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THE CROSS CULTURAL EXAMINATION OF A BRIEF AUTISM DIAGNOSTIC INTERVIEW (ADI-R) IN KOREA AND THE UNITED STATES

Elizabeth Lally Daley
DePaul University, LALLYDALEY@GMAIL.COM

THE CROSS CULTURAL EXAMINATION OF A BRIEF AUTISM

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ELIZABETH LALLY DALEY

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Department of Psychology

College of Science and Health

DePaul University

Chicago, IL

<u>THESIS COMMITTEE</u>

Christopher B. Keys, Ph.D.
Chairperson

Jocelyn Carter, Ph.D.

<u>VITA</u>

The author was born and raised in Chicago, IL on November 17, 1983. She graduated from St. Ignatius College Prep and received her Bachelor of Science degree from University of Notre Dame in 2006. She has been working with children and adults with autism for ten years.

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OVERVIEW

Autism is the fastest growing developmental disability in the United States; as many as 1 in 88 individuals have been identified with an Autism Spectrum Disorder (ASD) (Centers for Disease Control and Prevention [CDC], 2010). Researchers in countries around the globe are conducting epidemiology studies to learn more about the rates of autism worldwide. Although scientists are working on understanding how many people in the population have autism, there is a limited amount of focus on the identification of any cultural factors that may influence people's understanding about autism, attitudes about autism, and reporting of symptoms. The accepted methods for diagnosing autism are the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R). These assessment procedures have been translated into over thirty languages across the world. In order to make the assessment process more efficient and accessible for clinicians and clients, a shortened version of the ADI-R needs to be developed. In addition to developing a brief form of the ADI-R, this particular assessment tool can be used to help researchers identify any cultural influences by comparing the interview across cultures. This study seeks to develop a brief version of the ADI-R using Item Response Theory with a Korean sample of school aged children divided into two groups based on age and language ability. The specific items from the Brief Korean Autism Diagnostic Interview (KBADI) are compared to the Korean translated ADI-R scoring algorithms, which were originally derived in the United States, in order to give some insight into any cultural differences. This study aims to identify any

Korean cultural influences that may play a role in the parent or caregiver's

reporting of autism symptoms.

CHAPTER I

INTRODUCTION

Autism was first defined in 1943, by Leo Kanner, in a paper that described

eleven children with similar yet varying symptoms. He explained that these case

studies were markedly and uniquely different from anything reported thus far.

Kanner (1943) detailed the developmental progress of each child through

meetings and letters with the children's parents. The children varied in their

development and degree of symptoms. Yet, there were common features that

would manifest themselves into the disorder now known as autism. Kanner

explained the children interacted socially in a peculiar way. He observed that the

individuals with autism were not able to develop relationships with the other

person, but rather treated them as detached objects. The children's approach to

activities and behaviors were viewed as inflexible. He wrote, "All of the

children's activities and utterances are governed rigidly and consistently by the

powerful desire for aloneness and sameness" (Kanner, L, 1943). Each child

displayed a strong need for order and routine in all activities. The eleven children

all had an atypical development of language in the early years of life. Some of the

children developed echolalia, repetition of words or phrases (Kanner, L, 1943).

Within this paper, Kanner captured the three main deficits of autism: a lack of

social interaction, difficulty communicating, and restricted and repetitive

behaviors. The term used by Leo Kanner and many psychologists is autistic

disorder; however, for the purposes of this paper the term autism and autism

spectrum disorder will be used interchangeable. Over the years autism has evolved and expanded; however, these three core deficits remain part of the definition today.

Autism is reported to affect children in all racial, ethnic and socioeconomic groups. However, autism is four times more prevalent in males than females. According to the Centers for Disease Control and Prevention (CDC, 2012), autism affects an estimated 1 in 88 births and 1 in 54 males in the United States. This prevalence rate is based on health records identified in 14 states. A recent population-based study in South Korea reported a prevalence of 2.6%; that is, 1 in 38 Korean children has an Autism Spectrum Disorder (Kim et al., 2011). Kim et al. (2011) screened 55,266 children in schools around the Seoul, South Korea area and followed up with an evaluation of 292 school-aged children. Two-thirds of the children enrolled in the study were from mainstream education, which meant they did not have a formal diagnosis and were not receiving treatment (Kim et al., 2011). With the variability in prevalence rates of autism there is a need for more studies to examine prevalence rates in various regions and populations around the world. There is a need for more studies to examine prevalence rates of autism in more regions and populations across the world. Like South Korea, many children around the world go undiagnosed without receiving any support at home or in school.

In recent times, autism is described as a neurologically based developmental disability that develops during the first two years of life. Autism is part of a group of disorders defined by pervasiveness. Pervasive Development

Disorder (PDD) is a class of disorders that are characterized by pervasive and significant impairments in social interaction, verbal and nonverbal communication, restricted interests and repetitive behaviors (Tsai, 1998). The Pervasive Developmental Disorders include Autism, Asperger's Syndrome, Rett Syndrome and Childhood Disintegrative Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) Disorder. Each of these disorders shares similar symptoms, but have different diagnostic criteria. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, 1994), autism is described as a pervasive developmental disability that manifests in (a) qualitative differences in reciprocal social interaction, (b) qualitative differences in communication, and (c) repetitive and ritualistic preoccupations with objects, activities or interests (American Psychiatric Association, 2000). These same areas of abnormal functioning are also described in the International Statistical Classification of Diseases and Related Health Problems (ICD-10). The main deficits described by Kanner (1943) are still part of this criterion both in the United States and internationally. Each of the core deficits of autism, socialization, communication, repetitive and restricted behaviors, is identified on a continuum of symptoms.

In May 2013, the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) provided criteria for Autism Spectrum Disorder (ASD) and Social Communication Disorder (SCD). This change in the DSM-V meant that Asperger's Syndrome and PDD-NOS would be removed from the DSM-V and not used as a diagnostic category. According to the DSM-V, the

diagnostic criteria for Autism Spectrum Disorder is (a) persistent deficits in social communication and social interaction across multiple contexts, (b) restricted, repetitive patterns of behavior, interests or activities (c) symptoms must be present in early developmental period (d) symptoms cause clinically significant impairment in social, occupational or other important areas of current functioning (e) these disturbances are not better explained by intellectual disability or global developmental delay (American Psychiatric Association, 2013). The first two criteria for autism, social communication and restricted, repetitive behaviors, are classified in regards to severity. The severity levels include level 1: requiring support, level 2: requiring substantial support, and level 3: requiring very substantial support. Additionally, the Social Communication Disorder criteria includes (a) persistent difficulties in the social use of verbal and nonverbal communication (b) deficits result in functional limitations in effective communication, social participation, social relationships, academic achievement, or occupational performance, individually or combined (c) onset of symptoms is in the early developmental period (d) symptoms are not attributable to another medical or neurological condition or to low abilities in the domains or word structure and grammar, and are not better explained by autism spectrum disorder, intellectual disability, global developmental delay, or another mental disorder (American Psychiatric Association, 2013). Although there is a new classification for autism, many of the assessments used to diagnosis autism are still based on the DSM-IV classification of autism. This paper will focus on the DSM-IV classification of autism because the data was collected using this distinction.

However, this study will also consider the implications of the transition to the DSM-V classification in relation to the findings.

Autism is a spectrum disorder, meaning that individuals differ in the severity of their symptoms. Since autism is a spectrum disorder, each of the core deficits affects each individual with varying degrees of symptoms. For example, a person with autism who communicates verbally, lacks social reciprocity when interacting, and has a narrow restricted interest looks different from an individual with autism who is nonverbal, socially appropriate at times, and is rigid with his/her routine. The pathology of one individual with ASD does not match the pathology of another individual with ASD (Charman, 2002). There is a larger spectrum of autism and then within each symptom is a unique continuum. Each of the core deficits of autism ranges from one end of the spectrum to the other and vary in degree for every individual (Freeman, 1997). The main symptoms of autism are part of the diagnostic criteria: socializing, communicating and repetitive behavior (American Psychiatric Association, 2000).

Socialization

Individuals are expected to interact socially with friends, family members, co-workers, classmates and strangers on a daily basis. These social interactions have multiple layers of meaning and expression. The multiple layers of social interaction are determined by subtle differences in facial expression, tone of voice, and body language. The nuances of social interaction are complicated but necessary for navigating the social world. Without these social skills it is difficult for any individual to interact with others and develop relationships (Klin et al.,

2007). A social deficit is a core symptom of autism; therefore, individuals with autism have a difficult time interacting with peers and family members. Individuals who have autism have a challenging time following everyday social norms, which include participating in social activities, making friends, and following social rules in the community. Although autism is not commonly diagnosed until ages 3 – 4, the social deficits of autism can be observed during the first year (Anderson et al., 2009).

The first year of an individual's life is full of social exploration. A child develops early imitation skills that enable him or her to interact with others. Children learn to make noises, follow sounds, respond to their name, and imitate motor movements. Over the years researchers have been able to identify a cluster of behavioral impairments in early infancy related to symptoms of autism (Werner et al., 2000). These behaviors can be observed using home videos and parent interviews. A majority of parents with children who have autism suspect a problem within the first year (Osterling et al., 2002).

From an early age typically developing children naturally respond to faces and speech (Werner et al, 2000). It is common for parents and other families to call out the child's name and watch the child respond by looking towards the voice or at the person. At 12 months old, children who later receive a diagnosis of autism are less likely to look at people or objects held by people as compared to children the same age with mental retardation (Osterling, 2002). Children between the ages of 8 to 10 months, who receive a diagnosis of autism later, have fewer instances of orientating to their name being called than typically developing

children the same age (Werner et al., 2000). Not making eye contact or responding to one's name is a common characteristic of autism spectrum disorders in the United States. Making eye contact with others and looking at certain objects is an important skill necessary for developing joint attention.

Joint attention is the ability to "coordinate attention between interactive social partners with respect to objects or events in order to share an awareness of the objects or events" (Mundy et al., 1986, p. 657). Children share attention with their parents, other adults and even other children. Joint attention behavior includes sharing attention, following the attention of someone through an eye gaze or gesture, or directing the attention of someone else (Dawson, 2004). This experience is important for development of social cognitive processes and language abilities (Munday and Crowson, 1997). The early identification of failing to orient to one's name and look at people or objects demonstrates that not attending early in life impacts later social development, (Osterling, 2002; Werner at al., 2000). The failure to develop specific social skills early in life makes socializing more difficult, especially for individuals with autism.

Another important social skill is the development of understanding that others have different thoughts, beliefs, and attitudes. This concept is referred to as Theory of Mind (ToM). Baron-Cohen (1991) explored the possibility that the development of a theory of mind lies in the infants' understanding of attention in others, or joint attention. Joint attention is a prerequisite social skill for the development of theory of mind. Individuals who develop ToM are able to recognize that others have separate thoughts and feelings, which contribute to

conversations, social games, and friendships. For many years, researchers have studied ToM using false belief tasks like the Sally and Anne task particularly with a sample of children with autism (Happé, 1995). Baron-Cohen, Leslie & Firth (1985) developed the false belief task using dolls. This false belief task asks the child to watch as an experimenter places an object in location A, while a doll watches. Then the doll is brought out of the room and the experimenter moves the object to location B. The experimenter asks the child where the doll will look for the object. The child passes the task if they select location A because the child realizes that the doll (or other people) has a different belief than reality. Individuals with autism commonly fail false belief tasks. This deficit in false belief tasks is evident across all individuals with autism, including individuals who are nonverbal (Colle, Baron-Cohen and Hill, 2007). Since individuals with autism fail to develop ToM, they have a difficult time participating in most social exchanges because they do not realize that the other person has thoughts or opinions different from the person with autism. A significant part of a social exchange is social reciprocity. The conversation, friendship, or general interaction includes reciprocated interest for all parties involved. The lack of joint attention leads to problems with theory of mind, which in turn affects how individuals with autism communicate and interact socially.

Social expectations increase with age causing individuals with autism to continue to struggle with socializing throughout his or her life. Socialization is a very complex part of one's daily interactions. There are multiple instances throughout the day when one interacts with others. While an individual interacts

with others socially, that person typically communicates with them through social conversation. Socialization is relative to other key areas of development such as communication (Anderson at el., 2009). Individuals with autism not only struggle with socialization, but also they have problems with communication which make most interactions with others stressful and problematic.

Communication

A child's first words are a monumental moment for parents around the world. Communication is an essential aspect of a person's everyday life; therefore, language development is an important developmental milestone. Typically children develop expressive language around 12 months and continue to learn more words, understand meaning, form full sentences, acquire phonics, and master conversation skills until age seven. Once people fully develop language, they can use it to communicate socially with others by efficiently exchanging information. Many parents of children with autism first become concerned about a child's development because of a delay, absence, or regression of speech as compared to typically developing peers who establish their vocabulary more rapidly and completely with less difficulty (Short & Schopler, 1988).

The continuum of communication for children with autism ranges from verbal to nonverbal. Individuals with autism may never develop language as a means to communicate. Around 40% of individuals with autism will not develop language (Volkmar, 2009). Children with autism may have a delay in the development of language. Also, children with autism may demonstrate a loss of skills, specifically in terms of language (Rogers, 2004). For example, a child

might develop language and then start to lose the ability to use words. Around 25-30% of the children with autism spectrum disorder have some mastered words at 18 to 24 months and then lose them (Johnson, 2004). The regression of speech can be challenging for many parents, since at one point the child had language to communicate. Difficulty with language development can lead to social communication problems. Children who have a regression of developed language or a delay in language typically have impairments in pragmatic skills.

The communication concerns for individuals with autism are not just based on the development of language, but the appropriate use and understanding of language. An individual who has autism and is verbal can still have difficulty communicating with others. Likewise, an individual with autism who is nonverbal can struggle communicating verbally, but may use other forms to communicate successfully. An essential part of social communication is the recognition of intentions by others in the conversation (Eales, 1993). The intention of a speaker is significant for helping the other members of the conversation to understand the relevance of the words spoken. Individuals with autism fail to recognize the intended meaning of the other speaker in a conversation (Eales, 1993). By not recognizing the intention of the speaker, individuals with autism have a difficult time communicating socially in a conversation.

In addition, a person needs to be able to reference or link the discussion within the conversation. Children with autism do not make connections in the conversation, but they do often link the conversation to the physical space (Fine,

Bartolucci, Szatmari & Ginsberg, 1994). Individuals with autism have a difficult time relating to the social conversation, but are able to comment on the surrounding environment during a discussion. Sometimes an individual with autism might ask a question about the environment to which they already know the response. People with autism ask these questions because they do not understand the function of the question as a request for new information (Baron-Cohen, 1988).

