as Hispanic, and were not included in any other category, (*N=232*) were selected, for a total sample of 2,705 subjects. The SSC database includes a variety of cognitive, genetic, and behavioral measures, but for the purposes of this study, only data from the Social Responsiveness Scale (SRS) was and the ADOS CSS were utilized.

Measures

Autism Diagnostic Observation Schedule

The ADOS (Lord et al., 2002) is a semi-structured observational instrument administered by trained clinicians that provides quantifiable data in the area of communication, social interaction, and play skills (Aldridge et al., 2012). These data are used to determine the scores on two domains- Social Affect and Restricted and Repetitive Behaviors (Hus et al., 2014). These domains are reflective of the two main criteria used to diagnose ASD in the DSM-5. During the assessment, the clinician rates observed behaviors according to criteria specified by the scoring system (0 for behaviors not observed through 3 for very frequent/impactful behaviors), which includes detailed descriptions of what behaviors fall into what scoring category. The ADOS Calibrated Severity Score (CSS) ranges from 1-10, and provides information about the overall severity of ASD symptomology exhibited during the ADOS assessment, taking into account both Social Affect and Restricted and Repetitive Behavior scores (Hus et al., 2014).

Social Responsiveness Scale

The SRS is a questionnaire that consists of 65 questions reflecting dimensions of interpersonal behavior and was intended to offer a quantitative measure for parents and teachers to complete that addresses traits of autism in children (Constantino & Gruber, 2005). Each question allows the respondent to choose one of four choices in response to the behavioral prompt: not true, sometimes true, often true, and almost always true. Constantino and Gruber indicate that the scale is to be used as a screener or part of a clinical diagnosis. Designed for use with children ranging from 4 to 18 years old, it is written to reflect the child's behavior over the previous 6 months. Higher scores suggest higher levels of impairment. The total score reflects the five treatment subscales:

1. *Social Awareness: Ability to pick up on social cues; items in this category represent the sensory aspects of reciprocal social behavior.*
2. *Social Cognition: Ability to interpret social cues once they are picked up; this category represents the cognitive–interpretive aspects of reciprocal social behavior.*
3. *Social Communication: Includes expressive social communication; this category represents the motoric aspects of reciprocal social behavior.*
4. *Social Motivation: The extent to which a respondent is generally motivated to engage in social-interpersonal behavior; elements of social anxiety, inhibition, and empathic orientation are included among these items.*
5. *Autistic Mannerisms: Includes stereotypical behaviors or highly restricted interests characteristic of autism.* (Constantino & Gruber, 2005, p. 17).

Although the population samples upon which the normative tables for the SRS are based varied in their ethnic and racial makeup, with an overall estimate similar to the U.S. population figures at the time of standardization, separate norms by race/ethnicity were not calculated (Constantino & Gruber, 2005).

Correlations on the SRS. In a study involving 577 children, Constantino, LaVesser, Zhang, Abbachhi, Gray, & Todd (2007) found strong correlations between the overall scores on parent and teacher reports on the SRS ($r = 0.72$). Although they found the scales to correlate well, they asserted that correlations might not be as strong for young children, children with milder social deficits, and children who are anxious.

Using a larger selection of the SSC data used in the present study, but without regard for racial or ethnic background and including data from unaffected siblings, Schanding and colleagues (2012) also undertook an analysis of the SRS and found parent and teacher scores on the SRS to be highly correlated. They also found strong correlations between domain scores on the ADOS and teacher ratings on the SRS; higher, in fact, than those same correlations between the ADOS domain scores and parent ratings on the SRS. They felt this suggested more consistency between teacher report and clinical observation. Aldridge and colleagues (2012) also found a stronger relationship between SRS-Teacher scores and diagnostic outcome than what was seen with SRS-Parent and diagnosis.

Murray, Mayes and Smith (2011) compared the SRS with the ADI-R (LeCouteur, Lord, & Rutter, 2003) and found diagnostic agreement between the two measures to be 89.7%, when the raw score cut-off of the SRS was 75. Considering the high cost of lengthy interviews, such as the ADI-R, they concluded that the use of brief and cost-effective measures such as the SRS would be beneficial in assisting in the diagnosis of autism.

Hus, Bishop, Gotham, Huerta, and Lord (2013) found similarities between the SRS-Parent raw scores for children with good social skills but more problem behaviors to children with low behavior problems but more impacted social skills. In their analyses looking at the impact of non-ASD factors (e.g., developmental level, cognition, behavior problems) on raw SRS-Parent scores, they felt these results indicated that the raw scores were heavily influenced by characteristics specific to the child and unrelated to ASD, such as behavior problems and developmental level. They concluded that it might be most appropriate to understand the SRS-Parent as indicative of the overall level of impairment according to parent perception instead of a measure to indicate the severity of ASD specific features. Aldridge and colleagues (2012) similarly found that the SRS score was impacted by social developmental problems.

Use of the SRS in other cultures. There has also been some researcher interest in determining how the SRS functions across cultural groups outside the United States (Kamio et al., 2013; Fombonne et al., 2012). Kamio and colleagues looked at the use of the SRS with school children in Japan and found the SRS to be an appropriate measure with that population, although they strongly recommended establishing appropriate gender and cultural norms reflecting the Japanese culture. Their analysis found the SRS parent report appeared to be more accurate as a screening tool than the SRS teacher report with this population. When testing the SRS- Spanish version with children in Mexico, Fombonne and colleagues found a higher correlation between the parent and teacher reports on the SRS in populations identified with ASD than the correlation found in a control group provided the features of autism were more obvious. These studies may support the idea that different racial, ethnic, and cultural groups interpret common behaviors found in ASD in ways that reflect their own understanding and

biases and further underscores the need to investigate the utility of the SRS across racial and ethnic groups in the United States.

Analysis Plan

SSC project data was imported into SPSS version 18 for statistical analysis. Individuals were coded by self-reported racial or ethnic category. Only SSC data from the ADOS-CSS, race/ethnicity, and SRS-Parent scores were utilized for the purposes of this study.

Using only the selected participant group described above, descriptive statistics were computed for each of the groups. To respond to the first research question, Cronbach's Alpha was calculated on all five SRS domains using the total sample and then across racial/ethnic categories to determine the reliability of the dataset and calculate internal consistency. The Cronbach's Alpha for each domain for each racial/ethnic group was compared to the Caucasian American sample to determine any significant differences.

In order to address the second research question, linear regression was performed to determine the predictive value of the SRS-Parent for the ADOS-CSS across racial/ethnic group. This addressed the criterion validity of the SRS-Parent, providing further data to assess the appropriateness of the use of the SRS-Parent across racial/ethnic groups.

Finally, with regards to the third research question, an exploratory factor analysis (EFA) was calculated using SPSS on the entire sample (see Figure 1) to determine the factorability of this particular dataset. To determine factorability across racial/ethnic groups, EFA was performed for each racial/ethnic group separately. The results from each racial/ethnic group were compared. In this way, the utility of the SRS-Parent Report across racial and ethnic categories was assessed.

CHAPTER 4: RESULTS

Analyses

Analyses were conducted first on the total sample of 2,705 children aged four to 18 with a diagnosis of ASD drawn from the Simons Simplex Collection (SSC). Only subjects with parent-completed SRS rating scales and ADOS-CSS completed by the clinician were included in the sample. Additional analyses were conducted separately on each racial/ethnic group to determine if there were any differences based on group status. In accordance with the research questions, the reliability of subscales was first assessed using the whole group sample and then using each racial/ethnic group. The whole group reliability results were also compared to the reliability indices from the SRS standardization manual. Next, a regression analysis was performed using the total sample to determine how well the total SRS-Parent score predicted the ADOS-CSS for the sample population and whether there were significant differences between racial/ethnic groups. The regression analysis was also performed by subscale. Finally, an exploratory factor analysis was conducted to ascertain the factorability of the 65 items on the SRS-Parent scale using the total sample and each racial/ethnic group sample.

Reliability

As previously noted, the SRS-Parent consists of 65 questions divided into five treatment subscales. Each subscale consists of a different number of questions and no question contributes to more than one subscale. Measuring internal consistency of each individual subscale can help support the idea that the test items on any given subscale are indeed measuring the same general idea or construct. Reliability coefficients above .80 suggest good internal consistency.

Table 1.

Inter-item Correlation Matrix for Total Sample by Treatment Subscale

Social Awareness Scale (8 items)

Question number, item text	2	7	25	32	45	52	54	56
2. Facial expressions don't match words	1.00							
7. Unaware what others are thinking/feeling ®	.21	1.00						
25. Doesn't mind being out of step with others	.05	.13	1.00					
32. Good personal hygiene ®	.14	.18	.07	1.00				
45. Focuses attention where others look/listen ®	.18	.29	.15	.16	1.00			
52. Knows when talking too loud ®	.10	.27	.13	.20	.22	1.00		
54. Reacts to people as if objects	.32	.21	.17	.18	.21	.16	1.00	
56. Walks between people who are talking	.17	.16	.17	.18	.15	.25	.29	1.00

Social Cognition Scale (12 items)

Question number, item text	5	10	15	17	30	40	42	44	48	58	59	62
5. Doesn't recognie when others take advantage	1.00											
10. Takes things too literally	.32	1.00										
15. Is able to understand tone/facial expression ®	.15	.15	1.00									
17. Recognizes when something is unfair ®	.27	.10	.19	1.00								
30. Becomes upset in situation with lots going on	.19	.26	.16	.07	1.00							
40. Is imaginative, good at pretending ®	.19	.11	.14	.31	.12	1.00						
42. Overly sensitive to sounds, textures, smells	.13	.19	.10	.02	.42	.08	1.00					
44. Doesn't understand cause and effect	.30	.26	.16	.37	.25	.31	.19	1.00				
48. Has sense of humor, understands jokes ®	.22	.19	.18	.43	.10	.41	.10	.39	1.00			
58. Concentrates on parts rather than whole	.20	.31	.09	.07	.23	.11	.23	.25	.13	1.00		
59. Is overly suspicious	.01	.14	.09	-.14	.21	-.02	.18	.03	.00	.18	1.00	
62. Gives unusual/illogical reasons for actions	.17	.27	.12	-.07	.25	-.01	.18	.18	.00	.35	.26	1.00

Social Communication Scale (22 items)

Question number, item text	12	13	16	18	19	21	22	26	33	35	36	37	38	41	46	47	51	53	55	57	60	61
12. Able to communicate feelings ®	1.00																					
13. Awkward in turn-taking interactions	.15	1.00																				
16. Avoids or unusual eye contact	.15	.21	1.00																			
18. Difficult making friends	.18	.31	.18	1.00																		
19. Gets frustrated trying to get ideas across	.25	.26	.15	.30	1.00																	
21. Able to imitate others' actions ®	.24	.09	.11	.11	.08	1.00																
22. Plays appropriately with children same age ®	.30	.30	.15	.39	.20	.25	1.00															
26. Offers comfort to others when they are sad ®	.35	.15	.13	.18	.10	.23	.29	1.00														
33. Socially awkward, even when polite	.20	.38	.26	.48	.28	.10	.37	.18	1.00													
35. Has trouble keeping up with conversation	.28	.35	.18	.29	.29	.09	.34	.21	.38	1.00												
36. Difficulty relating to adults	.28	.24	.22	.23	.22	.11	.28	.26	.33	.47	1.00											
37. Difficulty relating to peers	.27	.39	.27	.56	.27	.15	.50	.26	.53	.42	.44	1.00										
38. Responds appropriately to others' moods ®	.29	.20	.14	.17	.14	.23	.30	.51	.20	.17	.20	.25	1.00									
41. Wanders aimlessly between activities	.18	.21	.13	.17	.20	.11	.24	.16	.19	.28	.24	.23	.14	1.00								
46. Overly serious facial expressions	.12	.14	.21	.16	.19	.09	.09	.10	.24	.05	.09	.19	.11	.08	1.00							
47.Too silly or laughs inappropriately	.09	.20	.16	.18	.19	.04	.21	.08	.26	.21	.20	.24	.14	.23	.19	1.00						
51. Difficulty answering questions directly	.15	.18	.18	.19	.25	.04	.15	.06	.21	.30	.25	.22	.09	.21	.15	.24	1.00					
53. Talks with unusual tone of voice	.06	.20	.18	.19	.12	.07	.12	.10	.27	.16	.12	.21	.11	.09	.27	.19	.21	1.00				
55. Understands personal space ®	.17	.19	.07	.08	.13	.11	.22	.19	.15	.20	.14	.15	.25	.18	.02	.14	.11	.03	1.00			
57. Gets teased a lot	.03	.13	.10	.31	.19	.08	.09	-.05	.28	-.03	.01	.25	.06	.02	.24	.18	.15	.18	.00	1.00		
60. Emotionally distant, doesn't show feelings	.31	.13	.24	.23	.17	.20	.20	.29	.26	.18	.28	.27	.22	.18	.31	.11	.16	.21	.06	.17	1.00	
61. Inflexible, hard time changing mind	.11	.24	.18	.19	.26	.06	.12	.11	.27	.10	.13	.22	.15	.13	.26	.18	.19	.20	.11	.22	.28	1.00

Social Motivation (11 items)

Question number, item text	1	3	6	9	11	23	27	34	43	64	65
1. Seems more fidgety in social situations	1.00										
3. Seems self-confident in interactions ®	.18	1.00									
6. Would rather be alone than with others	.24	.25	1.00								
9. Clings to adults, seems too dependent on them	.22	.20	.14	1.00							
11. Has good self-confidence ®	.18	.58	.18	.17	1.00						
23. Does not join group activities unless told	.17	.29	.42	.18	.21	1.00					
27. Avoids starting social interactions with others	.16	.40	.43	.15	.26	.46	1.00				
34. Avoids people who emotional closeness	.26	.24	.34	.15	.21	.27	.35	1.00			
43. Separates easily from caregivers ®	.08	.14	.02	.26	.14	.06	.07	.08	1.00		
64. Is too tense in social settings	.46	.30	.31	.29	.29	.29	.35	.37	.12	1.00	
65. Stares or gazes off into space	.19	.16	.26	.17	.12	.22	.22	.18	.00	.27	1.00

Autistic Mannerisms (12 items)

Question number, item text	4	8	14	20	24	28	29	31	39	49	50	63
4. Rigid/inflexible behaviors when stressed	1.00											
8. Behaves in ways that seem strange/bizarre	.40	1.00										
14. Not well coordinated	.14	.12	1.00									
20. Shows unusual sensory interests	.28	.44	.15	1.00								
24. Has more difficulty with changes in routine	.41	.27	.16	.26	1.00							
28. Things or talks about same thing repeatedly	.26	.25	.17	.17	.26	1.00						
29. Is regarded by other children as odd/weird	.30	.49	.23	.29	.26	.32	1.00					
31. Can't get mind off something	.35	.29	.20	.21	.37	.57	.33	1.00				
39. Has an unusually narrow range of interests	.28	.35	.22	.33	.26	.35	.39	.35	1.00			
49. Does extremely well at a few tasks	.24	.23	.22	.23	.19	.21	.26	.23	.32	1.00		
50. Has reptitive, odd behaviors	.20	.36	.15	.46	.16	.11	.24	.11	.26	.19	1.00	
63. Touches others in an unusual way	.23	.34	.06	.38	.19	.13	.26	.15	.20	.17	.25	1.00

Note. N=2705. Items with longer text are paraphrased; ® = Reverse Scored

Analyzing Reliability on the SSC Sample

Using the total SSC sample, inter-item correlations were first calculated by treatment subscale. Correlations are shown in Table 1 and range from little correlation (.01) to moderately correlated (.56). Reliability was then calculated using Cronbach's Alpha. Results are in Table 2. Overall reliability, using the entire eligible sample size, ranges from 0.63 to 0.84, suggesting the reliability of individual scales range from less acceptable to good.