In addition to having a difficult time interpreting language in a social conversation, some individuals with autism use language in an odd manner. Some individuals with autism use "stereotyped phrases" (Lord, 1994) or echolalia. Echolalia is the repetition of words or phrases that someone else has said with similar tone (Tager-Flusberg, Paul, & Lord (2005). Stereotyped phrases are words or phrases that are repeated and do not serve a communicative purpose. These repetitive words or phrases are used to self-stimulate, so are also considered repetitive behaviors. However, these repetitive words or phrases often affect social communication for children with autism.

Repetitive Behaviors

Individuals with autism display restricted and repetitive behaviors and interests. Even though these behaviors are identified in a homogenous symptom category of autism, there are substantial differences within the repetitive and restricted behaviors (Cuccaro et al., 2003; Szatmari et al., 2006). Researchers have been trying to identify homogenous dimensions of restricted and repetitive behaviors and interests (Carcani-Rathwell, 2006; Szatmari et al, 2006). There are

two factors of restricted and repetitive behaviors, repetitive sensory and motor behaviors (RSMB) and interests and insistence on sameness (IS) (Cucaro et al., 2003). The RSMB consists of hand and finger mannerisms, repetitive use of objects or parts of objects, unusual sensory interests, other complex mannerisms or stereotyped body movements, and rocking (Szatmari et al., 2006). These types of motor behaviors do not serve any specific purpose other than self stimulation (Cucaro et al, 2003). The IS domain, which is also referred to as Resistance to Change (RS), includes difficulties with minor changes in personal routine and environment, resistance to trivial changes in environment, and compulsions and rituals (Szatmari et al, 2006). Individuals with autism tend to impose order and routine in their surrounding environment (Cucaro et al, 2003). These two domains of repetitive and restricted behavior, RSMB and IS, enable researchers to understand a set of complex behaviors within two constructs (Szatmari et al, 2006). Individuals with autism can meet criteria in both or just one of the constructs. There is some research that identifies the level of functioning and symptoms of autism as they relate to each domain of restricted repetitive behavior and interest. Szatmari et al (2006) described the RSMB domain as negatively correlated with level of adaptive functioning. Therefore, an individual who is more developmentally delayed is more likely to have repetitive sensory and motor behaviors. Also Szatmari et al (2006) explained that the IS domain is related to the communication domain of the autism symptoms. Individuals with higher levels of communication express more insistence on sameness behavior. A main reason for this is that individual with autism who are highly verbal are able to

communicate problems concerning a change in routine or topic. Although verbal

individuals with autism are able to express these strong preferences, all

individuals with autism develop repetitive or restricted behaviors.

Culture & Autism

Socialization, communication and repetitive/restricted behaviors are the

core deficits of autism that are used to diagnosis autism in the United States and

across the world. Autism does not just affect individuals in the United States; it is

a disorder that has been found in many other countries (Grinker, 2007). Autism

can affect any family or child across varieties of race, ethnicity, culture,

education, or socioeconomic status.

When the Centers for Disease Control (CDC, 2007) estimated that autism

affects 1 in 110 births in the United States, other countries began to identify other

emerging trends in children and adults. Currently other countries are conducting

epidemiology studies in order to identify prevalence rates. Researchers have been

able to identify prevalence rates in western countries, and parents in non-western

countries describe an increase in numbers and difficulty accessing care (Daley,

2002). Multiple countries have used identified health records to estimate

prevalence rates of autism, including the United Kingdom, Mexico, China, India,

Philippines, and Thailand (Action for Autism India, 2008, Baird et al., 2006; Sun

& Allison, 2010). The rates of prevalence for autism in these cultures range from

1 in 33 to 1in 1,000 (Kim et al., 2011; Baird et al., 2006; Sun & Allison, 2010). A

recent prevalence study (Kim et al., 2011) screened a sample of the population to

determine the rates of autism in South Korea and determined that 2.6% of the

population has an autism spectrum disorder. As countries continue to determine autism incidence rates, autism organizations, clinics and schools are being developed to support children and adults with autism and their families around the world (Daley, 2002).

With an increase in international autism awareness and organizations, researchers have started to explore autism through a cultural lens. These explorations indicate there is a need for more autism research within and across cultures (Daley, 2002). While there are a myriad of ways to define culture, in a commonly used framework Triandis (2007) describes culture as consisting of three further distinctions. Culture: (1) emerges from interactions between persons and the environment, (2) contains shared elements, and (3) is transmitted across time and generations. These three aspects of culture describe how the culture transpires, what makes up the culture and how the culture continues to exist over time. Using these distinctions, different cultures can have different views, beliefs and understanding of the same topic, like autism spectrum disorders. Culture plays a role on how individuals understand, accept, identify and treat autism (Ennis-Cole, Durodoye, & Harris, 2013).

In order to recognize cultural differences in disabilities like autism, researchers use cross-cultural approaches (Trembath, Balandin, & Rossi; 2005). Cross-cultural psychology is the study of relationships between cultural contexts and behaviors that become established in a community within a particular culture (Berry, Poortinga, & Pandey; 1997). Using this framework, researchers can understand autism in a cultural context and be able to support families, teachers

and professionals. A majority of the cross-cultural autism research examines individual's perceptions about autism. Conners (1993) conducted research with Navajo individuals and explored their perceptions and social competence of individuals with autism. Shu (1989) examined how Caucasian and Chinese-American parents' ethnic background may influence their attitude and behaviors toward autism. Moreno (1995) studied Latino parent's perceptions and concerns regarding autism. Kim (2009) studied the teacher's perceptions of autism in the United States and Korea, concluding that the cultural values in each country play an important role in one's view and understanding of autism. Many researchers including Kim (2009) refer to the model of collectivist versus individualistic orientation as a main part of cultural influences, including the perception and understanding of autism (Shin, 2002 & Cha, 1995). A collectivist culture focuses on the interdependence of people within their own groups, including families, tribes, and nation (Triandis, 2001). An individualistic culture places more importance on the individual rather than giving the group a primary priority. These two types of cultures impact a variety of views and perceptions including the view of disabilities, more specifically autism. To learn more about autism across cultures, the role of collectivism and individualism should be further explored. Many countries in Asia, including South Korea, are considered more collectivist cultures as opposed to the United States, which is viewed as an individualistic society.

Autism researchers have started comparing different measurements of autism across cultures to learn more about the influence of culture and to know if

the measurement can be used across cultures (Ennis-Cole, Durodoye, & Harris, 2013). Wakabayashi et al. (2006) conducted a cross-cultural comparison of the Autism-Spectrum Quotient in Japan and the United Kingdom to determine if the measurement was culturally specific to western cultures or culturally independent. This study concluded that the AQ measure was culturally independent, so therefore the assessment could be used in Japan. Wang, Lee, Chen & Hsu (2012) investigated the cross cultural validity of the Social Responsiveness Scale (SRS) in a Taiwanese preschool population as compared to a United States and German samples. The Taiwanese translated SRS could distinguish between children with autism spectrum disorders and individuals with typical development suggesting the tools cross cultural validity. International research in autism appears to examine various assessments in other countries; however, many studies fail to consider and discuss any cultural factors (Daley, 2002). Autism research would benefit from explicitly studying the cultural factors that affect families and individuals with autism across the world. By examining cultural factors, researchers and clinicians would better understand the way in which cultures understand and treat autism. In turn this could help with getting more accurate autism prevalence rates around the world.

Autism & South Korea

South Korea is a country in Asia that neighbors China and Japan and borders North Korea. The population of South Korea is about 50 million people. Like many countries, South Korea has a history of both supporting and neglecting

individuals with disabilities. Over the years, South Korea has worked to support individuals with disabilities through education. Traditionally, family members would care for children with special needs. In the 19th century (Kwon, 2005), protestant missionaries from the United States travelled to South Korea and developed schools for children with disabilities (Seo & Oakland, 1992). The first schools with a focus on special education in South Korea were designed to educate children with physical disabilities. More schools were developed to help all children with physical and mental disabilities. In the late 1930s some private schools offered special education classrooms, however this was not a requirement of all schools (Seo & Oakland, 1992). In 1977, the Korea Special Education Promotion Act (SEPA) mandated free education for children with disabilities across the country (Seo & Oakland, 1992). In 1994 SEPA was reformed to include four major contents: special education is offered in the form of free appropriate education to individuals with disabilities; non-discriminatory identification and evaluation; local governors are given the responsibility to improve special education; and private schools offering special education received financial support from the government (Park, 2002). Among the children in South Korea who are eligible for special education services, a majority of students remain in general education without receiving services (Kim et al., 2011). Seo (1997) determined that only 42% of children, who qualify for special education services, are enrolled in special education programs (Seo, 1997). Although special education services are required in South Korea, the quantity and quality are considered substandard (Shin, 2002). Recently, Korean Special

Education for Individuals with Disabilities and Others Law (2007) was passed to promote inclusion within the entire education field. A major reason for the lack of special education resources is the shortage of trained staff and teachers (Kang-Yi, Grinker, & Mandell, 2013). The lack of support for children with disabilities, including autism continues outside of the classroom, families in South Korea have a difficult time receiving support outside of school (Lee & Jung, 2005). This absence of formal support for children with disabilities ultimately leads to families not having access to treatment (Cho et al., 2000). Kang-Yi, Grinker, & Mandell (2013) suggest some possible reasons for the lack of support for families of children with disabilities, particularly autism. The first reason for the lack of services may be related to the recent establishment of child psychiatry in South Korea. It was not until 1981, that the first division of child psychiatry within a medical center was established at Seoul National University Hospital. Also this hospital is the only academic medical hospital that employs a certified clinician who can administer certain diagnostic instruments, like the ADOS-G and ADI-R for autism spectrum disorders. Although there are some centers in South Korea that provide assessment and treatment for autism, there are some cultural misunderstandings related to the diagnosis of autism.

Culturally, Koreans want to be the same within their set population; no one should stand out and be different; this desire for uniformity includes people with disabilities (Grinker, 2007). Due to this cultural belief and the big emphasis on family in Korea, many families prefer to label children with autism as Reactive Attachment Disorder (RAD) (Grinker, 2007). According to the DSM-IV,

Reactive Attachment Disorder is described as children, more than often orphans, who crave attention and care from a parental figure (American Psychiatric Association, 2000). Mothers in Korea would prefer to have a child with the diagnosis of Reactive Attachment Disorder because the blame is placed on the mother not showing enough emotion and affection rather than blaming the child (Grinker, 2007). The diagnosis of RAD is similar to the American concept of "refrigerator mother" in the 1960s. Bettelheim (1967) presented a theory that an emotionless parenting style led to children developing autism. In the United States, this theory has been viewed as flawed. However in places around the world, like South Korea, many people believe that the way in which a parent engages with the child leads to autism or a disorder like autism, RAD. Shin et al. (1999) assessed children in South Korea who received a diagnosis of autism. In this study, the children between the ages of 2-4 were observed playing with their mothers. Researchers concluded that the mothers lacked social skills, were insensitive to their children's social cures, and did not join the children in play. The study also revealed that after the parents engaged in play therapy and improved their social skills, the children showed improvements in language and socialization. Even though the blame is placed on the mother with attachment disorder diagnosis, many mothers in South Korea seem to prefer the diagnosis over one of autism. South Koreans believe that autism is untreatable; however mothers can learn to develop play and engagement skills to help their child with RAD (Grinker, 2007). RAD is not viewed as a permanent condition; mothers can work on their skills to improve the symptoms of the child. Grinker (2007) further

explains that RAD stigmatizes the mother, autism could stigmatize the entire family, including extended family members. He further explains that this could have a negative impact on marriage proposals. The general understanding of autism is South Korea is a little dated as compared to the United States. With the recent epidemiology study on autism in South Korea (Kim et al., 2011), families, practitioners and researchers are started to explore autism in South Korea in the 21st century.

Autism Diagnostic Evaluation

Autism is a developmental disability that manifests in the first two years of life, therefore parents and professionals need to be aware of the early signs of autism, the screening tools, and the diagnostic evaluation. The early signs of autism include two patterns, an early onset and regression of behavior (Ozonoff, Losif, Baguio, Cook, Hill, Hutman, et al., 2010). Ozonoff et al. (2010) explain that many researchers have identified the early onset pattern as the atypical development of orienting to name, gaze to faces, joint attention and affect sharing. Additionally Ozonoff et al. (2010) described the regression pattern for individuals with autism when children develop typically, but then lose certain skills that were previously acquired. One of the most recognized regression patterns is the loss of language. Parents typically report that children had verbal language abilities and then later lost the verbal language skills leading to a decline in communication, which indicates the importance of language in the assessment of autism (Siperstein & Volkmar, 2004). When a child has an early onset of atypical

behavior or a regression in behavior then professionals and parents should have the child screened for autism. Screening is the process used by pediatricians, psychologists, psychiatrists, and other mental health professionals to determine if a child should receive further evaluation. A majority of the autism screening tools include parent report, questionnaires and checklists (Ozonoff et al., 2005). If the screening tool indicates that a child is positive for autism tendencies, then a child should receive a full diagnostic evaluation.

Filipek (1999) suggests that the assessment of autism should include cognitive, adaptive behavioral and psychiatric measures. The diagnostic measures include parent interviews and structured observations. Over the years, researchers and clinicians have developed a number of autism diagnostic measurements that include structured observation of the child and an interview with the parent. The Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview (ADI-R) are considered the "gold standard" for diagnostic instruments within autism research protocols (Ozonoff et al., 2005). The ADOS and the ADI-R are currently used to diagnose individuals from age 2 to 16 years old. Although the majority of people using these instruments are researchers, many clinicians use these diagnostic instruments to provide a full evaluation of autism (Ozonoff et al., 2005).