The SRS Standardization Sample

The SSC is a very large dataset that contains over 2000 children with ASD. It is interesting to note how well the analyses done on this specific population compare to the population used during the standardization of the SRS. The developers of the SRS used several different samples during the standardization process. Of significance in relation to the current study, each sample used was much smaller than the sample in the present study and included a wider range of ages. The SRS samples also included individuals with and without an ASD diagnosis. It is well know that there is wide variability in symptomology in ASD (Tager-Flusberg, 2004). It is possible a very large sample made up exclusively of individuals with ASD, such as the SSC, would therefore show more variation on items designed to assess the symptomology of ASD than a much smaller sample that contained both individuals with ASD and those without. With that being said, some interesting comparison can be made between the standardization sample and the SSC dataset used in the present study.

Table 2.
Descriptives and Internal Consistency of Subscale Raw Scores by Group

	Awareness			Cognition			Communication			Motivation			Mannerisms			*N*
Group	*(8 items)*	*Mean*	*SD*	*(12 items)*	*Mean*	*SD*	*(22 items)*	*Mean*	*SD*	*(11 items)*	*Mean*	*SD*	*(12 items)*	*Mean*	*SD*	
Entire Sample	**.63**	***12.59***	***3.66***	**.72**	***18.60***	***5.63***	**.84**	***33.54***	***9.91***	**.77**	***14.82***	***5.73***	**.81**	***18.78***	***6.83***	**2705**
Caucasian American	.64	*12.54*	*3.67*	.73	*18.33*	*5.67*	.85	*33.27*	*10.10*	.78	*14.61*	*5.78*	*.81*	*18.80*	*6.85*	2038
African American	.64	*12.25*	*3.77*	.65	*18.73*	*5.09*	.82	*33.62*	*9.37*	.76	*14.56*	*5.58*	*.82*	*18.45*	*7.03*	110
Asian American	.70	*12.47*	*4.02*	.69	*19.89*	*5.45*	.81	*34.25*	*9.33*	.73	*15.02*	*5.48*	*.81*	*17.69*	*7.14*	111
Mixed Race	.61	*13.02*	*3.53*	.72	*18.57*	*5.56*	.81	*33.20*	*9.39*	.71	*14.84*	*5.29*	*.77*	*17.96*	*6.40*	214
Hispanic	.54	*12.71*	*3.48*	.69	*19.80*	*5.47*	.81	*35.05*	*9.16*	.77	*16.08*	*5.92*	*.79*	*19.23*	*6.84*	232

Note: *SD* = Standard Deviation

Comparison of reliability between the SRS and SSC sample populations. During the development of the SRS, Cronbach's Alpha was conducted to determine the internal consistency of the SRS-Parent using a clinical sample of 281 subjects with and without autism spectrum disorder (58 females, 223 males; 3 years to 40 years old; 32 with autism, 129 with pervasive developmental disorder, 120 clinic control cases; Constantino & Gruber, 2005). Alpha values ranged from .77 to .92 for the five scales. The number of non-Caucasian American subjects in the sample was not reported. The alpha scores from the SSC sample reported in the current paper (ranging from 0.63-0.84) were somewhat lower than those reported in the SRS manual (Constantino & Gruber, 2005). Comparisons are represented in Table 3. While four of the five scales were reliable at .80 or higher on the SRS sample, only two of the scales (Social Communication and Autistic Mannerisms) were reliable when using the SSC ASD sample.

Table 3.
Comparison of Internal Consistency Subscale Scores Between SRS Manual and SSC Sample

Group	Social Awareness *(8 items)*	Social Cognition *(12items)*	Social Communication *(22 items)*	Social Motivation *(11 items)*	Autistic Mannerisms *(12 items)*	*N*
SRS Manual	**0.77**	**0.87**	**0.92**	**0.82**	**0.90**	***281***
SSC Sample	**0.63**	**0.72**	**0.84**	**0.77**	**0.81**	***2705***

Comparing Reliability by Racial/Ethnic Group

Reliability was also calculated for each racial/ethnic subgroup in the SSC sample, with similar results (see Table 1). By far the largest subgroup in the sample, the Caucasian American group was used as the comparison. A significant difference was found on only two subscales with only two groups: the Hispanic group on the Awareness subscale ($\chi^2 = 6.06$, $p = 0.014$) and the Mixed Race group on the Motivation subscale ($\chi^2 = 6.11$, $p = 0.014$). Any other differences between the Caucasian American group and other racial/ethnic groups were not significant.

Criterion Validity

Criterion validity provides an assessment of how well a given measure predicts a given outcome. The SRS is designed to differentiate between individuals with and without ASD and provide an estimate of the severity of ASD symptoms present in an individual. Assuming ASD symptomology can be objectively observed, one may expect the level of severity documented on the SRS to predict other measures of ASD severity. For this study, the ADOS-CSS was chosen as the outcome measure. The ADOS-CSS reflects the severity of ASD symptomology as determined by a trained clinician using a semi-structured observational instrument.

Using the SRS-Parent Total Score to Predict ADOS-CSS

A multiple linear regression with sequential predictor entry was used to predict ADOS-CSS. Results (see Table 4) showed that race/ethnicity accounted for very little variation in the outcome while the SRS-P total score was significant, R^2= 0.01 (Adjusted R^2= 0.01), F_{change}(5, 2625) = 7.276, p = <0.001.Controlling for race/ethnicity, SRS-P total raw score, and SRS-P total score interactions by race/ethnicity (Block 2) did not account for any additional variance, R^2= 0.01 (Adjusted R^2= 0.01), F_{change} (9, 2621) = .413, p = >0.05.

Results from the final block, with all predictors entered in the model, showed that the average ADOS-CSS score was 6.80 (SE = 0.14), holding all other variables constant, t(2621) = 48.99, p = <0.001. With all predictors entered, there was no significant difference between the racial/ethnic groups (slope coefficient t test p-values = >0.05). SRS-P total raw score uniquely predicted ADOS-CSS, holding all else constant (b = 0.01, SE = <0.01, t(2621) = 4.70, p = <0.001, sr^2 = <0.01). There were no significant interactions between SRS-P total raw score and racial/ethnic group.

Table 4.
Regression Results for SRS Parent Total Raw Score and ADOS-CSS by Race/Ethnicity (Model 1)

	Block 1					Block 2				
	R^2_{change}	R^2_{total}	R^2_{adj}	*b*	sr^2	R^2_{change}	R^2_{total}	R^2_{adj}	*b*	sr^2
Model Fit	0.01 ***	0.01 ***	0.01			<0.01 ***	0.01 ***	0.01		
Coefficients										
Intercept				6.75 ***					6.80 ***	
African American				0.22	<0.01				0.53	<0.01
Asian American				0.11	<0.01				-0.43	<0.01
Mixed Race				-0.10	<0.01				-0.33	<0.01
Hispanic				<0.01	<0.01				-0.29	<0.01
SRS Parent Raw Total				<0.01 ***	0.01				<0.01 ***	<0.01
SRS*AfricanAmerican									<-0.01	<0.01
SRS*AsianAmerican									<0.01	<0.01
SRS*MixedRace									<0.01	<0.01
SRS*Hispanic									<0.01	<0.01

Note. Total *N*=2604, African American *N* = 111, Asian American *N* = 111, Mixed Race *N* = 215, Hispanic *N* = 231. Block 1 *F*-change test *df* = 5, 2625, Block 2 *df* = 9, 2621. SRS = Social Responsiveness Scale

* $p < .05$, ** $p < .01$, *** $p < .001$.

Predicting the ADOS-CSS Using the SRS-Parent Subscales

In order to determine any differences between racial/ethnic groups on the five subscales of the SRS-P (Social Awareness, Social Cognition, Social Communication, Social Motivation, and Autistic Mannerisms), a multiple linear regression on the entire sample with sequential predictor entry was used to predict ADOS-CSS (see Table 5). Results showed that race/ethnicity accounted for very little variation in the outcome while the Autistic Mannerisms subscale was significant, R^2= 0.03 (Adjusted R^2= 0.02), F_{change} (9, 2615) = 5.715, p = <0.001.Controlling for race/ethnicity, SRS-P subscales and SRS-P subscale interactions by race/ethnicity (Block 2) accounted for very little variance (above and beyond the main effects of race/ethnicity and subscale), R^2= 0.03 (Adjusted R^2= 0.02), F_{change} (29, 2595) = 1.040, p = >0.05

Results from the final block, with all predictors entered in the model, showed that the average ADOS-CSS score was 6.88 (*SE* = 0.15), holding all other variables constant, t(2595) = 47.04, p = <0.001. The Autistic Mannerisms subscale uniquely predicted ADOS-CSS, holding all else constant (b = 0.04, *SE* = 0.01, t(2595) = 4.20, p = <0.001, sr^2 = <0.01). Importantly,

there was a significant interaction between the Social Motivation subscale and the Asian American group status, $b = 0.08$, $SE = 0.04$, $t(2595) = 4.20$, $p = 0.05$, $sr^2 = <0.01$. To understand the nature of the interaction, predicted values were plotted for varied levels of Social Motivation subscales by Asian and non-Asian group status. As illustrated in Figure 2, the interaction is partial. This indicates that the parent scores on the Social Motivation subscale for Asian American children significantly impacted the ADOS-CSS scores while this was not true for the comparison group. With all predictors entered, there was no significant difference between the racial/ethnic groups (slope coefficient t test p-values = >0.05).

Table 5.
Regression Results for SRS Subscales and ADOS-CSS by Race/Ethnicity (Model 2)

	Block 1					Block 2				
	R^2_{change}	R^2_{total}	R^2_{adj}	*b*	sr^2	R^2_{change}	R^2_{total}	R^2_{adj}	*b*	sr^2
Model Fit	0.06 ***	0.06 ***	0.05			<.001 ***	0.06 ***	0.05		
Coefficients										
Intercept				6.78 ***					6.88 ***	
African American				0.23	<0.01				0.37	<0.01
Asian American				0.17	<0.01				-0.63	<0.01
Mixed Race				-0.07	<0.01				-0.63	<0.01
Hispanic				0.04	<0.01				-0.40	<0.01
Social Awareness				0.02	<0.01				<-0.01	<0.01
Social Cognition				-0.01	<0.01				-0.01	<0.01
Social Communication				<0.01	<0.01				0.01	<0.01
Social Motivation				0.03	<0.01				0.04	<0.01
Autistic Mannerisms				<-0.01 ***	<0.01				-0.02 ***	<0.01
Aware*AfricanAmerican									0.07	<0.01
Aware*AsianAmerican									<-0.01	<0.01
Aware*Mixed Race									0.08	<0.01
Aware*Hispanic									0.09	<0.01
Cog*AfricanAmerican									0.03	<0.01
Cog*AsianAmerican									0.05	<0.01
Cog*MixedRace									<-0.01	<0.01
Cog*Hispanic									0.01	<0.01
Com*AfricanAmerican									-0.04	<0.01
Com*AsianAmerican									-0.02	<0.01
Com*MixedRace									<0.01	<0.01
Com*Hispanic									-0.04	<0.01
Motiv*AfricanAmerican									-0.03	<0.01
Motiv*AsianAmerican									0.08 *	<0.01
Motiv*Mixed Race									0.02	<0.01
Motiv*Hispanic									0.04	<0.01
Manner*AfricanAmerican									<0.01	<0.01
Manner*AsianAmerican									-0.04	<0.01
Manner*MixedRace									-0.05	<0.01
Manner*Hispanic									<-0.01	<0.01

*Note. Total N=2604, African American N = 111, Asian American N = 111, Mixed Race N = 215, Hispanic N = 231. Block 1 F-change test df = 9, 2615, Block 2 df = 29, 2595. Interactions denoted by *. Aware = Social Awareness, Cog =Social Cognition, Com = Social Communication, Motiv = Social Motivation, Manner = Autistic Mannerisms*

* $p < .05$, ** $p < .01$, *** $p < .001$.

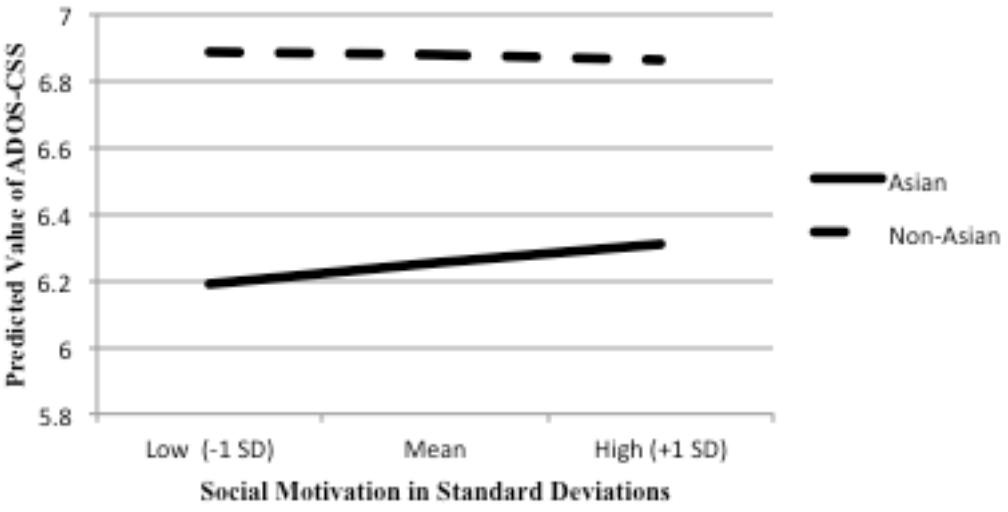

Figure 2. **Predicted ADOS-CSS for Asian and non-Asian groups by Social Motivation subscale.**

Structural Validity

The 65-item SRS is divided into five treatment subscales representing different dimensions of interpersonal behavior. The treatment subscales were developed to provide guidance for treatment of ASD symptoms (Constantino & Gruber, 2005). An exploratory factor analysis (EFA) was conducted in order to explore the factorability of the 65 items and whether it differs by racial/ethnic group. A principal components analysis (PCA) was first conducted to provide guidance as to how many factors should be reasonable retained. An EFA was then conducted to determine how the items factor out.