The ADOS is a semi-structured observational assessment of social interaction, communication, play and imaginative use of materials for individuals who may have autism or another pervasive developmental disability (Lord et al., 2000). This assessment is used to appraise children, youth and adolescents, who

display early warning signs of autism or screen positive for Autism Spectrum Disorders (ASDs). Trained clinicians administer the ADOS to individuals between the ages of two and sixteen. This standardized assessment consists of "presses" which elicit spontaneous behavior in the social and communication context (Lord et al., 2000). Clinicians use these presses in a naturalistic social situation in order to identify social and communicative reactions (Klin, 2007; Ozonoff et al., 2005). The assessment provides a standard context through structured activities and informal social interactions, so relevant behaviors are observed in relation to Pervasive Developmental Disorders (Lord et al., 2000). In some cases, specific aspects of the activity are missing; therefore, individuals being assessed are pressed to interact socially and communicate. Some of the activities include a pretend birthday party, acting out the routine of brushing teeth, telling a story based on pictures, and answering questions about friends and marriage. The goal for each of these activities is to provide a standard context that is interesting and age appropriate while prompting social interaction and proper communication (Ozonoff et al., 2005).

Since autism is considered to have a spectrum of symptoms, The ADOS has four modules, which are based on language abilities and developmental level. Each of the four modules contains 10-15 activities that elicit specific communication and social skills. The first module is used when the child is young and does not use spontaneous language to communicate (Lord et al., 2000). The second module is intended for children who use consistent spontaneous speech in phrases (Lord et al., 2000). Older children and adolescents, who are verbally

fluent and play with age appropriate toys, follow the third module (Lord et al., 2000). The final module is intended for adolescence or young adults who are verbally fluent and can answer social-emotional and daily living questions (Lord et al., 2000). During the administration of a module, the observed behaviors are coded throughout the session in the areas of social communication, social relatedness, imagination, and restricted and/or repetitive behaviors (Klin, 2007). The ADOS-G does not include a standardized opportunity to measure restricted or repetitive behavior; however, if it is observed the clinician can code such behavior (Lord et al., 2000).

A classification of autism is met when an individual meets or exceeds the threshold on three domains: socialization, communication and a combined social-communication total. However, the ADOS does not ask about the child's history or specifically address issues related to restricted/repetitive behavior. Since the ADOS does not systematically assess for repetitive or restricted behavior, there is a difference in the ADOS classification of autism and the DSM-IV (1994) diagnostic criteria of autism. Therefore, the ADOS cannot independently be used to make a diagnosis of autism. Clinicians need to interview the parent or guardian of the child in order to find out more about the child's background and repetitive behaviors.

The parent/guardian interview is part of the diagnostic assessment of autism. The parent report is also significant because the observation of the child is usually short and in a clinical setting (Ozonoff et al., 2005). The Autism Diagnostic Interview (ADI) is a comprehensive semi-structured parent interview

conducted by a trained clinician to identify the range of behaviors relevant to the diagnosis of autism in the DSM-IV and the ICD-10 (Lord, Rutter, Le Counteur, 1994; Lord, Storoschuk, Ritter, & Pickles, 1993). The original protocol of the Autism Diagnostic Interview (ADI) was developed in 1989 to create an assessment that was based on the newly developed diagnostic criteria for autism in the DSM-III-R (1987) and the ICD-10 (Lord, Storoschuk, Ritter, & Pickles, 1993). This original interview was very detailed and long because it was developed for research purposes. In 1994, the ADI was revised to shorten the length of the interview in order to make it more efficient for clinicians to use for diagnostic assessments. Additionally, the ADI needed to be updated in order to be consistent with the Pervasive Developmental Disorders criteria in the DSM-IV. (Lord, Rutter, & Le Counteur, 1994).   Although the ADR-R shortened the interview time, the length of the interview still often makes administration burdensome for clinicians and/or caregivers.

The ADI-R is administered to the main caregiver or parent regarding a child from 18 months until adulthood (Lord, Rutter, & Le Counteur, 1994). The administration of this interview can take up to 3-4 hours (Ozonoff et al., 2005). A parent or caregiver completes the interview, which details the early development of the child related to these core deficits of autism (Lord, Rutter, & Le Couteur, 1994). The interview focuses on the three core deficits of autism: language and communication, socialization, and restricted and repetitive behaviors. The interview is divided into five main sections: background; questions about social development and play; questions regarding communication; details about

repetitive and restricted behavior; and finally, questions about general behaviors (Lord, Rutter, & Le Couteur, 1994). Each of the trained clinicians, who administer the interview try to obtain detailed, complete and consistent descriptions from the parent or caregiver (Ozonoff et al., 2005).

There are a total of 93 items in the interview. The first 8 questions in the interview are to gather information regarding the early development of the child including onset of symptoms, motor milestones, and toilet training. The remaining questions are divided into three distinct areas (1) communication, (2) social developmental and play, and (3) interests and behaviors. The communication section highlights the development of language and the use of social communication in 41 questions. This includes the acquisition and loss of language as well as language and communication functioning levels. In regards to social development there are a total of 17 questions including questions about the individual's play skills. The third area includes interests and behaviors. There are a total of 27 questions asked in this section. The first 13 questions are about repetitive behaviors and restricted interests. The next 14 items are about more general behaviors. Questions are generally open-ended with a majority of the questions requesting the caregivers to specify if the particular behavior occurred currently, within the last 3 months, or ever, meaning throughout his or her life. The other questions require the interviewee to report a specific age; for example, what was the age, in months, when the child said his/her first single words.

The clinician administering the interview wants to be able to obtain a sequential account of each behavior; when the behavior began, and what

happened after the behavior developed (Lord, Rutter, & Le Couteur, 1994).

Parents describe the symptoms and behavior of the child in order to give the

clinician a better perspective of the early developmental progress. Since the

interview is appropriate for a wide age range, the clinician needs to define the age

period for specific items in a way that is comparable across subjects (Le Couteur,

Rutter, & Lord, 2003). This age defining is done in a few different ways within

the interview. There are specific items in the ADI-R that indicate qualitative

abnormalities that would be identified as atypical at any age. An example of

these items includes delayed echolalia and abnormal preoccupations (Le Couteur,

Rutter, & Lord, 2003). All of these items are coded in terms of "current" or

"ever." The "current" response refers within the last three months from the date of

the interview. "Ever" responses mean anytime during the child's life including the

current time. These responses enable the clinician to determine when specific

behaviors developed by classifying the response to now or in the past.

Another set of items in the ADI-R is influenced by the subject's

developmental level. Many of the items affected by a person's developmental

standing include social behavior and communication (Le Couteur, Rutter, & Lord,

2003). Therefore, the clinician asks about a specific time period early in

development. Le Couteur, Rutter, & Lord (2003) give two reasons for the age

specificity with these behaviors. The first concern is that older children may have

outgrown some of these abnormal behaviors. The second reason is some children

who have severe cognitive delays may display impairments as a result of the

developmental delay alone. Therefore, the ADI-R codes the behavior that was

most abnormal between age 4.0 to 5.0 years as well as any current behavior (Le Couteur, Rutter, & Lord, 2003). If the child is 4 years old or younger, then the questions are asked; however, the responses are coded as current, reflecting that currently this behavior is being observed. Finally there are a few behaviors, for example, direct gaze, imaginative play, and friendships, which are relevant to a specific age. These items have specific age restrictions for the coding. Clinicians use all of these age periods for coding in order to understand the development of symptoms of autism more efficiently. Trained clinicians use the coded responses to fit in the established algorithms in order to make a diagnosis of autism. Each of the set algorithms for the ADI-R are based on the child's age and language ability.

In order to administer the ADI-R for research purposes, a clinician needs to participate in a research specified training of the ADI-R and establish reliability before they administer the interview. The inter-rater reliability is high (.90) both for individual items and for overall scores (Le Couteur, Rutter, & Lord, 2003). The ADI-R has high sensitivity and specificity and good inter-rater reliability for a range of ages (Lord et al., 1993, Lord et al. 1994, & Lord, 1997). Cichetti et al. (2007) evaluated the reliability of the ADI-R using seven clinicians from two sites and one case. The seven examiners demonstrated agreement levels of 94-96% across all items in the ADI-R with weighted kappa between .80 - .88.

The ADOS-G and ADI-R are being used more in clinics around the United States as well as around the world. Both diagnostic instruments have been translated into Danish, Dutch, Finnish, French, German, Hebrew, Hungarian, Icelandic, Italian, Korean, Norwegian, Russian, Spanish, and Swedish. The

Korean version of the ADI-R was forward and backward translated (Yoo, 2007).

By making these autism assessments accessible to clinicians in other countries,

researchers can better examine the prevalence rates as well as cross-cultural

research.

Despite its strong validity and reliability, several problems exist with the

current version of the ADI-R, The full interview and even the items in the

algorithms take a long time to administer and score. Also the scoring algorithms

for the ADI-R are divided up by age and language ability. For many clinicians in

these countries, there are limited resources and time to devote to one interview.

Many countries use other screening tools to diagnose autism. In order for more

research to look at the disorder across cultures, there needs to be an assessment

that accounts for each particular culture. One way to support clinicians around the

world is to develop a brief version of the ADI-R to make the diagnostic process

more efficient and accessible.

Rationale

There is an increase in autism diagnoses across the world; therefore, there is a growing need for efficient diagnostic assessments. The ADOS and ADI-R are used to make these diagnoses; however, the process can be very time consuming. Therefore, eliminating some of the items to shorten the interview would create a new briefer form of ADI. This brief form would enable both researchers and clinicians to see more children. Additionally, the ADI-R is an extensive interview that researchers can use to understand any cultural differences. The ADI-R has been translated in over 30 languages across the globe. The technique used to translate includes translating the interview to another language, then back to English and then back to the translated language. The algorithms that have been identified in a United States population are applied as well. Researchers have not examined the role of culture on parent reporting of autism symptoms. This paper will try to identify any areas of possible cultural influences of autism by examining a Korean autism sample. Item response theory will be applied to the Korean translated ADI-R to create a Korean Brief ADI-R (KBADI). The KBADI will be compared to the United Stated derived, Korean translated ADI-R scoring algorithms. The overall comparison of the Korean and U.S interviews will allow for a cultural comparison of the KBADI and the Korean translated ADI-R scoring algorithms. The specific items in the brief form of the ADI-R and the scoring algorithm will give insight into any differences across culture. The development

of a brief ADI-R in Korea may enable other countries, which now use the ADI-R, to develop similar short versions.

Statement of Hypotheses and Research Questions

Research Goal. The major research goal for this paper is to develop a Korean Brief ADI-R (KBADI) measure for use in the Korean culture.

Research Question I. To what extent and in what direction does the Korean Brief ADI-R (KBADI) correlate with the Korean-translated ADI-R diagnostic algorithm for Korean children under the age of ten years with fluent language?

Research Question II. To what extent and what direction does the Korean Brief ADI-R (KBADI) correlate with the Korean-translated ADI-R diagnostic algorithm for Korean children ten years of age and older with fluent language?

Hypothesis I: The Korean Brief ADI-R (KBADI) predicts the diagnosis of autism in Korean children with accuracy at least comparable to that of the Korean-translated ADI-R diagnostic algorithm for children under the age of ten with fluent language.

Hypothesis II: The brief Korean ADI-R predicts the diagnosis of autism in Korean children with accuracy at least comparable to that of the Korean-translated ADI-R diagnostic algorithm for children ten years of age and older with fluent language.

Research Question III. What are the similarities and differences in the subset of items from the Korean Brief ADI-R (KBADI) and the Korean-translated diagnostic algorithm for Korean children under the age of ten years with fluent language?

Research Question IV. What are the similarities and differences in the subset of items from the Korean Brief ADI-R (KBADI) and the Korean-translated diagnostic algorithm for Korean children ten years of age and older with fluent language?

CHAPTER II

METHOD

Participants

The total number of participants included 292 school-aged Korean children. The children are part of a larger autism epidemiological study in South Korea, which included both verbal and nonverbal school aged children. For the purposes of this study, we used the total number of participants to create the Korean Brief ADI-R (KBADI). In order to compare the KBADI to the Autism Diagnostic Interview- Revised (ADI-R), algorithms the nonverbal children were removed (n = 22). The remaining Korean children with verbal language (n = 270) were divided up based on age due to age restrictions in ADI-R algorithms. The first group included children under the age of ten with fluent language (n = 109). The

second group included children ten years of age and older with fluent language (n = 161).

All children were recruited from local schools, both general and special education, from a suburb of Seoul, South Korea. This Korean sample includes 78% males (n = 214) and 26% female (n = 78). The age of the school aged children ranged from 7 – 14 years old with a mean age of 10.17. There were a total of 56 children registered on the national disability registration. The South Korean disability registry allows the government to grant certain benefits for the individual based on their diagnosis, including vocational training, personal care services, rehabilitation treatment, and education (http://seoul.angloinfo.com/information/healthcare/people-with-disabilities/). Individuals are added to the disability registry after receiving an official diagnosis from a government hospital. A majority of the children were from general education classrooms and not receiving any formal services. Based on the overall best estimate of diagnosis, from the epidemiological study (Kim et al., 2011), a total of 207 students were identified, as having an Autism Spectrum Disorder while 85 students did not receive a diagnosis of ASD.

Materials

Diagnoses were made using a variety of standardized measurements translated in Korean including Autism Spectrum Screening Questionnaire (ASSQ) (Ehlers, Gillberg, & Wing; 1999), the Autism Behavior Checklist (ABC) (Krus, Arick & Almond; 1980), and the Behavior Assessment System for Children (BASC-2)

(Reynolds & Kampuhaus; 2004), Wechsler Intelligence Scale for Children

(WISC-IV) (Dombrowski & Noonan; 2004), the Autism Diagnosis Observation

Schedule (ADOS-G) (Lord et al., 2000), and the Autism Diagnostic Interview-

Revised (ADI-R) (Lord, Rutter & Le Couteur; 1994). First, children were

screened using the following parent reports from the ASSQ, ABC, and BASC-2.

Then children were screened positive based on the screening tools were invited

for a full evaluation using the Korean translated WISC-IV, ADOS-G, and ADI-R.

Diagnostic evaluations were completed using the same standardized

measurements translated into Korean. All instruments were translated from

English to Korean and then back to English to check the accuracy of the language

(Yoo, 2007); Park et al., 2002). The Korean translated Autism Diagnostic

Interview Revised (ADI-R) was used for the purposes of this study.

Procedure

In South Korea, the target population included 55, 266 school aged

children who were screened for autism using two screening tools. The children

were between the ages of 7 – 14 and came from both general and special

education classrooms in the suburb of Seoul, South Korea. Parents and teachers

completed the appropriate screening tools. Out of target population a total of

36,886 completed both set of screening tools with a response of 23,337 school-

aged children. The children who screened positive for autism spectrum disorder (n

= 1,826), based on the screening tools, were invited to receive a full evaluation. A

total of 292 children underwent autism assessment, including the ADOS and ADI-R, Korean translated versions.