Principal Components Analysis

The scree plot of the item correlations indicated that up to 12 factors could possibly be retained for analysis in EFA; however the shape of the plot suggested a one or three factor EFA may be most appropriate. There was little indication of problematic items in the communalities, since the majority were > .40 (factors ranged from .381 to .674, with five of the 65 factors falling below .40; average was .505). Inspection of eigenvalues showed that the first 12 factors account

for just 50% of the variance in the original set of items, which is not as optimal as hoped (70% or higher is preferred). With this particular population, only half of the variance is accounted for by 12 factors. The first factor accounts for the largest amount of variance (20%) while three factors account for 30% of the variance. The actual SRS is divided into five factors, and the first five factors account for 37% of the variance in this sample population.

Exploratory Factor Analysis with the Total Sample

An exploratory factor analysis (EFA) with orthogonal (Varimax) rotation was conducted using the total sample. The Kaiser-Meyer-Olkin of Sampling Adequacy was .946, above the recommended value of .8, and Bartlett's Test of Sphericity was significant (χ^2 (2080)= 55673.60, $p < 0.001$). Given these indicators, factor analysis was conducted using all 65 items. The results of the PCA suggested a one-, three-, or 12-factor analysis; however, the Goodness-of-fit test was significant for every possible choice from one to 12 factors. As nothing was a good fit, the decision was made to constrain the EFA to five factors to maintain consistency with the structure of the five treatment subscales on the SRS. In this way, the results of the EFA could be compared to the structure of the SRS.

Orthogonal rotation was purposefully used to better understand and represent the item-factor and factor-factor relationships. With $N = 2705$, a critical value of $r_{\alpha=.01,\ 2\text{-tailed}} = \pm .162$ (Stevens, 2002) was used to determine which loadings were significantly different from 0. Using this criterion and constraining the factor analysis to five factors (consistent with the five subscales on the final version of the SRS), 23 items loaded significantly on factor 1 (ranging from .260 to .527), 17 items loaded on factor 2 (ranging from .312 to .556), 13 items loaded on factor 3 (ranging from .286 to .582), seven items loaded on factor 4 (ranging from .379 to .634), and four items loaded significantly on factor 5 (ranging from .513 to .619) (see Table 6 for factor

loadings). One item (question 43, “Separates easily from parents”) did not load significantly on any factor. Several factors showed significant cross-loading. Using Stevens’ (2002) criteria for reliability (loadings of at least .40 for more than 10 items and an N >150), eight of the 23 items for factor 1 were not reliable; however the items loading on this factor average .440. Nine of the 17 items on factor 2 do not meet criteria of .40, but the items loading on factor 2 average .410. Five of the 13 items on factor 3 do not meet reliability criteria, but the loadings average .458. Two of the seven items on factor 4 do not meet criteria, but the item loadings average .475. Finally, all four items loading on factor 5 meet reliability criteria, averaging .558.

Exploratory Factor Analysis by Racial/Ethnic Group

A 5-factor EFA was run separately for each racial and ethnic group. Eigenvalues and the number of factors loading significantly on each of the five factors along with the range of those loadings is represented in Table 7. Consistent with the findings with the whole sample, question 43, “Separates easily from parents” did not load significantly on any factor for the Caucasian American, Mixed Race, and Hispanic groups. Additionally, question 49, “Does extremely well on a few tasks” did not load significantly on any factor for the Mixed Race group. Furthermore, analyses showed the Mixed Race group to have the least percentage of variance explained using five factors as compared to the other groups. Similar to the total sample, the Caucasian American sample had 24 items loading on the first factor. The Hispanic group had 21 items loading on the first factor while the three other groups had only 15 or 16 items loading on the first factor.

Table 6.
Rotated Factor Matrix for Entire Sample

SRS Item (abbreviated)	*Mean*	*SD*	Factor 1	2	3	4	5
Inflexible, hard time changing mind	1.55	.98	.63	.11	.09	.04	.05
Can't get mind off something	1.88	.95	.58	.18	-.05	-.10	.20
Upset in situations with a lot going on	1.72	.97	.57	.20	.10	.20	.06
Has more difficulty with changes in routine	1.85	.99	.57	.18	.10	.09	.02
Is too tense in social situations	1.18	.99	.54	.07	.06	.45	.03
Gives unusual or illogical reasons for actions	.93	.96	.54	.03	.04	-.06	.12
Shows rigid or illogical behavior under stress	1.72	1.01	.54	.25	.09	.10	.06
Seems more fidgety in social situations	1.56	1.00	.48	.08	.03	.21	.03
Overly sensitive to sounds/textures/smells	1.74	1.03	.46	.24	.02	.10	-.04
Has overly serious facial expressions	.75	.90	.46	-.06	.12	.20	.07
Gets teased a lot	.96	.97	.45	-.16	.05	-.02	.45
Thinks/talks about same things repeatedly	1.91	1.01	.43	.24	-.12	-.10	.22
Is overly suspicious	.30	.66	.43	-.13	.03	.12	.05
Expressions on face don't words	.72	.81	.42	.06	.27	.17	.02
Concentrates on parts rather than whole	1.42	1.03	.41	.26	.03	-.01	.07
Takes things too literally	1.79	.95	.37	.24	.08	.00	.19
Talks to people in unusual tone of voice	.86	1.01	.35	.13	.05	.11	.14
Gets frustrated trying to get ideas across	1.67	.94	.33	.26	.12	.15	.12
Seems to react to people as if objects	.56	.79	.32	.29	.25	.21	.06
Clings to adults, seems too dependent	.90	.92	.32	.18	.07	.16	-.01
Does extremely well at a few specific tasks	1.49	.97	.31	.26	.05	.12	.15
Is not well coordinated	1.29	1.02	.27	.03	.09	.06	.22
Avoids eye contact or unusual eye contact	1.65	.96	.26	.18	.10	.24	.07
Has trouble keeping up with conversation	2.00	.95	.00	.56	.18	.20	.20
Shows unusual sensory interests	1.41	1.11	.25	.55	.14	.09	.00
Behaves in ways that seem strange or bizarre	1.46	.85	.31	.51	.10	.15	.21
Doesn't understand cause and effect	1.75	.98	.12	.50	.29	.12	.10
Wanders aimlessly between activities	1.00	.96	.14	.45	.15	.10	-.01
Touches others in an unusual way	.91	1.02	.22	.44	.17	.03	.02
Has difficulty relating to adults	1.18	.98	.05	.44	.22	.34	.10
Has repetitive, odd behaviors	1.21	1.14	.13	.44	.12	.12	-.04
Doesn't mind being out of step with others	2.11	.93	.02	.36	.02	.05	.15
Walks in between people who are talking	1.62	.99	.27	.36	.17	-.08	.12
Plays appropriately with peers ®	1.96	.84	.03	.36	.34	.24	.33
Is awkward in turn-taking interactions	1.85	.98	.22	.36	.14	.10	.29
Doesn't recognize when others take advantage	2.11	.94	.17	.35	.21	-.01	.22
Stares or gazes off into space	1.17	.93	.27	.34	.07	.22	.03
Has an unusually narrow range of interests	1.73	1.04	.33	.34	.12	.18	.21
Is too silly or laughs inappropriately	1.29	.93	.30	.32	.09	-.04	.15
Has difficulty answering questions directly	1.49	1.03	.28	.31	.06	.04	.07
Responds appropriately to others' moods ®	1.92	.81	.11	.14	.58	.05	.08
Offers comfort to others ®	1.69	.98	.00	.14	.56	.24	.00
Is aware of what others are thinking/feeling ®	2.14	.75	.10	.16	.55	.06	.09
Is able to communicate own feelings ®	1.79	.82	.04	.16	.50	.28	.02
Understand tone/facial expressions ®	1.62	.84	.20	.00	.47	.02	.10
Has a sense of humor, understands jokes ®	1.62	.94	-.04	.36	.47	.12	-.04
Recognizes when something is unfair ®	1.76	.95	-.17	.41	.46	.11	-.04
Is able to imitate others' actions ®	1.28	.89	.07	.02	.41	.16	.01
Is imaginative, good at pretending ®	1.77	1.02	-.03	.31	.40	.15	.02
Knows when talking too loud ®	2.30	.85	.11	.26	.38	-.14	.09
Focuses attention where others are looking ®	1.80	.77	.03	.25	.37	.13	.06
Knows when too close to someone ®	2.25	.91	.06	.30	.36	-.18	.06
Good personal hygiene ®	1.31	.98	.14	.12	.29	.00	.18
Separates easily from caregivers ®	1.01	.98	.11	.00	.13	.08	-.11
Avoids starting social interactions	1.42	1.05	.09	.23	.16	.63	.05
Seems self-confident during interactions ®	1.88	.87	.06	.04	.34	.50	.10
Does not join group activities unless told to	1.78	1.00	.10	.25	.09	.50	.20
Would rather be alone than with others	1.46	.97	.21	.15	.03	.50	.15
Avoids people who try to be emotionally close	.72	.85	.34	.10	.16	.44	.03
Is emotionally distant/doesn't show feelings	.72	.87	.33	.04	.30	.39	.02
Has good self-confidence ®	1.69	.88	.15	-.08	.36	.38	.10
Is regarded by other children as odd or weird	1.85	.95	.31	.30	.11	.13	.62
Has difficulty making friends	1.86	1.03	.18	.17	.11	.31	.57
Has difficulty relating to peers	1.95	.91	.17	.35	.18	.37	.53
Is socially awkward	1.77	.94	.29	.31	.13	.26	.51

Note. Total N=2604; ® = reverse scored; Extraction: maximum likelihood; Rotation: Varimax with Kaiser Normalization.

Table 7.
Cumulative Percentage of Variance Accounted for by Each Factor, Number of Items Loading Significantly on Each Factor, and Range of Factor Loadings by Racial/Ethnic Group

	Factor									
Racial/Ethic Group	1		2		3		4		5	
Caucasian American	**20.94**		**27.03**		**31.23**		**34.52**		**37.28**	
N=2038	**24**	0.255- 0.632	**13**	0.313- 0.575	**13**	0.271- 0.586	**7**	0.372- 0.642	**5**	0.478- 0.623
African American	**19.44**		**26.75**		**31.06**		**35.12**		**38.51**	
N= 110	**16**	0.264- 0.679	**16**	0.292- 0.715	**18**	0.202- 0.604	**8**	0.244- 0.637	**7**	0.289- 0.631
Asian American	**19.74**		**27.02**		**31.73**		**35.73**		**39.49**	
N=111	**16**	0.296- 0.682	**15**	0.311- 0.643	**12**	0.223- 0.700	**12**	0.318- 0.762	**10**	0.349- 0.581
Mixed Race	**17.64**		**24.67**		**29.64**		**33.37**		**36.50**	
N= 214	**15**	0.265-.0.723	**17**	0.250- 0.616	**13**	0.266- 0.523	**11**	0.219- 0.519	**7**	0.227- 0.614
Hispanic	**19.09**		**25.75**		**29.69**		**33.40**		**36.84**	
N= 232	**21**	0.211- 0613	**15**	0.275- 0.670	**12**	0.294- 0.611	**9**	0.262- 0.684	**7**	0.237- 0.530

Note. The top number in each box is the cumulative percentage of variance accounted for by each factor. Underneath each percentage, the first number represents the number of variables loading on each factor and the set of numbers following represents the range of factor loadings.

CHAPTER 5: DISCUSSION

Summary

This study strove to identify the appropriateness of using the SRS-P across different racial and ethnic groups. As such, this study assessed the reliability, criterion validity, and structural validity of the Social Responsiveness Scale (SRS) Parent Form using 2705 children from the Simons Simplex Collection (SSC) dataset with diagnoses of ASD. Although there have been many studies addressing the reliability and validity of the SRS, there is a dearth of available research that conducted similar analyses by racial/ethnic group. Specifically, the purpose of this study was to identify any significant differences in the reliability and validity of the SRS by racial/ethnic group and determine how well the SRS predicted the severity of symptoms of ASD as measured by the ADOS-CSS. It was hoped that these results would add to the literature base and possibly provide further information to address why there is a documented disparity in the identification of ASD in children from different racial/ethnic backgrounds.

Reliability of the Total Sample and by Racial/Ethnic Group

Reliability was analyzed for the total sample as well as for each racial/ethnic group separately. The analyses found some differences in reliability between subscales and between racial/ethnic groups.

Subscale reliability in the total SSC sample. As reported previously, only two subscales were found to be reliable using Cronbach's alpha for the total SSC group analysis: Autistic Mannerisms and Social Communication. The results of the regression (further discussed below) found that only the Autistic Mannerisms scale, which targets stereotypical behaviors and highly restricted interests, significantly predicted the ADOS-CSS. With such a strong correlation between the Autistic Mannerisms scale and the ADOS-CSS (which relates the severity level of

ASD behaviors), it is not surprising that this particular scale is reliable. Unlike many of the items on the other four scales which target the absence of expected behaviors (e.g., expected social behaviors that may be more difficult to identify when absent or quantify), the Autistic Mannerisms scale targets the presence of very specific and unusual behaviors that are easier to identify and quantify. These are the behaviors that may immediately stand out to parents and clinicians alike in that they tend to be more disruptive and unexpected. It is therefore not surprising that there is a higher reliability when identifying these behaviors, and that the presence of these behaviors are more likely to be noted by parents and clinicians alike.

The Social Communication scale was also found to be reliable for the total SSC sample. This scale, which assesses expressive social communication, includes almost double the number of items of other scales. Additionally, the scale addresses the "motoric" aspects of social communication (Constantino & Gruber, 2005), suggesting that it identifies behaviors that are expressive and can be viewed externally versus internal thoughts or reactions that may be more difficult to assess. With regards to both the Autistic Mannerisms and Social Communication scales, it is reasonable that items asking parents to rate outward behaviors may be most reliable. Indeed, those scales received the highest alpha scores in the SRS manual sample as well.

Reliability alphas for each of the subscales were also calculated separately for each racial and ethnic group. When analyzed independently, the Autistic Mannerisms and Social Communication scales were the only reliable scales for the Caucasian American, African American, and Asian American groups. For the Mixed Race and Hispanic groups, the Social Communication scale was the only reliable scale, while the alphas for the Autistic Mannerisms scale were .77 and .79, respectively.

Subscale reliability by racial/ethnic group. To further assess the reliability by racial/ethnic group, each group was compared to the much larger Caucasian American group. Significant differences were found in only two subscales for two groups. The Hispanic group received significantly lower average scores on the Social Awareness subscale as compared to Caucasian Americans. The Social Awareness scale purports to address the child's ability to pick up on social cues and have a sensory awareness of social reciprocity (Constantino & Gruber, 2005). These results may suggest that the parents of Hispanic children in this dataset were not as attuned to whether their children demonstrated an awareness of social cues and social reciprocity as the parents of Caucasian American children. A lower score on that subscale means that parents of Hispanic children were not endorsing items that suggested deficits as often as parents from the Caucasian American group. It is challenging to deduce why that may be. Disparate group size may certainly have an effect. Alternatively, it may relate to a fundamental difference of social expectations between the two populations. If this finding is replicated using other database samples, it may suggest a direction for future study.