As stated previously, the ADI-R has been translated into a number of other languages. When the translated ADI-R is used in another country, the established scoring diagnostic algorithms are applied as well. Figure 1 shows a flow chart of this process for the Korean translated ADI-R. First, the process begins with the original English version of the ADI-R, which includes a total of 93 items. From the ADI-R (93 items) there are United States derived scoring diagnostic algorithms, which are based on language level and age. For this study, the following two algorithms were examined: Korean children younger than ten years old with fluent language and Korean children ten years of age or older with fluent language. These smaller Korean groups, defined by language and age, allow for a more detailed comparison on the ADI-R. Additionally, the original English version of the ADI-R, 93 items, was translated into Korean. All 93 items of the Korean translated ADI-R were used to develop the Korean Brief ADI-R (KBADI). The ADI-R comprehensive diagnostic algorithm includes three domains that closely reflect the specific abnormalities of autism from the DSM-IV and ICD-10 (Lord, Rutter, & Le Couteur, 1994). The ADI-R diagnostic algorithm domains are qualitative abnormalities in reciprocal social interaction; qualitative abnormalities in communication; and restricted, repetitive, and stereotyped patterns of behavior. Table 1 details the specific items within the three domains including the subcategories in each domain for Korean children

with fluent language under the age of ten. Table 2 provides the items for each

domain for Korean children with fluent language ten years of age and older.

Figure 1. Autism Diagnostic Interview Revised (ADI-R) Korean Translation Flow Chart

Autism Diagnostic Interview – Revised (ADI-R)
Original
- **English Language**
- **93 items**

ADI-R Scoring Diagnostic Algorithm
- United States Derived
- Under 10 years of age
- Verbal only
- 35 items

ADI-R Scoring Diagnostic Algorithm
- United States Derived
- 10 years of age and older
- Verbal only
- 29 items

ADI-R original
- Translated to Korean
- 93 items

ADI-R Scoring Diagnostic Algorithm
- United States Derived
- Under 10 years of age
- Verbal only
- Translated into Korean
- 35 items

ADI-R Scoring Diagnostic Algorithm
- United States Derived
- 10 years of age and older
- Verbal only
- Translated into Korean
- 29 items

Korean Brief Autism Diagnostic Interview (KBADI)
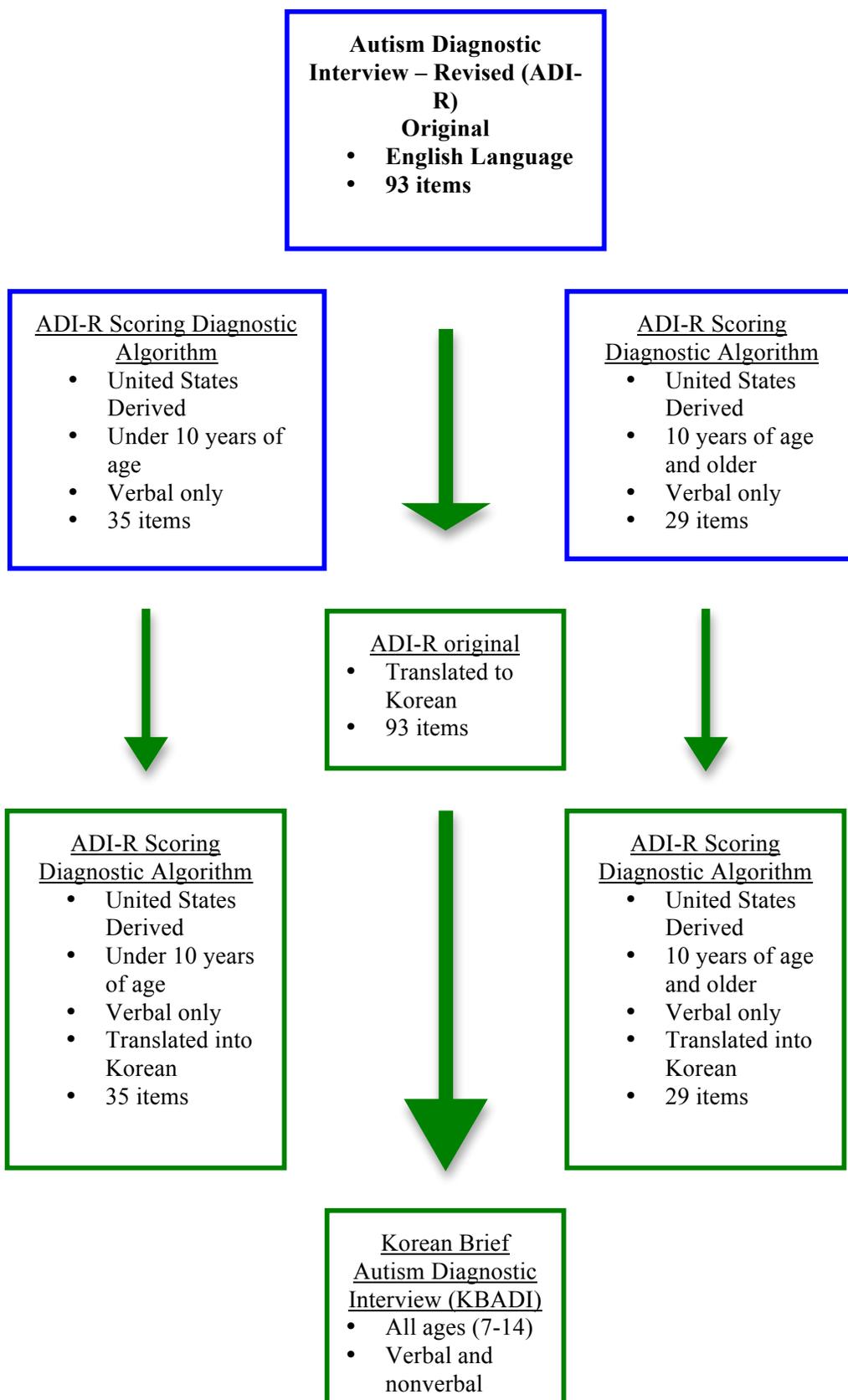- All ages (7-14)
- Verbal and nonverbal

Table 1.

ADI-R Scoring Algorithm Domains for Korean Translated ADI-R for Children with language under the age of ten years old

Qualitative Abnormalities in Reciprocal Social Interaction

Failure to use nonverbal behaviors to regulate social interaction
        Social Smiling
        Range of Facial Expressions used to communicate
Failure to develop peer relationships
        Imaginative play with peers
        Interest in children
        Response to approaches of other children
        Group play with peers
Lack of shared enjoyment
        Showing and directing attention
        Offering to share
        Seeking to share enjoyment with others
Lack of socioemotional reciprocity
        Use of other's body to communicate
        Offering comfort
        Quality of social overtures
        Inappropriate facial expressions
        Appropriateness of social responses

Qualitative Abnormalities in Communication

Lack of, or delay in, spoken language and failure to compensate through gesture
        Pointing to express interest
        Nodding
        Head Shaking
        Conventional/instrumental gestures
Lack of varied spontaneous make-believe or social imitative play
        Spontaneous imitation of actions
        Imaginative play
        Imitative social play
Relative failure to initiate or sustain conversational interchange
        Social verbalization/Chat
        Reciprocal Conversation
Stereotyped, repetitive, or idiosyncratic speech
        Stereotyped utterances and delayed echolalia
        Inappropriate questions or statements
        Pronominal reversal
        Neologisms/idiosyncratic language

Restricted, Repetitive, and Stereotyped Patterns of Behavior

Encompassing preoccupation or circumscribed pattern of interest
        Unusual preoccupations
        Circumscribed Interests
Apparently compulsive adherence to nonfunctional routines or rituals
        Verbal Rituals
        Compulsions/rituals
Stereotyped and repetitive motor mannerisms
        Hand and finger mannerisms
        Other complex mannerism or stereotyped body movements
Preoccupation with parts of objects or nonfunctional elements of material
        Repetitive us of objects or interest in parts of objects
        Unusual sensory interests

Table 2.

ADI-R Scoring Algorithm Domains for Korean Translated ADI-R for Children with language ten years of age and older

Qualitative Abnormalities in Reciprocal Social Interaction

Failure to use nonverbal behaviors to regulate social interaction
      Social Smiling
      Range of Facial Expressions used to communicate
Failure to develop peer relationships
      Friendships
Lack of shared enjoyment
      Showing and directing attention
      Offering to share
      Seeking to share enjoyment with others
Lack of socioemotional reciprocity
      Use of other's body to communicate
      Offering comfort
      Quality of social overtures
      Inappropriate facial expressions
      Appropriateness of social responses

Qualitative Abnormalities in Communication

Lack of, or delay in, spoken language and failure to compensate through gesture
      Pointing to express interest
      Nodding
      Head Shaking
      Conventional/instrumental gestures
Relative failure to initiate or sustain conversational interchange
      Social verbalization/Chat
      Reciprocal Conversation
Stereotyped, repetitive, or idiosyncratic speech
      Stereotyped utterances and delayed echolalia
      Inappropriate questions or statements
      Pronominal reversal
      Neologisms/idiosyncratic language

Restricted, Repetitive, and Stereotyped Patterns of Behavior

Encompassing preoccupation or circumscribed pattern of interest
      Unusual preoccupations
      Circumscribed Interests
Apparently compulsive adherence to nonfunctional routines or rituals
      Verbal Rituals
      Compulsions/rituals
Stereotyped and repetitive motor mannerisms
      Hand and finger mannerisms
      Other complex mannerism or stereotyped body movements
Preoccupation with parts of objects or nonfunctional elements of material
      Repetitive us of objects or interest in parts of objects
      Unusual sensory interests

CHAPTER III
RESULTS AND ANALYSIS

Item response theory was used to develop a Korean brief ADI-R (KBADI) based on all the items from the ADI-R. Correlation and ROC curves were used to examine the Korean brief ADI-R and its relationship to the Korean-translated ADI-R scoring algorithms. This current chapter details the statistical analyses used for each hypothesis and research question.

In order to test hypotheses and research questions, Korean participants were divided into two groups based on the ADI-R scoring algorithms. The scoring algorithms are based on language ability and a specific age range. The first group consisted of Korean children with fluent language and under the age of ten years. The second group consisted of Korean children with fluent language and over the age of ten years. Children considered nonverbal were eliminated from the database for certain purposes of this study. Analyses explore the relationship between the Korean brief ADI-R (KBADI) and the Korean-translated ADI-R scoring algorithm.

Hypothesis Testing

Research Goal. The major research goal for this paper is to develop a Korean Brief ADI-R (KBADI) measure for use in the Korean culture.

The Item Response Theory (IRT) was used to develop a brief measure of the Korean ADI-R from all 93 items. IRT is a model-based measurement that identifies both the trait and item level in relation to a person's response

(Embreston & Reise, 2000). It focuses on the theory of the item as opposed to the

test as is the case for Classical Test Theory (Embreston & Reise, 2000). IRT

includes a range of diverse models used for education and psychological testing.

There are two characteristics associated with IRT models: the dimension and

parameter. IRT models can be divided into two categories in regards to

dimension: unidimensional and multidimensional. The unidimensional, which is

most often applies, measures the same latent trait in all participants (Spiel, Gluck,

& Goossler, 2001). Each participant is positioned on the unidimensional line to

determine his or her placement along the continuum of items, which range in

difficulty (Spiel, Gluck, & Goossler, 2001). The items must fit onto this ideal

unidimensional line that ranges in difficulty or severity, as in the case for

psychological measures (Bond & Fox, 2007). All of the items should contribute

in a meaningful way to the overall construct, while items that do not fit the ideal

straight line or the unidimensional construct differ from the expected construct

and therefore are removed (Bond & Fox, 2007). Multidimensional IRT models

allow traits to be measured and compared across items or within the test

(Embreston & Reise, 2000). Additionally, IRT models can also be categorized

based on the number of parameters. Currently there are three IRT models used:

the 3-parameter logistic, the 2-parameter logistic, and the 1-parameter logistic

which is also referred to as the Rasch model (Harris, 1989).

This study selected the Rasch model or one-parameter IRT model because

of two important assumptions. The Rasch model assumes that all items fit the

model and each item has equivalent discriminations along one parameter (Bond &

Fox, 2007). Also the Rasch model has specific objectivity which means the measurement of a subject's specific trait is independent of the distribution of the overall set of items used to measure that trait (Bong & Fox, 2007). Additionally, the Rasch analysis is uniquely relevant to other IRT models because it enables the data to fit the model, whereas with other test theories a model is selected based on the data (Bond & Fox, 2007). Another way to understand the Rasch model is to think of it in terms of deductive reasoning as opposed to inductive reasoning. Deductive reasoning is a top-down approach that makes a working assumption that general statements apply to a group of individuals. Inductive reasoning is a bottom- up logic that uses observations to make generalizations. The Rasch model is similar to deductive reasoning as it makes the working assumption that all items apply to each participant.

A rating scale model was applied to test the overall data fit to the model by using the software, WINSTEPS version 3.75.0 (Linacre, 2006). Table 3 shows the final brief Korean ADI-R (KBADI) items. These items were selected to include a full range of autism symptoms and each item needs to be distributed across the scale in order to create a unidimensional line. During this process of distilling the scale to include only the most discriminating items, specific criterion was used to remove certain items from the scale. The first step for removing certain items was identifying the fit of each item in the scale. The fit was assessed in this unidimensional scale using a standardized index of outlier-sensitive fit (Crouch, Gresham, & Write, 1985). The overall fit of the item helps determine if each item contributes to the measure of the overall construct, in this

case autism (Bond & Fox, 2007). The outfit or outlier sensitive is the unexpected observations that are either too sensitive or too extreme for predicting a diagnosis of autism (Linacre, 2006). The Winsteps manual explains that the outfit, as seen in Table 2, should have a desirable value of between .50 to 1.50. All of the items in the KBADI range from .69-1.33; therefore the primary criteria for outlier sensitive fit are met.

Table 3

KBADI Items, Location on the Autism Dimension, Estimated Discrimination, and Fit Statistics

Item	Location	Standard Error	Estimated Discrim.	Outfit
Overall level of language*	1.50	.16	1.09	.80
Hand and finger mannerisms	1.36	.15	1.05	.98
Self-injury*	1.31	.15	1.03	.97
Comprehension of simple language*	1.27	.14	1.08	.69
Gait*	1.15	.14	.97	1.18
Undue general sensitivity to noise*	.91	.12	.96	1.39
Quality of social overtures	.41	.09	1.02	.87
Range of facial expressions used to communicate	.18	.08	1.03	1.00
Seeking to share his/her enjoyment with others	.00	.07	1.03	.95
Social smiling	-.13	.06	1.01	1.31
Offering comfort	-.14	.06	.96	.94
Showing and directing attention	-.17	.06	.98	.96
Unusual sensory interest	-.21	.06	.92	1.03
Aggression toward caregivers or family members*	-.22	.06	.79	1.23
Conventional/Instrumental gestures	-.31	.05	.96	.91
Offering to share	-.38	.05	.89	1.26
Circumscribed interests	-.43	.04	.58	1.18
Current communicative speech*	-.45	.04	1.30	1.18
Inappropriate questions or statements	-.49	.04	1.11	1.27
Age when abnormality was first evident*	-.83	.03	-.52	1.28
Response to approaches of other children	-1.41	.03	1.32	.85
Imitative social play	-1.42	.03	1.32	.86
Imaginative play with peers	-1.41	.03	1.15	.91

*Items not part of ADI-R Korean-translated scoring algorithm

In this study, the outfit models were first used to eliminate items from the Korean-translated ADI-R, which included 93 items. The second criterion for eliminating certain items is the item location. This criterion allows the research to check that all items are relatively evenly distributed along the unidimensional line. The item location for each item in the brief measure can be seen in Table 2, under the location column. Each item is somewhat equally spaced out from the next to represent and thereby measure the entire range of the autism spectrum. For these purposes, the difference between the item location numbers usually is less than three times the standard error. The standard error is the precision of the measure. If a particular item is greater than three standard errors then that item is more difficult than other items. There are a total of only six items within the KBADI in which the location number exceeds three standard errors. Moreover, when these items were removed from the overall measure it negatively affected all the location items for the remaining questions. Therefore, the six items remain included in the measure in order to allow for a better distributed unidimenstional line.

The final criterion included the estimated discrimination, which was used to confirm the final measure. The estimated discrimination is also referred to the item slope and should be relatively uniform across items (Linacre, 2006). All item discrimination or item slope is stated to equal 1.00 to fit the Rasch Model. However, item discriminations are not exactly equal therefore the amount of difference from 1.00 indicated the degree to which the item does not fit the Rasch model. Some of the items either high discriminate (greater than 1.00) or low

discriminate (less than 1.00). The KBADI item discrimination ranges, however a majority of the items near 1.00. When certain items identifies as low discriminate, such as age when abnormality was first evident, were eliminated from the measure it negatively affected the item location for remaining items. The items that demonstrate a significantly low discrimination (circumscribed interests and age when abnormality was first evident) are placed on the lower end of the scale. The items on the lower end of the KBADI scale represent individuals who are less likely to display as many symptoms of autism, such as individuals with PDD-NOS or Asperger's. Therefore, one may expect more issues with these items because they represent individuals with fewer symptoms.

The Rasch model is an interactive process that enables the researcher to identify a general indication on the items within the measure. There were a total of five steps taken to eliminate certain items from the overall measure. Each time the outfit criterion was used to initially eliminate items; however the item location was also taken into consideration during the final two steps. At the very end the estimated discrimination table was used to confirm the measure. The full measure of 93 items was run using the Rasch model and initially 12 items were eliminated based on the outfit criteria. During this step a majority of the items removed were items previously identified as having a significant amount of missing data. Many of these items included asking parents and caregivers to recall a specific age for certain developmental milestones like first time walking, toilet training, first word, first phrase, etc. After the items were eliminated, the model was run again and the outfit measures were examined and a total of 22 items were removed.

The measure had a total of 59 items remaining and the Rasch model was applied again. This time after evaluating outfit of each item a total of 19 items were removed from the measure. Now, the measure had 40 items and the Rasch model was run a final time eliminating 17 items based on outfit numbers. The final measure included 23 items. At this point, the location measure was examined further to confirm that there was a relatively equal distribution among items in this column. Although this measure seemed final at 23, four other items were identified as items that could possibly be removed based on slightly higher outfits and close location measures. However, after the four items were removed and the 19 item measure was analyzed, the person reliability that is similar to a Cronbach's alpha fell significantly and the location measures were not evenly distributed. Therefore it was determined that the 23-item measure would be used for the Korean Brief ADI-R (KBADI).

The internal consistency of the KBADI by Cronbach's α was .78 based on the total sample (n = 292). One thing to note is that autism is a disorder that has three core deficits: communication, socialization and repetitive behaviors, and the set of items needs to capture all three of these domains. Therefore, there may not be as much internal consistency, but rather some variance. Therefore, the alpha was considered very appropriate for such a measure.

Research Question I. To what extent and what direction does the Korean Brief ADI-R (KBADI) correlate with the Korean-translated ADI-R diagnostic algorithm for Korean children under the age of ten years with fluent language?

Correlation analyses were used to examine the relationship between the brief Korean ADI-R (KBADI) and the Korean-translated ADI-R diagnostic algorithm for children under the age of ten with language. Correlation analyses revealed the KBADI and the Korean-translated ADI-R algorithm for children under the age of ten with fluent language are very strongly correlated, $r(107) =$ .92, $p < .001$. This very high correlation indicates that the two measures are closely related to one another. To further examine this relationship, scatterplots were constructed to recognize the linear relationship between the KBADI and the Korean-translated ADI-R diagnostic algorithm. Graph 1 presents the scatterplot for measures, KBADI and ADI-R algorithm, with Korean children under the age of ten with fluent language. The scatterplot indicates that the assumption of linearity is reasonable. It shows that there is a positive association between the KBADI and the ADI-R algorithm for children under the age of ten with fluent language. In other words, the KBADI and the ADI-R algorithm have a strong positive linear relationship for Korean children under the age of 10 with fluent language.

Graph 1.
Scatter Plot Group 1, Korean age less than 10 years with fluent language
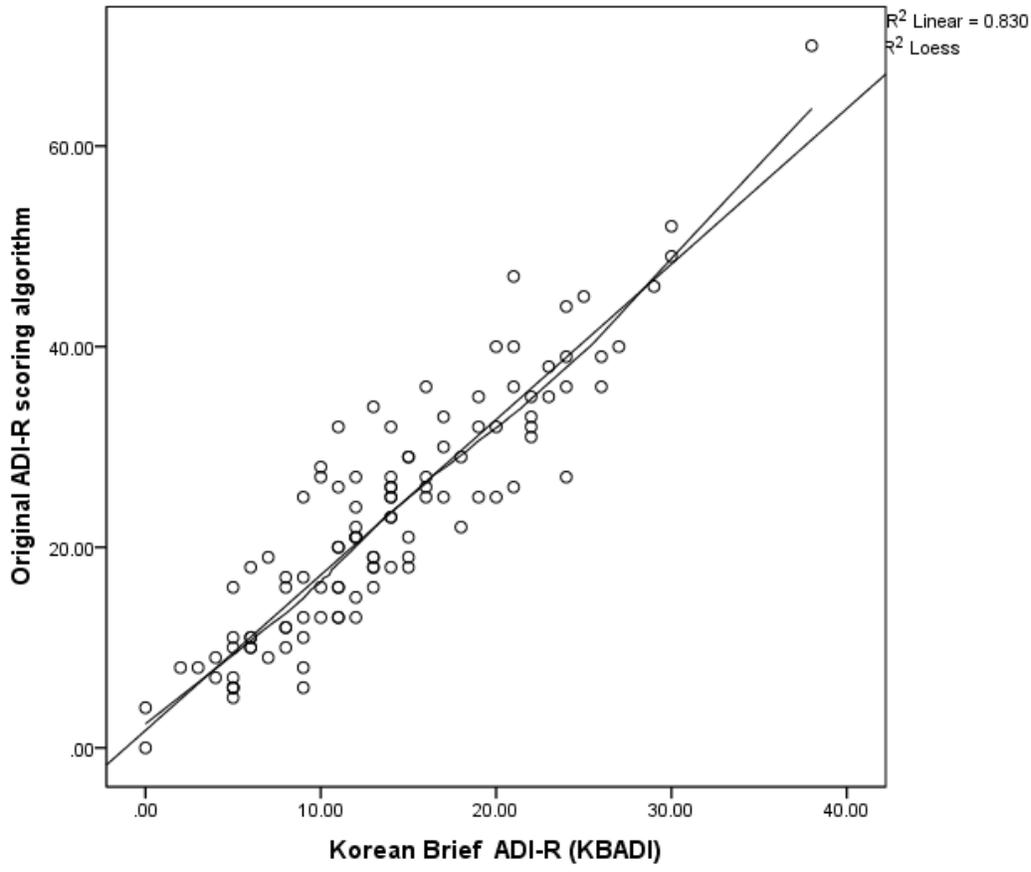
Research Question II. To what extent and what direction does the Korean

Brief ADI-R (KBADI) correlate with the Korean-translated ADI-R diagnostic

algorithm for Korean children ten years of age and older with fluent language?

Correlation analyses were used to examine the relationship between the

brief Korean ADI-R (KBADI) and the Korean-translated ADI-R diagnostic

algorithm for children ten and older with language. Correlation analyses revealed

the Korean brief ADI-R (KBADI) and the Korean-translated ADI-R scoring

algorithm for children ten years of age and older with fluent language are strongly correlated, $r(177) = .94, p < .001$. These results determine that the two measures are closely related to one another. Scatterplots were used to further examine the relationship between KBADI and the ADI-R algorithm for this particular age group. Graph 2 presents the scatterplot for both measures with Korean children ten years of age and older with fluent language. The scatterplot indicates that the assumption of linearity is reasonable. It shows that there is a positive association between the KBADI and the ADI-R algorithm for children ten years of age and older with fluent language. In other words, the KBADI and the Korean-translated ADI-R algorithm have a strong positive linear relationship for Korean children ten years of age and older with fluent language.

Graph 2.
Scatter Plot Group 2, Korean age 10 years and older with fluent language
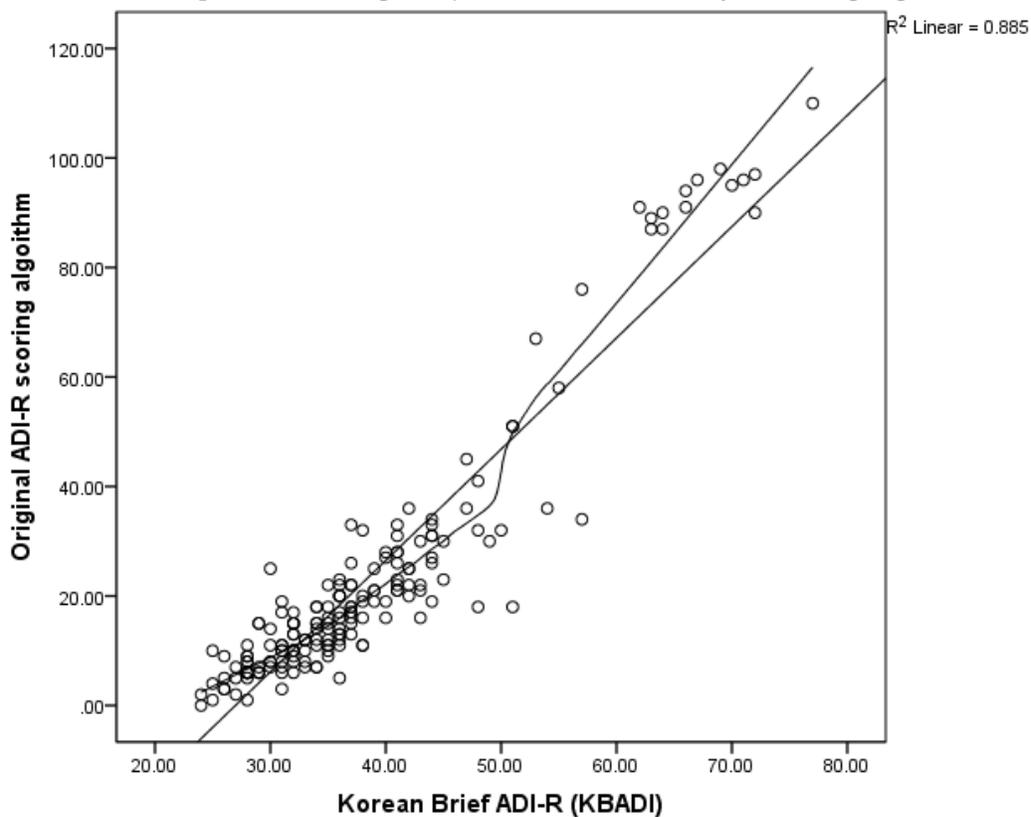
Hypothesis I. The brief Korean ADI-R predicts the diagnosis of autism in Korean children with accuracy at least comparable to that of the Korean-translated ADI-R diagnostic algorithm for children under the age of ten with fluent language.

A receiver operating characteristic (ROC) analysis examines a meaningful comparison of two diagnostic measures. In the case of this study, the ROC analysis will compare the KBADI and the Korean-translated ADI-R diagnostic

algorithm. The ROC analysis is used to evaluate the performance and accuracy of diagnostic tests (Zou, O'Malley, & Mauri, 2007). In order to create an ROC curve, the sensitivity versus 1 – specificity for cutoff points of the two scales are plotted (Zweig & Campbell, 1993). Sensitivity is the measure of true positive rate, so in this study children who have autism receive a diagnosis of autism (Zou, O'Malley, & Mauri, 2007). Whereas, specificity is the true negative rate or the rate of children who do not have autism not receiving a diagnosis of autism (Zou, O'Malley, & Mauri, 2007). The Y-axis represents sensitivity, and the X-axis represents 1 – specificity. An ideal ROC curve or perfect test would fall straight up the y-axis to the top and then move horizontally to the right, therefore the more the ROC curve is placed toward the upper-left hand corner, the better the sensitivity and specificity of the test (Steiner & Cairney, 2007). Once the curves are plotted a primary statistic of the ROC curve is the area under the curve (AUC). The AUC indicates the accuracy of the measure, with a perfect scale having an AUC = 1.0. So if the AUC was equal to 0.50, it would make a straight line that would indicate the measure was not accurately measuring autism versus non autism (Steiner & Cairney, 2007). When an AUC is between 0.50 -0.70, it is considered low, and between 0.70 and 0.90 is a moderate accuracy, and anything over 0.90 is high accuracy (Steiner & Cairney, 2007). Next, an optimal cut point is selected to minimize the amount of false positive and false negative errors (Steiner & Cairney, 2007). This cut off point can be shifted in order to have the measure include higher false positives than false negatives or vice versa.