Compared to Caucasian American group, the Mixed Race group scored significantly lower on the Social Motivation subscale. This subscale assesses the degree of motivation to engage in social behaviors and empathy, as well as social anxiety and inhibition (Constantino & Gruber, 2005). As the Mixed Race group consists of individuals with any mix of race/ethnicity, it is difficult to surmise why a significant difference on this scale may exist when it is not present in any other racial/ethnic group analyzed in this paper. The Mixed Race group also includes individuals who report Native American or Hawaiian/Pacific Islander as one of their races; however the number of individuals who report these races in the Mixed Race group is very small and not likely to be significant. Regardless, it is still important to note the presence of these

additional races in this group. (Due to the small numbers of individuals reporting those races as their only racial group in the SSC dataset -*n* <30 for each group- these races were not included for individual analysis outside of the Mixed Race group.) As the Mixed Race group includes a wide variation in racial/ethnic reporting, any guesswork on why this significant difference arose would be difficult to substantiate or replicate using other samples.

Suggestions for intervention. As stated, the treatment subscales were designed primarily to help interventionists target specific areas for remediation. The subscales were created by asking expert opinion about potential grouping of the test items into different areas, and using the rate of agreement to confirm ratings (Constantino & Gruber, 2005). Although this appeared to have been an effective division of items based on the reliability rates found in the relatively small standardization sample, current results using a much larger and ASD-targeted sample may suggest the items do not group as well together as intended. In fact, only the Social Communication scale met reliability criteria for all racial/ethnic groups in the SSC sample. This may be due to the higher number of items as well as the externalizing nature of the items including in this scale. Perhaps a more effective approach to using the SRS-P for identifying treatment needs would be to target individual items that were strongly endorsed. By noting items that were strongly endorsed (or not at all endorsed for reverse-coded items), interventionists may be better equipped to provide very specific, targeted treatment options for individuals.

Predictive Ability of the SRS

The multiple linear regression found a significant relationship between the raw total SRS-P score and the ADOS Calibrated Severity Score (ADOS-CSS). This relationship was not significant by racial/ethnic group. In line with the findings of Constantino and Gruber (2005), this suggests that the raw total SRS-P is effective at identifying individuals with ASD.

Furthermore, there is a relationship between the number of items endorsed by the parent that are reflective of specific ASD behaviors and the level of severity of ASD symptomology as identified by a clinician trained in ASD identification. This suggests the total SRS-P score is an appropriate part of a comprehensive diagnostic evaluation, regardless of the race/ethnicity of the child being assessed. This is a positive finding, suggesting that the raw total is similarly effective for all racial/ethnic groups used in this study. Previous research has reported that some racial and ethnic groups are identified at a lower rate than Caucasian Americans (Sullivan, 2013; Tincani et al., 2009; Travers et al., 2011), but the current study does not find data to support the hypothesis that the SRS-P may show a similar disparity in ASD symptom reporting. As a whole, the SRS-P does not appear to differ in its ability to identify severity of symptoms of ASD by racial/ethnic group.

SRS subscale prediction of the ADOS-CSS. The regression analysis was also conducted by individual scale. The results indicated that only the Autistic Mannerisms scale significantly predicted the ADOS-CSS. The Autistic Mannerisms subscale purports to assess the degree of stereotyped behaviors and highly restricted interests. Restricted, repetitive behaviors and stereotypy tend to be very external behaviors that are less subjective and more easily identified. Scoring on the ADOS can be very subjective when considering the presence or absence or specific social interaction and communication behaviors. The presence of restricted and repetitive behaviors in a semi-structured testing environment may be easier to identify. As these behaviors are more objective and are included on both the ADOS and SRS, it is not surprising that this particular SRS subscale may be most predictive of ADOS-CSS.

Significant interaction of subscale and race. The interaction between Social Motivation and Asian American was an interesting finding. The graph of the interaction (Figure 2) suggests

that the higher the score on the Social Motivation scale, the higher the ADOS-CSS in the Asian American group while the Caucasian American group maintained relatively consistent ADOS-CSS scores regardless of whether the Social Motivation score was high or low. This may suggest that parents of Asian American children may attend more to expected social motivation behaviors (e.g., lower rates of social anxiety, higher rates of empathy, inhibition, and motivation to be social with others) than other racial/ethnic groups and therefore may be more observant of the presences or absence of such behaviors. Furthermore, a higher level of ASD symptomology on the Social Motivation scale reported by parents of Asian American children significantly correlated with clinician observations of the severity of ASD behaviors as represented by the ADOS-CSS. This same correlation was not observed in any other racial/ethnic group.

Structural Validity

Comparisons with the SRS standardization sample. During the standardization process, the factor structure of the SRS was calculated using three different sample populations with and without ASD. The SRS developers concluded that those results did not support the idea of separate subdomains of dysfunction. Rather, they supported a single underlying domain that represented the social interaction and communication deficits as well as repetitive and stereotyped behaviors (Constantino & Gruber, 2005). The exploratory factor analysis (EFA) done in the present study using the SSC sample supports this conclusion. The results of the current EFA demonstrate that the first factor explained the most variance in the sample. The SRS sample of 226 child psychiatrist patients with and without ASD found 34.97% of variance to be explained by the first factor, which was comprised of over 25 of the SRS items. When using the total SSC sample, only 20% of the variance was explained by the first factor, which was

comprised of 23 items. While five factors accounted for 49% of the variance in the SRS sample, five factors only accounted for 37% of the variance in the total SSC sample.

As previously stated, the SSC sample used in this study only included children with a diagnosis of ASD. It may be that the lower variance explained in the SSC dataset is directly related to the wide variation of symptomology found in ASD symptoms across the autism spectrum. The SRS is designed to distinguish between typical development and autistic behaviors. For typically developing children who may not present with these particular deficits, a more stable score may be expected. More consistency may explain more variance because it lacks extreme variability in rating scale responses. For children with ASD who demonstrate a much wider range of behaviors (e.g., typically developing children may only rarely exhibit any of these deficits while children with ASD may present with any variation of deficits/typical behaviors), it may be more difficult to explain variance. Therefore, a low rate of variance explained by a population of children with ASD diagnoses may not necessarily suggest that the SRS is unable to do what it purports to do. That is, it may still distinguish between ASD and non-ASD presentations.

Consistent with the findings during the validation process of the SRS, the first factor is comprised of items reflecting social and language deficits as well as restricted and repetitive behaviors, and does not correlate to one specific treatment subscale. Constantino and Gruber (2005) specifically state that the treatment subscales were not designed to be treated as separate entities; rather they were meant to assist with planning for specific, individualized interventions. Evaluating the utility of the treatment subscales as the basis for planning targeted intervention is outside the scope of the current study; however it is interesting to note that not one of the 5 factors identified in the EFA correlated directly to any particular subscale delineated by the

authors. Instead, each factor contained items from a variety of subscales. It may therefore be reasonable to assume that creating a different constellation of treatment subscales may be just as reliable, if not more, in this current sample. Furthermore, the opinions of the professionals surveyed in the creation of the treatment subscales may reflect differences in interpretation of the individual items. It may be that parents would have grouped these items into different subscales that would better describe the constellation of behaviors they observe in their own children. It would be an interesting extension to create five scales based on the EFA results in the current study and then assess the reliability of each scale to see if it is stronger.