Figure 2 displays the empirical ROC curves for the two measures, KBADI and the ADI-R algorithm, for Korean children under the age of ten with fluent language. From this figure, it appears that the KBADI predicts a diagnosis of autism with accuracy comparable to that of the Korean-translated ADI-R algorithm. The area under the curve is .79 with 95% confidence interval (.70, .88) for the Korean-translated ADI-R diagnostic algorithm. For the KBADI, the area under the curve is .82 with 95% confidence interval (.75, .90). Although the KBADI has a slightly better area under the curve, the AUC difference between the diagnostic algorithm and the KBADI is not statistically significant. These findings indicate that the 23-item KBADI is comparable to the 35-item ADI-R diagnostic algorithm in accurately identifying those who have and those do not have a diagnosis of autism. Thereby hypothesis 1 is supported.

Figure 2.
ROC Curve Group 1, Korean under 10 years of age with fluent language
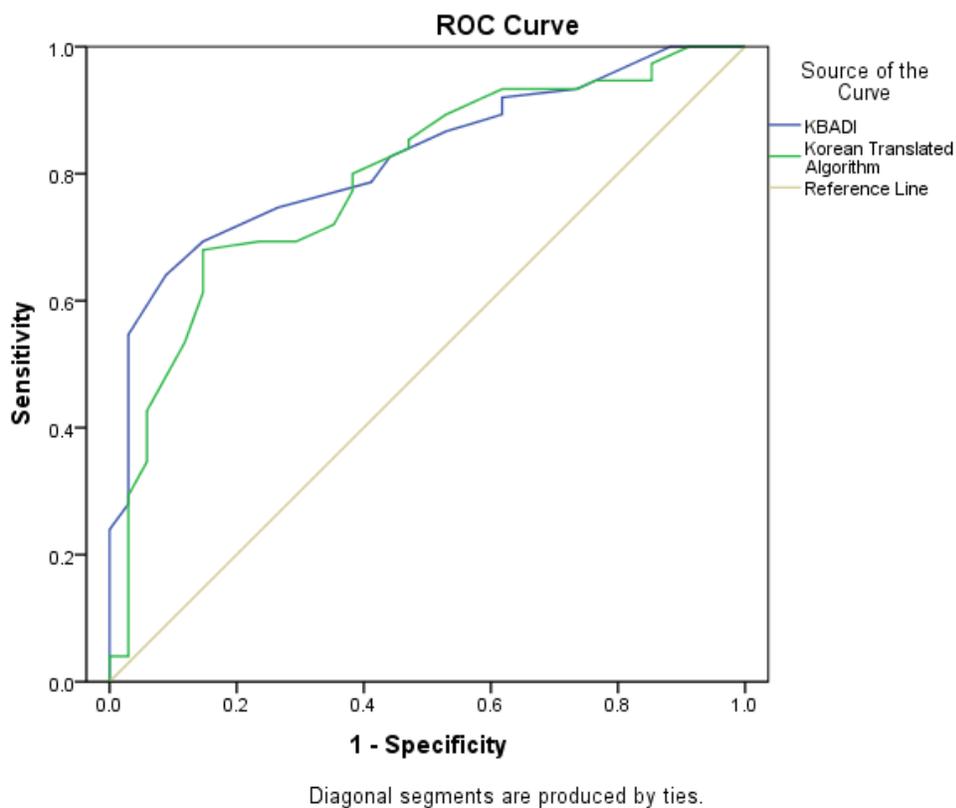
Diagonal segments are produced by ties.

Hypothesis II. The brief Korean ADI-R predicts the diagnosis of autism in Korean children with accuracy at least comparable to that of the Korean-translated ADI-R diagnostic algorithm for children ten years of age and older with fluent language.

Figure 3 displays the empirical ROC curves for the two measures, KBADI and the Korean-translated ADI-R algorithm, for Korean ten years of age and older with fluent language. From this figure, it appears that the KBADI predicts a

diagnosis of autism with accuracy comparable to that of the Korean-translated

ADI-R algorithm for this particular age group. The area under the curve is .84

with 95% confidence interval (.78, .91) for the Korean-translated ADI-R

diagnostic algorithm. For the KBADI, the area under the curve is .85 with 95%

confidence interval (.78, .91). Although the KBADI has a slightly greater area

under the curve, the difference is not statistically significant. The AUCs are very

close and indicate that they both are in the upper range of moderate accuracy in

predicting a diagnosis of autism for children ten years of age and older in a

Korean population.

Figure 3.
ROC Curve Group 2, Korean 10 years of age and older with fluent language
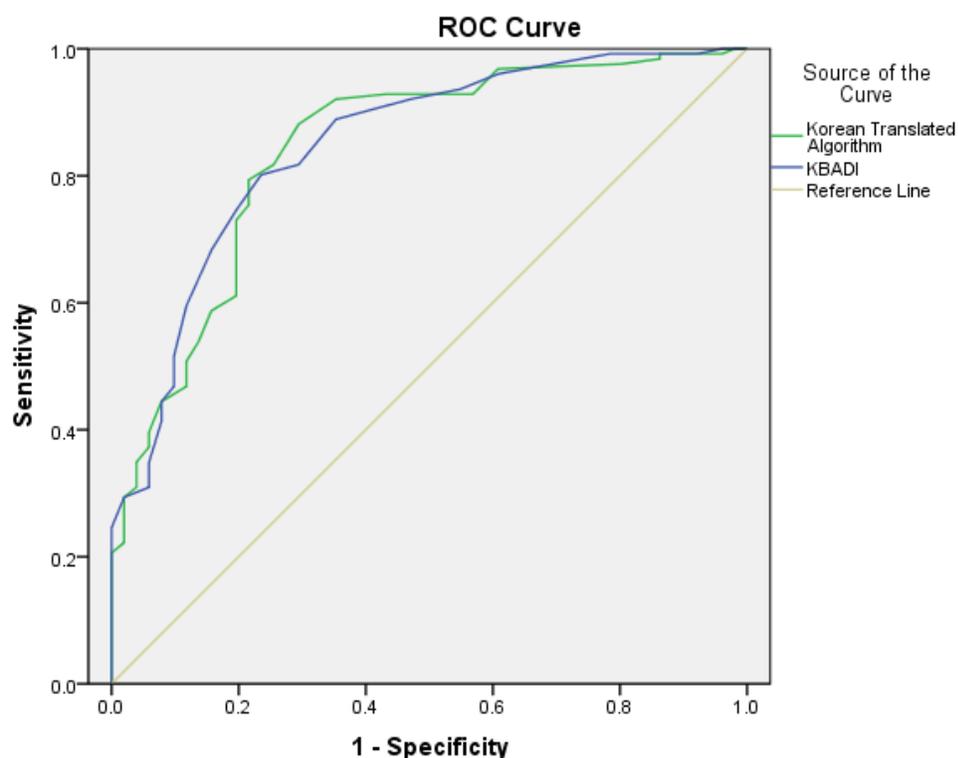
Diagonal segments are produced by ties.

Research Question III. What are the similarities and differences in the

subset of items from the Korean Brief ADI-R (KBADI) and the Korean-translated

ADI-R scoring diagnostic algorithm for Korean children under the age of ten with

fluent language?

In order to compare the similarities and differences in the items for the

KBADI and the Korean-translated ADI-R algorithm, the overall items were

examined. To develop the KBADI, the Rasch model was used, which places the

items in order of severity of autism symptoms. Another way to look at it is the

items toward the top of the measure have a stronger indication for autism as

opposed to the ones at the bottom of the list. In order to compare the KBADI and

the Korean-translated ADI-R algorithm, a Rasch model was applied to the

Korean-translated ADI-R algorithm. This Rasch model places all 35 items from

the Korean translated ADI-R algorithm for children under the age of ten with

verbal language in order based on the symptom indication for autism. Table 4

displays both the Korean Translated ADI-R algorithm for children under the age

of ten with language and the KBADI next to one another with the top items

indicating a higher level of autism severity and the lower items representing a less

severe form of autism. First, let us compare the first six items of both scales. For

the KBADI, five out of the first six items are not included in the Korean

Translated ADI-R scoring algorithm. These items include: overall level of

language, self-injury, comprehension of simple language, gait, and undue general

sensitivity to noise. These items seem to represent a general delay in

development with a slight focus on language. Two of the first six items relate to

language. The first six items in the Korean translated ADI-R algorithm emphasize stereotyped and repetitive behaviors such as movement and speech and rituals. These items include hand and finger mannerisms, neologisms/idiosyncratic language, verbal rituals, and other complex mannerisms or stereotyped body movements. Additionally, two of the six items highlight a lack of social emotional reciprocity (use of other's body to communicate and quality of social overtures).

Table 4.

Comparing the ADI-R Algorithm and KBADI for Korean children under the age of 10 with fluent language via Rasch Analysis (Severity of symptoms)

ADI-R Algorithm	Korean Brief ADI-R (KBADI)
1. Hand and finger mannerisms	1. Overall level of language*
2. Neologisms/idiosyncratic language	2. Hand and finger mannerisms
3. Verbal Rituals	3. Self-injury*
4. Other complex mannerisms or stereotyped body movements (does not include isolated rocking)	4. Comprehension of simple language*
5. Use of other's body to communicate	5. Gait*
6. Quality of social overtures	6. Undue general sensitivity to noise*
7. Pronominal reversals	7. Quality of social overtures
8. Compulsions and rituals	8. Range of facial expressions used to communicate
9. Repetitive use of objects or interest in parts of objects	9. Seeking to share his/her enjoyment with others
10. Social smiling	10. Social smiling
11. Range of facial expressions used to communicate	11. Offering comfort
12. Unusual preoccupations	12. Showing and directing attention
13. Response to approaches of other children	13. Unusual sensory interest
14. Showing and directing attention	14. Aggression toward caregivers or family members*
15. Stereotyped utterances and delayed echolalia	15. Conventional/Instrumental gestures
16. Seeking to share his/her enjoyment with others	16. Offering to share
17. Nodding	17. Circumscribed interests
18. Offering comfort	18. Current communicative speech*
19. Inappropriate facial expressions	19. Inappropriate questions or statements
20. Head shaking	20. Age when abnormality was first evident*
21. Unusual sensory interests	21. Response to approaches of other children
22. Conventional/instrumental gestures	22. Imitative social play
23. Imitative social play	23. Imaginative play with peers
24. Inappropriate questions or statements	
25. Appropriateness of social responses	
26. Pointing to express interest	
27. Offering to share	
28. Interest in children	
29. Social verbalization/chat	
30. Reciprocal conversation (within subject's level of language	
31. Circumscribed interests	
32. Imaginative play	
33. Group play with peers	
34. Spontaneous imitation of actions	
35. Imaginative play with peers	

*Items not part of ADI-R Korean-translated scoring algorithm

To further explore the similarities and differences across items, the KBADI and Korean translated algorithms items were placed into one of four domains. The first three domains are based on the sections in the ADI-R algorithm, which are established in the DSM-IV diagnostic criteria: qualitative abnormalities in reciprocal social interaction; qualitative abnormalities in communication; and restricted, repetitive, and stereotyped patterns of behavior. The final domain includes items from the KBADI that do not fit in other three categories.

Table 5 illustrates a comparison of items for qualitative abnormalities in reciprocal social interaction. The co-occurring items are presented first and the items that only show up on one measure or the other follow. Within the Korean translated ADI-R scoring algorithm, the social domain is divided into four parts: failure to use nonverbal behaviors to regulate social interaction; failure to develop peer relationships; lack of shared enjoyment and lack of socioemotional reciprocity. These four sections of the social interaction domain are based on the DSM-IV and ICD-10 autism criteria. Table 1 provides the list of items for all four sections of the social interaction domain in the Korean-translated ADI-R algorithm. The KBADI included nine out of the fourteen items with at least two items in each of the four categories from the Korean translated ADI-R algorithm. This pattern of representation in each of the four categories suggests that the KBADI has a range of reciprocal social interaction items comparable to that of the ADI-R scoring algorithm. The KBADI included nonverbal behaviors (social

smiling and range of facial expressions used to communicate), peer relationships

(imaginative play with peers & response to approaches of other children), shared

enjoyment (showing and directing attention, offering to share, seeking to share

enjoyment with others), and socioemotional reciprocity (offering comfort and the

use of other body to communicate). The remaining items from the Korean

translated ADI-R scoring algorithm that are from the following two sections:

failure to develop peer relationships (Interest in children and group play with

peers) and lack of socioemotional reciprocity (Use of other's body to

communicate, inappropriate facial expressions, and appropriateness of social

responses).

Table 5. *Qualitative Abnormalities in Reciprocal Social Interaction for Korean Children less than 10 years old, with language (First items listed are co-occurring items)*

ADI-R Algorithm	Korean Brief ADI-R (KBADI)
1. Social smile	1. Social smile
2. Range of facial expressions used to communicate	2. Range of facial expressions used to communicate
3. Imaginative play with peers	3. Imaginative play with peers
4. Response to approaches of other children	4. Response to approaches of other children
5. Showing and directing attention	5. Showing and directing attention
6. Offering to share	6. Offering to share
7. Seeking to share his/her enjoyment with others	7. Seeking to share his/her enjoyment with others
8. Offering comfort	8. Offering comfort
9. Quality of social overtures	9. Quality of social overtures
10. Inappropriate Facial Expressions	
11. Appropriate of Social Responses	
12. Interest in other children	
13. Group play with peers	
14. Use of other's body to	

communicate

Table 6 details the items for qualitative abnormalities in communication in both the KBADI and Korean-translated ADI-R algorithm. The co-occurring items are presented first and the items that only show up on one measure or the other follow. The communication domain for the ADI-R algorithm is divided into four categories: lack of, or delay in, spoken language and failure to compensate through gesture; lack of varied spontaneous make believe or social imitative play; relative failure to initiate or sustain conversational interchange; and stereotyped, repetitive, or idiosyncratic speech. As shown in table 4, only three items in the KBADI measure are the same as the Korean translated ADI-R diagnostic algorithm. The three items that are similar include: conventional/instrumental gestures, inappropriate questions, and imitative social play. Table 1 details all of the items in the communication domain of the Korean-translated ADI-R algorithm. The KBADI has one item from each category within the communication domain except for the relative failure to initiate or sustain conversational interchange. Additionally, three items were added to the communication KBADI category. These new items come from the Korean translated full ADI-R (93 items) and include: overall level of language, comprehension of simple language and current communicative speech. These new communication items from the KBADI do not fit into any of the preexisting communication domains. In general, the communication domain for the Korean translated ADIR algorithm is focused more on social communication in contrast to the KBADI, which has a stronger focus on communication.