EFA by racial/ethnic group. As previously reported, the PCA done with each racial/ethnic group sample found some differences in the variance explained by the first five factors calculated. The first factor for the Mixed Race group included only 15 items that explained less than 18% of the variance. Conversely, the first factor for the Caucasian American group contained 24 items that explained almost 21% of the variance. Five factors explained just under 37% of the variance in both the Mixed Race and Hispanic groups, and explained over 39% of variance in the Asian American group. Although these differences may not be significant, it is of interest that there is such variation in the number of items explained by each factor when broken down by racial/ethnic group. It is difficult, however, to draw conclusions based on these differences. The differences in sample size alone may account for much of the variation.

Implications for School Psychologists

The results of this study provide important implications for school psychologists working with children with ASD. The results suggested that parents are effective reporters of ASD behaviors in their children on a standardized rating scale such as the SRS-P, regardless of racial or ethnic status. School psychologists are in a prime position to identify students who fit

educational criteria for ASD. As part of this process, school psychologists should provide screening and high-quality assessments (Schwartz & Davis, 2014). The SRS-P can be an effective tool as one piece of the ASD identification process for children from diverse racial and ethnic backgrounds. School-based evaluations are important to help identify those who do not have adequate access to clinical services outside of school (Yeargin-Allsopp et al., 2003). Therefore school psychologists need racially and ethnically fair instruments to use with their school populations. As the SRS-P performed similarly regardless of the race or ethnicity of the child and the total score significantly predicted the ADOS-CSS, this particular instrument may be a valuable resource to use with children from diverse racial and ethnic backgrounds. However, an important caveat would be to realize that the treatment subscales are not reliable for every group, and nor do they provide adequate predictive value for the severity of ASD symptomology when taken individually.

Limitations of the Current Study

As with any study, there are several limitations to the present study. First and foremost is the concept of generalizability. The SSC dataset used was generated as part of a national effort to collect a variety of data about children with ASD. The data were collected through the efforts of 12 clinical sites connected with universities across the United States (Fishbach & Lord, 2010). The SSC sites followed stringent guidelines when recruiting families for inclusion in this dataset, which limited the range of individuals with ASD in the dataset. Fishbach and Lord (2010) specify that common reasons for excluding candidates for inclusion included: primary relatives with diagnoses of ASD, an age that was outside the parameters of 4-18 years old, nonverbal mental age under 18 months, birth trauma, genetic evidence of a comorbid syndrome, and medically significant perinatal events. Furthermore, this dataset only reflects individuals who

could be recruited by the researchers at those specific sites. As unequal access to these types of services for low SES and/or racially/ethnically diverse groups is a well-documented issue in the literature, the SSC dataset likely represents a specific portion of the entire ASD population (Stiller et al., 2014; Yeargin-Allsopp et al, 2003). With such limitations on the data collected, the ability to generalize these results to other members of these populations is also limited.

Another major limitation to the present study is the sample size available for each of the different racial/ethnic groups. While there were ample Caucasian American individuals in the dataset, there were comparatively few of each of the other racial and ethnic groups. In fact, the samples sizes available for the other groups were merely 5-10% of the size of the sample of Caucasian American individuals. The sample size differences may have had a significant impact on the results. If the sample size for each group had been more equivalent, the findings may have been different for the various groups. Several of the *p* values approached significance for some of the analyses done. With more similar sample sizes for each group, it is possible that some analyses may have been significant.

The individuals chosen for inclusion in the present study all had a diagnosis on the autism spectrum. There were no typically developing individuals included in this study. The results of the reliability and structural validity analyses may have had different results had individuals without ASD also been included. The SRS manual suggests higher alpha scores reflecting a higher level of internal consistency in their sample population than was found in the SSC sample. A significant difference between the two samples was that the SRS sample contained individuals without ASD while the SSC sample used only contained individuals with ASD. More study may need to be done on whether the reliability and structural validity is similarly impacted by other samples consisting only of individuals with ASD.

This study did not take into account additional variables such as age or education level of the child or previous treatment services. Furthermore, the parents' level of education around ASD was not addressed. These factors may have influenced the ability of the parents to rate certain behaviors consistent with ASD. For example, parents who have a stronger knowledge base of ASD symptoms may have been more attuned to the symptoms in their own children and thus endorse them more consistently. Children who have had treatment may appear to parents to have made significant improvements, and a parent may provide ratings that include an internal comparison of previous and current behaviors of the child. Clinicians may be more objective in rating behaviors as they would not necessarily have knowledge of previous interventions that might influence ratings, and they are likely comparing them to other individuals with and without ASD.

Implications for Future Research

Despite the limitations, this study provides some direction as to future research possibilities. The results of this study support that the SRS does not generally show significant differences when applied to racial/ethnic populations outside of the Caucasian American population. This may suggest that the SRS applies similarly to racially and ethnically diverse populations. However, there were a few significant findings reported above. Further studies addressing the specifics of the significant differences may confirm the differences found and shed some light on why these differences may exist. Such findings may offer valuable contributions to research addressing the disparity in ASD identification rates between racial/ethnic groups. Additionally, using samples that are more consistent in size may allow for more confidence in the results obtained.

The SRS-P used in this study is just one rating scale used to help identify ASD. Its utility has been documented in other countries with other races, but very little has been done to address different racial and ethnic groups in the United States. The SRS now has an updated version, the SRS-2 (Constantino & Gruber, 2012). Future studies could look at the utility of the SRS-2 with regards to different racial and ethnic groups. With the proliferation of secondary data collected and available for researchers over the last several years, using other datasets would provide additional information to corroborate or dispute the findings in this study. If similar results are found, the generalizability to a wider population may be supported. Additionally, there are several other rating scales, interviews, and observational tools that are widely used as part of a comprehensive diagnosis of ASD. Other commonly used instruments that may be used in future research include the Autism Diagnostic Interview- Revised (LeCouteur et al., 2003), the Autism Spectrum Rating Scale (Goldstein & Naglieri, 2010), and the Childhood Autism Rating Scale, Second Edition (Schopler & Van Bourgondien, 2010).

This study was specific in that it only analyzed the SRS-P across racial and ethnic groups. Additional studies could compare the concordance rates of the SRS-2-P and the SRS-2-T (teacher edition) across racial and ethnic groups. It may also be enlightening to look at location effects on these concordance rates or on the appropriateness of specific instruments with specific populations. For example, there may be important differences found between families living in less diverse areas versus families who live in more racially and ethnically diverse areas. Similarly, there may be differences between ratings of children who live in urban areas where there are more likely to be autism centers and information around autism spectrum disorders than in rural or isolated areas where there may be fewer experts in the area of autism and less might be known about the symptoms.

Finally, more needs to be done to illuminate possible issues surrounding parent understanding of behaviors and symptoms consistent with ASD and identification rates amongst different populations. Asking parents directly for their input around these issues might provide additional context. For example, collecting qualitative data in the form of direct parent interviews, cognitive interviews using questions from rating scales commonly in use (e.g., SRS-P-2), and observational data of the child in unstructured family and community settings in addition to school observations would provide researchers with context to support the responses given on standardized assessments. The purposes of the interviews would be to qualify parents' recognition of symptoms of ASD along with their understanding of specific questions on rating scales designed to identify ASD symptoms. Observations would be used to gain insight into what typical interactions look like (with particular attention to verbal/nonverbal communication and social interaction) in unstructured settings outside of schools and clinics. A qualitative approach to understanding the disparity in identification rate is largely missing from the existing literature base and may augment the quantitative research that currently exists.

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