Table 6.

Comparison of Qualitative Abnormalities in Communication for Korean Children less than 10 years old, with language (First items listed are co-occurring items)

ADI-R Algorithm	*Korean Brief ADI-R (KBADI)*
1. Conventional/instrumental gesture	1. Conventional/Instrumental gestures
2. Inappropriate questions or statements	2. Inappropriate questions or statements
3. Imitative social play	3. Imitative social play
4. Pointing to Express Interests	4. Overall level of language*
5. Nodding	5. Comprehension of simple language*
6. Head Shaking	6. Current communicative speech*
7. Spontaneous imitation of actions	
8. Imaginative play	
9. Social verbalization/chat	
10. Reciprocal Conversation (within subjects level of language	
11. Stereotyped utterances and delayed echolalia	
12. Pronominal reversal	
13. Neologisms/idiosyncratic language	

*Items not part of Korean-translated ADI-R scoring algorithm

Table 7 includes restricted, repetitive, and stereotyped patterns of behavior. In this ADI-R algorithm domain there are four categories, which include: encompassing preoccupation or circumscribed pattern of interest; apparently compulsive adherence to nonfunctional routines or rituals; stereotyped and repetitive motor mannerisms; and preoccupation with parts of objects or nonfunctional elements of material. The KBADI has three co-occurring items as the Korean translated ADI-R algorithm within this domain. The three similar

items in the KBADI and the Korean translated ADI-R came from three of the four

categories. The items from the ADI-R algorithm category are described in Table

1. There were no items from the following two ADI-R algorithm repetitive

behavior categories: apparently compulsive adherence to nonfunctional routines

or rituals category. Additionally, self-injury and aggression were added to the

KBADI repetitive behavior domain. Often self-injurious behavior is repetitive in

nature.

Table 7.
*Restricted, Repetitive, and Stereotyped Patterns of Behavior for Korean Children
less than 10 years old, with language as well as children 10 years of age and
older with fluent language (First items listed are co-occurring items)*

ADI-R Algorithm	*Korean Brief ADI-R (KBADI)*
1. <u>Hand and finger mannerisms</u> 2. <u>Unusual sensory interests</u> 3. <u>Circumscribed interests</u> 4. Unusual preoccupations 5. Verbal Rituals 6. Compulsions/rituals 7. Other complex mannerisms or stereotyped body movements (does not include isolated rocking) 8. Repetitive use of objects or interest in parts of objects	1. <u>Hand and finger mannerisms</u> 2. <u>Unusual sensory interests</u> 3. <u>Circumscribed interests</u> 4. Self-Injury*

*Items not part of Korean-translated ADI-R scoring algorithm

And finally, Table 8 represents the final four items of the KBADI that did

not fit into other domains. These items include: gait, undue sensitivity to noise,

age when abnormality was first evident, and aggression toward caregivers or

family members. Gait relates to how a person walks. Often individuals with

autism develop odd gaits, such as walking on toes. A common sensory issue for

individuals with autism is sensitivity to noise. Autism is considered a

developmental disability, so it is important to understand when certain

abnormalities were present in childhood. Often, individuals with autism can

become aggressive toward certain people in their life. The question in the Korean-

translated ADI-R asks about any type of aggression towards others. The question

does not ask about the possible reasons for aggression.

Table 8. *Other concerns for Korean Children less than 10 years old with language as well as 10 years of age and older.*

Korean Brief ADI-R (KBADI)

1. Gait*
2. Undue general sensitivity to noise*
3. Age when abnormality was first evident*
4. Aggression toward caregivers or family members*

*Items not part of Korean-translated ADI-R scoring algorithm

For this particular group, Korean children with fluent language under the age of

ten, the main differences in the KBADI and the Korean-translated ADI-R are

communication and repetitive and stereotyped behavior. The social interaction

items are fairly similar. However, Korean parents seem to focus more on the

linguistics of communication as opposed to social communication. Additionally,

there is not a focus on repetitive and stereotyped behaviors. The KBADI also

includes a few items that do not fit into the main categories of autism.

Research Question IV. What are the similarities and differences in the subset of items from the Korean Brief ADI-R (KBADI) and the Korean-translated ADI-R scoring diagnostic algorithm for Korean children ten years of age and older with fluent language?

The KBADI and the Korean translated ADI-R algorithm for children ages 10 and older with language were compared to identify any overall similarities and differences. Table 9 displays the comparison of both measures based on the Rasch model, which places the items in order based on the level of severity. The Korean translated ADI-R Algorithm for children 10 years of age and older with fluent language is very similar to the Korean translated ADI-R algorithm for children under ten years of age with language. There is a distinct pattern for both Korean translated ADI-R algorithms. Some of the items that pull for more severe symptoms of autism include restricted and repetitive behaviors. These items include both repetitive body movements like hand and finger mannerisms, other complex mannerisms or stereotyped body movements, and compulsions and rituals. Additionally the first few items also include some language difficulties like verbal rituals, use of other's body to communicate and pronominal reversal. On the opposite end of the Korean translated ADI-R algorithms includes more socialization and social communication skills like offering to share, friendship, social chat, and reciprocal conversation. The KBADI items also reflect a similar pattern similar that noted for the KBADI with those under 10 years old, however as explained before the first few items also include some general developmental delay difficulties and exclude most items about repetitive behavior.

Table 9. *Comparing the ADI-R Algorithm and KBADI for Korean children ten years of age and older with fluent language (Order of severity of symptoms)*

ADI-R Algorithm	Korean Brief ADI-R (KBADI)
1. Hand and finger mannerisms	1. Overall level of language*
2. Neologisms/idiosyncratic language	2. Hand and finger mannerisms
3. Verbal Rituals	3. Self-injury*
4. Other complex mannerisms or stereotyped body movements (does not include isolated rocking)	4. Comprehension of simple language*
5. Use of other's body to communicate	5. Gait*
6. Quality of social overtures	6. Undue general sensitivity to noise*
7. Pronominal reversals	7. Quality of social overtures
8. Compulsions and rituals	8. Range of facial expressions used to communicate
9. Repetitive use of objects or interest in parts of objects	9. Seeking to share his/her enjoyment with others
10. Social smiling	10. Social smiling
11. Range of facial expressions used to communicate	11. Offering comfort
12. Unusual preoccupations	12. Showing and directing attention
13. Showing and directing attention	13. Unusual sensory interest
14. Stereotyped utterances and delayed echolalia	14. Aggression toward caregivers or family members*
15. Seeking to share his/her enjoyment with others	15. Conventional/Instrumental gestures
16. Nodding	16. Offering to share
17. Offering comfort	17. Circumscribed interests
18. Inappropriate facial expressions	18. Current communicative speech*
19. Head shaking	19. Inappropriate questions or statements
20. Unusual sensory interests	20. Age when abnormality was first evident*
21. Conventional/instrumental gestures	21. Response to approaches of other children
22. Inappropriate questions or statements	22. Imitative social play
23. Appropriateness of social responses	23. Imaginative play with peers
24. Pointing to express interest	
25. Offering to share	
26. Friendship	
27. Social verbalization/chat	
28. Reciprocal conversation (within subject's level of language	
29. Circumscribed interests	

*Items not part of ADI-R Korean-translated scoring algorithm

To further explore the similarities and differences across items, the KBADI and the Korean-translated algorithm for children ten years of age and older items were compared using the three domains of the ADI-R algorithm. Like the previous research question, three of the four domains are sections from the ADI-R algorithm. The domains include: qualitative abnormalities in reciprocal social interaction; qualitative abnormalities in communication; restricted, repetitive, and stereotyped patterns of behavior; and other concerns. The items for each of these categories are provided in Table 3. The final domain includes items from the KBADI that do not fit in the other categories.

Table 10 displays a comparison of items for qualitative abnormalities in reciprocal social interaction for children ten years of age and older. Within the Korean translated ADI-R scoring algorithm for children ten years of age and older with fluent language, the social domain includes the same four sections: failure to use nonverbal behaviors to regulate social interaction; failure to develop peer relationships; lack of shared enjoyment and lack of socioemotional reciprocity. However, some items are not the same as the previous groups, children under ten years of age with language. In the failure to develop peer relationships section only includes one item, friendship. The Korean translated ADI-R scoring algorithm for children ten years of age and older includes a total of eleven items. This algorithm has seven similar items to the nine items from the KBADI. Unlike the previous comparison for younger children, when the KBADI is compared to the Korean-translated ADI-R social interaction for children ten years of age and

older, only three of the four domains are included. The three domains are: failure

to use nonverbal behaviors to regulate social interaction; lack of shared

enjoyment; and lack of socioemotional reciprocity. For children 10 and older, the

KBADI does not represent the failure to develop peer relationships because it

does not include the item friendships.

Table 10. *Qualitative Abnormalities in Reciprocal Social Interaction for Korean Children 10 years old and older with language*

ADI-R Algorithm	Korean Brief ADI-R (KBADI)
1. Social smile	1. Social smile
2. Range of facial expressions used to communicate	2. Range of facial expressions used to communicate
3. Showing and directing attention	3. Showing and directing attention
4. Offering to share	4. Offering to share
5. Seeking to share his/her enjoyment with others	5. Seeking to share his/her enjoyment with others
6. Offering comfort	6. Offering comfort
7. Quality of social overtures	7. Quality of social overtures
8. Friendship	8. Response to approaches of other children*
9. Inappropriate Facial Expressions	9. Imaginative play with peers*
10. Appropriate of Social Responses	
11. Use of other's body to communicate	

*KBADI items that are not part of the Korean-translated ADI-R algorithm for this age group

Table 11 illustrates the qualitative abnormalities in communication for

both the Korean translated ADI-R algorithm for children ten years of age and

older and the KBADI. For this age group communication domain is divided into

three categories: (1) lack of, or delay in, spoken language and failure to

compensate through gesture; (2) relative failure to initiate or sustain conversational interchange; and (3) stereotyped, repetitive, or idiosyncratic speech. The items for each of these communication categories are displayed in Table 3. Only two items in the KBADI measure are the same as the Korean translated ADI-R scoring algorithm. These items include: inappropriate statements or questions and conventional/instrumental gestures. The KBADI has one item from each category within the communication domain except for the relative failure to initiate or sustain conversational interchange. As stated before, three items were added to the communication KBADI category including overall level of language, comprehension of simple language and current communicative speech. This pattern of items suggests that the communication domain for the Korean translated ADI-R algorithm is focused more on social communication compared to the KBADI, which has a stronger focus on linguistic communication.

Table 11. *Comparison of Qualitative Abnormalities in Communication for Korean Children 10 years and older with fluent language*

ADI-R Algorithm	*Korean Brief ADI-R (KBADI)*
1. Conventional/instrumental gestures	1. Conventional/Instrumental gestures
2. Inappropriate questions or statements	2. Inappropriate questions or statements
3. Pointing to Express Interests	3. Imitative social play
4. Nodding	4. Overall level of language*
5. Head Shaking	5. Comprehension of simple language*
6. Social verbalization/chat	6. Current communicative speech*
7. Reciprocal Conversation (within subjects level of language	
8. Stereotyped utterances and delayed echolalia	
9. Pronominal reversal	
10. Neologisms/idiosyncratic language	

*Items not part of ADI-R Korean-translated scoring algorithm

The next two domains for the comparison of the Korean translated ADI-R scoring algorithm and then KBADI include restricted, repetitive, and stereotyped patterns of behavior and other concerns. The category "restricted, repetitive, and stereotyped patterns of behavior" includes all the same items for this group, Korean children ten years of age and older with fluent language. Therefore the results from the previous research question are the same. Also the category "other concerns" includes items from the KBADI that do not fit into one of the other ADI-R scoring algorithm sections. The results are the same from the previous research question.

CHAPTER IV

DISCUSSION

Results from this study indicate that a Korean Brief Autism Diagnostic

Interview (KBADI) can predict the diagnosis of autism spectrum disorders with

accuracy comparable to that of the Korean-translated Autism Diagnostic

Interview-Revised (ADI-R) diagnostic algorithms for two age groups. The current

study used a sample of Korean children from an autism epidemiology study in

South Korea. This sample included children between the ages of 7 – 14 with

verbal language. The Korean sample used for this study was then divided into

two groups based on age and language level. The first group included Korean

children under the age of ten with fluent language, and the second group was

Korean children ten years of age and older with fluent language. The criteria used

for the groups are based on the ADI-R diagnostic algorithm to allow for a detailed

comparison of the items included in the KBADI. The ADI-R diagnostic

algorithm is divided into three sections: qualitative abnormalities in reciprocal

social interaction; qualitative abnormalities in communication; and restricted,

repetitive, and stereotyped patterns of behavior. These three sections coincide

with the three main deficits of autism used to determine a diagnosis of autism

(American Psychiatric Association, 2000; World Health Organization, 2008). A

majority of the children in this study were recruited from general education

classrooms and were previously undiagnosed with autism spectrum disorders.

Many of the children from this study were not receiving services at school or from outside resources.

This study developed the KBADI, a brief measure derived from all 93 items of the Korean ADI-R. By using all 93 items from the ADI-R, the KBADI measures symptoms of autism from a larger pool of possible issues than would be feasible using only items that were part of the US-derived algorithms translated into Korean. This larger pool enables a broader range of selection options that is more likely to yield items selected for the KBADI that are both more relevant to Korean culture and play a significant role for the diagnosis and understanding of autism. The KBADI includes a total of 23 items that consist of a range of symptoms, which represent the diagnosis of autism. The Korean-translated ADI-R diagnostic algorithm includes a different number of items based on age and language ability. There is a total of 35 items for children under ten years of age and older with fluent language. For children ten years of age and older with fluent language there are 29 items in the algorithm. The KBADI was developed using both children with verbal and nonverbal skills as well as across age groups. To compare to the KBADI and the ADI-R diagnostic algorithm, only verbal children were used.

The KBADI measure is consistent with the criteria of autism; items include deficits in social development, communication, and repetitive/stereotyped behaviors and interests. Additionally, there are items in the KBADI that elicit other development concerns not used in the Korean translated ADI-R diagnostic algorithms for each age group. These other developmental concerns include the

following items: overall level of language, self-injury, comprehension of simple language, gait, and undue general sensitivity to noise. The inclusion of these other developmental concerns suggests that parents and/or caregivers believe these items play a significant role in regards to the diagnosis of autism spectrum disorders. Also these particular items are five out of the top six items within the KBADI that highly influence the diagnosis of autism (Table 1). Some of these developmental concerns are not part of the diagnosis criteria for autism according to the DSM-IV or ICD; however, when included in the brief measure (KBADI) accurately predict a diagnosis of autism spectrum disorder. The items that are not part of the formal diagnosis of ASD are self- injurious behavior, comprehension of simple language, gait, and sensitivity to noise. The overall level of language item could elicit some information regarding their level of communication and would therefore be part of the impairment communication criteria for autism

While these other developmental concerns highlighted by parents/caregivers in South Korea are not part of the diagnosis criteria of autism, many researchers understand the importance of these items in relation to diagnosing and understanding autism. In terms of communication, more often the focus is on expressive communication rather than the comprehension of language (Tager-Flusberg, Paul & Lord, 2005). The role of language comprehension is just as important and impacts the way in which an individual develops nonverbal social communication skills (Tager-Flusberg et al., 2005). In regards to the item that asks about the child's gait, some researchers suggest that motor development could play a key role in early bio-marker of autism (Ozonoff et al. 2007).

Additionally some of the initial concerns for parents include a delay in motor

development (Esposito, Venuti, Apicella & Muratori, 2011). The Korean

Translated ADI-R question regarding a child's gait specifically inquires about

walking on one's tiptoes, bouncing while walking, and any odd behaviors related

to walking. Self-injurious behavior is a common characteristic associated with

some individuals with autism spectrum disorder (Richards, Oliver, Nelson &

Moss, 2012). McClintock et al. (2003) determined that individuals with autism

were six times more likely to engage in self-injurious behavior than those without

autism. An additional characteristic of autism that is not part of the diagnostic

criteria is sensitivity to noise. Individuals with autism often exhibit clinical

features such as odd response to the environment and sensory issues (Filipek et

al., 1994). Individuals with autism display symptoms of discomfort or pain in

response to certain loud pitch noises or when there are many different sources of

noise (Kern et al., 2006). Although each of these four items (self- injurious

behavior, comprehension of simple language, gait, and sensitivity to noise) is not

part of the formal diagnostic criteria for autism, they play an important role in the

understanding of this complex disorder. This study determined the role of certain

symptoms that are typically described by clinicians and researchers as

characteristics of autism can contribute to the diagnosis of autism in this Korean

sample.

The entire KBADI measure includes four subscales: qualitative

abnormalities in reciprocal social interaction; qualitative abnormalities in

communication, restricted, repetitive, and stereotyped patterns of behavior; and

other concerns. When comparing each of these subscales to the Korean translated

ADI-R scoring algorithms, which include social interaction, communication and

restricted and repetitive behaviors, certain themes suggest some possible cultural

influence on the Korean understanding and recognition of autism. The KBADI

social interaction subscale includes nine similar items from the Korean translated

ADI-R. At this time, there are no specific themes that emerge from the

comparison of socialization items that speak to cultural differences between

Korea and the United States. However, the role of socialization in South Korea

and its similarity with and difference from socialization in the US could be

explored more carefully in future research.

When the KBADI communication subscale is compared to the Korean-

translated ADI-R diagnostic algorithm, only three items are the same. The

Korean-translated ADI-R algorithm has a total of 13 items that includes items

related to nonverbal social behavior, social play, conversational interexchange,

and stereotyped or repetitive speech. The items in this subscale try and

understand the role of communication grounded in socialization. The KBADI

communication items include: conventional/instrumental gestures; inappropriate

questions or statements, imitative social play, overall level of language,

comprehension of simple language and current communicative speech. The last

three items (overall level of language, comprehension of simple language and

current communicative speech) are part of the full Korean-translated ADI-R.

Based on the items within KBADI communication subscale, it is suggested that

South Korean parents are more concerned with linguistics in regard to

communication. For example, four of the six items within the KBADI that focus on communication relate to the rules of communication such as: inappropriate questions or statements, overall level of language, comprehension of simple language, and current communicative speech. Whereas the Korean translated ADI-R diagnostic algorithm includes a range of social communication questions such as pointing to express interest, nodding, head shaking, social chat, and reciprocal conversation. These items do not seem to be as important within the Korean culture. Parents in South Korea understand the communication difficulties in regards to linguistics rather than the complexity of social communication. In the United States, there is more emphasis on certain aspects of social communication such as nonverbal behaviors (Lord, Rutter, & Le Couteur 1994). There is a possible cultural reason for the lack of social communication within the communication subscale. Often, children in Korea are taught to respect their elders by avoiding certain social norms that children in the US use on a day-to-day basis. For example, children in South Korea are taught to respect their elders, including parents, family members, and even teachers, by not making eye contact (Grinker, 2007). Although eye contact is not one of the items this could possible explain how it may be rude to point, shake one's head while another person is speaking, or use other nonverbal gestures with elders. However, further research is needed in order to make a direct correlation between the lack of nonverbal social communication in the KBADI. While, social communication is still plays a significant role in the diagnosis of autism in South Korea, parent reporting of symptoms tends to not focus on that aspect of communication. When

the social communication items from the Korean translated ADI-R diagnostic algorithm are removed in the KBADI, this suggests possibilities for further exploration of cultural patterns.

When the KBADI items in the domain of restricted, repetitive, and stereotyped patterns of behavior are compared to items in the same domain in the Korean-translated ADI-R diagnostic algorithm, only three items are identical. These items include: hand and finger mannerism, unusual sensory interests, and circumscribed interest. These particular items focus on some repetitive behavior such as a repeated pattern of movement by the hands and or fingers. However, there are other ways that individuals with autism display repetitive behavior such as other repetitive and complex body movements or repetitive use of a particular object. The KBADI does not focus on all forms of repetitive behavior just the hand and finger mannerisms. Also the KBADI addresses the issues related to narrow and odd interests. A main aspect missing from the KBADI is the lack of rituals both verbal and compulsive. The lack of these items could possibly be explained culturally; however there is no evidence of an explanation at this time. It could be suggested that certain cultural rituals or religious rituals could explain the lack of parent understanding of compulsive and verbal rituals as they relate to autism. Also the lack of resources and knowledge about autism and the symptoms of autism could also play a role in the lack of certain symptoms such as compulsion. Further research into the role of rituals in the South Korean culture could help explain this gap in the restricted, repetitive, and stereotyped patterns of behavior subscale of the KBADI.

For this study, the KBADI was explored from the perspective of the autism diagnosis in the DSM-IV because the Korean-translated ADI-R algorithms are based on that classification. Using the DSM-V autism spectrum disorder classification, the KBADI lacks many of the social communication items. The KBADI emphasizes the linguistics of communication, whereas the DSM-V classification highlights social communication skills. Further research is needed to further explore the relationship of the KBADI to the DSM-V classification of autism spectrum disorders.

<u>Implications for Practice</u>

The most important implication for practice is the possible use of the KBADI in South Korea. The KBADI is a new measure to help clinician's diagnosis autism spectrum disorder. It is a briefer measure that clinicians and other professionals in South Korea can use in an interview format. The field of autism focuses on early intervention and identification for autism in order to allow for improvement in education, home and community settings (Filipek et al., 1999). The identification of children as soon as possible is important, however a large number of children go undiagnosed for years, as is the case in South Korea (Kim et al., 2011). An autism interview that accurately predicts the diagnosis of autism for school aged children is a helpful tool for clinicians in South Korea. Also this new measure gives clinicians an insight into important items within the measure like self-injury, comprehension of simple language, gait, and undue general sensitivity to noise.

Although the current format of the KBADI is a parent/caregiver interview by a trained clinician, the brief measure could be re-developed in the format of a parent/caregiver questionnaire to enable a range of professionals such as pediatricians, psychiatrists, psychologists, teachers and other professionals, to administer it. This questionnaire format would allow for people in a variety of settings across South Korea to complete it. Additionally, a questionnaire is easier for parents to complete independent of a clinician. This screening tool would include questions regarding the core deficits of autism as well as some characteristics of autism. A screening tool would be developed based on school-aged children with differing language abilities. Some of the screening tools developed for the younger population (Stone, McMahon, & Henerson, 2008; Filipek et al., 1999).

<div align="center">Implications for Research</div>

A main implication for research is the inclusion of culture when developing and applying autism assessments in other countries. Over the years, a number of measurements have been developed and used to help professionals identify autism (Ozonoff, 2004). Researchers are starting to compare certain autism measures across cultures (Wakabayashi et al., 2006; Wang et al., 2012). Often these cross-cultural studies are determining if the specific measure can be used across the world to help with the investigation of autism spectrum traits. This study sought to create a measure more based in the Korean culture than the existing ADI-r or its algorithms. It also aimed to understand the influence of culture on a measure of autism from within that particular culture. In order to gain

a better understanding on the role of culture and how parents, caregivers and professionals identify symptoms of autism, more studies needs to be completed within and across cultures. This study looked within one culture by using a measure that was American derived. This approach is more culturally sensitive than simply applying an American-derived measure translated in that particular language. When a measure is translated and accurately predicts the diagnosis of autism that does not necessarily mean that measure is the best option for that particular culture. By using a cultural lens, researchers and clinicians can gain a more insight in the way in which individuals, particularly parents or caregivers, understand autism and report its symptoms. Ultimately, this cultural understanding will enable clinicians to better diagnose and provide suitable treatment. The KBADI could further the support of research aimed at identifying and understanding the role of culture within autism.

<center>Strengths & Limitations</center>

A significant strength of this study is the development of an autism measure using the Rasch model. The Rasch model has played an important role in education, however psychologists are just starting to apply this method (Embretson & Reise, 2002). The sample used in this study included school aged children with a range of autism symptoms. Children varied across all three main deficits of autism including communication, socialization and repetitive and restricted behavior. The sample-included children identified as both fluent and non-fluent in language. However, the nonverbal group was significantly smaller

than the verbal children. For this reason, the nonverbal children were included during the development of the KBADI, however in order to compare the measure to the Korean-translated ADI-R diagnostic algorithms statistically, the nonverbal children were removed. This is one of the main limitations of the study. Another limitation of the study is way in which it explored the cultural influences of an autism measure that is filtered through American culture. A good way to understand more completely the nature of the cultural influence in South Korea is to replicate this study in another culture. In particular, future research could develop a brief ADI-R measure for the United States using item response theory and then compare items across cultures. This comparison would allow for better understanding of the cultural differences and similarities in the US and South Korea.

In conclusion, the development and comparison of the KBADI enabled the study to examine the possible influence of culture on an autism assessment. Some of the differences between the two measures suggested possible cultural influences, however no direct connections were made. Future research could examine these particular differences in South Korea in order to draw a more explicit relationship. The development of the KBADI lays the foundation for future research both in South Korea and around the world.

CHAPTER V

SUMMARY

Autism spectrum disorder is a developmental disability with three core deficits: communication, socialization and repetitive or stereotyped behaviors. Autism affects individuals around the world. In the United States, 1 in 88 children are identified on the autism spectrum disorder (CDC, 2008). The prevalence rate in South Korea is 1 in 39 children (Kim et al., 2011). Over the years, the prevalence rates of autism have increased due to better assessment tools and more resources for families. However, the assessment process for diagnosing autism can be very time consuming for professionals. Often, families are waiting an extended period of time to receive a formal assessment. For some other families, there are not clinics or other facilities to provide such assessments; therefore, individuals may go undiagnosed and not receive appropriate services. At its core, the symptoms of autism are thought to be the same across cultures; however, culture could play a role in the understanding of autism, which could affect the way in which individuals report symptoms of autism.

This study investigated the role of culture on an autism interview measure, developed in the United States, using a South Korean sample. Previous studies have simply applied measures across cultures by translating them into the other language. This current study developed a brief measure from a Korean-translated autism interview and used it to explore the way in which culture influences parent reporting of symptoms.

The Korean Brief Autism Diagnostic Interview (KBADI) was developed using item response theory, particularly the Rasch model (Bond & Fox, 2007). This statistical analysis is an appropriate method for diagnostic measures. Item response theory has been used to develop brief forms of diagnostic measures as well as with certain standardized testing, such as the GRE and SAT. The KBADI included 23 items that nicely represented the diagnostic criteria for autism. The KBADI accurately predicted the diagnosis of autism as compared to both of the Korean-translated ADI-R diagnostic algorithms for younger and older children. The KBADI is also 20 to 36% briefer than the two algorithms.

Overall, the KBADI has a number of strengths that suggest it could be a useable measure in South Korea. The first strength is that the KBADI has fewer items than either of the Korean-translated ADI-R algorithms. The KBADI includes certain autism characteristics that are not part of the Korean-translated ADI-R algorithms, but are often reported by parents. The KBADI is one interview that can be used for two age groups, including children between the ages of 7 – 14. There are some cultural links that suggest culture may influence the way in which a population may understand and report symptoms of autism.

Additionally, the items from the KBADI were compared to the Korean-translated ADI-R to examine any cultural themes or influences. The initial difference between the two measures was the inclusion of certain items in the KBADI that are not part of the diagnostic algorithm in the Korean-translated ADI-R. These particular items are not formally part of the diagnostic category,

however when included in the KBADI accurately predict a diagnosis of autism. While these items could not be explained by Korean culture, the inclusion of these items raises questions regarding the role of certain symptoms of autism that are not part of the diagnostic criteria. The two main subscales in the KBADI that elicit some possible cultural influence are the communication and repetitive/restricted behaviors. In regards to communication, the South Korean measure focused more on the linguistics of communication as opposed to social communication. And in regards to repetitive and restricted behavior, the South Korean measure excluded items that asked about compulsions. Although there is not a particular connection to culture, future research could look into these two domains of autism. The results of this study shed new light in understanding the role of culture on autism, particularly in South Korea. The development and comparison of the KBADI suggests that researchers need to continue to use a cultural lens when applying and developing autism assessments throughout the world.

After this study was completed, the principal investor informed researchers that there was a change in the data. The author is seeking an accurate, updated data set. If and when obtained, the author will re-run the analysis for the development of a manuscript.

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