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## Validation of the ASK-ASD in a Sample of Parents, Teachers, and Medical Students

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VALIDATION OF THE ASK-ASD IN  
A SAMPLE OF PARENTS, TEACHERS, AND MEDICAL STUDENTS

by

Laura K. Hansen

A Dissertation  
Submitted to the Graduate School,  
the College of Education and Human Sciences  
and the School of Psychology  
at The University of Southern Mississippi  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy

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## ABSTRACT

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that begins in childhood and manifests in social communication impairment and restricted, repetitive behaviors (American Psychiatric Association, 2013). Although accurate information about ASD is available through a variety of sources, this access to information may not translate into increased knowledge in parents, teachers, and medical professionals. A Survey of Knowledge of Autism Spectrum Disorder (ASK-ASD) was initially established as a reliable, valid measure of perceived and actual knowledge of ASD (Hansen, 2015). The current study evaluated the psychometric properties (i.e., factor structure, reliability, and validity) of the ASK-ASD in a sample of parents, teachers, and medical students. The two-factor structure was not well-supported by a confirmatory factor analysis. Additionally, the ASK-ASD received mixed support for reliability and validity. Analyses of differences between actual knowledge levels among the three groups revealed no significant differences, suggesting the parents, teachers, and medical students had relatively similar levels of actual ASD knowledge. Exploratory analyses also examined the relation between ASD knowledge and various demographic characteristics (e.g., race, income level, relationship status) as well as group-specific factors (parenting efficacy, teacher efficacy, and characteristics of the imposter phenomenon). Limitations of the study included difficulties recruiting equal groups, as well as the online method of data collection.

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Finally, I want to express my gratitude to those without whom this dissertation could not have been completed – the school districts, parenting organizations, medical schools, and residency programs who shared my request for data with their constituents and the parents, teachers, medical students, and residents who completed the survey.

## DEDICATION

This dissertation is dedicated my parents, David and Patricia Hansen, for their unfailing love and support, and to my patients and their caregivers, who inspired me with the idea in the first place.

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## CHAPTER I - INTRODUCTION

Mental health literacy (MHL) refers to knowledge and attitudes regarding mental health concerns. According to the original definition put forth by Jorm and colleagues (1997), MHL includes components such as recognition of symptoms of specific disorders (e.g., anxiety, depression), knowledge of risk factors and etiology of those disorders, and attitudes regarding stigma and help-seeking behaviors. Several studies have reported the development of general measures of mental health literacy (see O'Connor, Casey, & Clough, 2014 for review). Furthermore, several questionnaires have been developed to ascertain literacy for specific mental health concerns (e.g., depression, anxiety, suicide).

One disorder notably absent from the MHL literature is autism spectrum disorder (ASD), a neurodevelopmental disorder that is characterized by social communication impairment and restricted, repetitive behaviors that manifests in childhood (American Psychiatric Association, 2013). ASD previously consisted of subcategories of an overarching disorder (APA, 2000), but it is now classified as a unitary disorder that manifests in a variety of clinical presentations that are classified by different levels of symptom severity (APA, 2013). According to the Centers for Disease Control and Prevention (CDC), ASD affects approximately 1 in 59 children and can be reliably diagnosed as early as age 2 years (Baio et al., 2018).

Although there are a variety of sources that disseminate accurate information about ASD (e.g., National Institute of Mental Health, CDC, peer-reviewed scientific journals), this information does not always translate into application by parents, teachers, and medical professionals. For example, though ASD can be diagnosed as early as age 2, most children are not diagnosed until age 4, and some children are not diagnosed until

they begin attending school (CDC, 2012; Ruble & Gallagher, 2004). One study found a positive correlation between the age at which parents noticed impairments and the age at which the child is assessed, suggesting that awareness of warning signs may facilitate a timelier diagnosis (Kozlowski, Matson, Horovitz, Worley, & Neal, 2011). The proliferation of information about ASD, some of which is not accurate or supported by research, may also lead to unfounded hope in unverified or controversial treatments and information. For example, websites providing information about ASD often contain advertisements and information regarding treatments and interventions that are not evidence-based, thus making it difficult for caregivers and teachers to determine which treatments and support strategies are scientifically valid (Ruble & Gallagher, 2004).

Early recognition and intervention for a variety of mental health concerns can improve long-term outcomes and prognoses (Bartlett, Travers, Cartwright, & Smith, 2006). Given the established efficacy of early interventions for ASD in minimizing impairment and improving the quality of life of children with ASD and their families, (Klinger, Dawson, Barnes, & Crisler, 2014), it is vital that caregivers, teachers, and medical professionals are aware of the symptoms as well as the best ways to have children assessed. A measure, A Survey of Knowledge of Autism Spectrum Disorder (ASK-ASD), was recently developed to fill a perceived gap in the literature concerning comprehensive tools to evaluate actual and perceived knowledge of ASD. Initial estimates indicate that this measure provides a reliable, valid evaluation of knowledge among undergraduate students. However, it will be useful to further evaluate the ASK-ASD as a knowledge measure to promote its more widespread use in the mental health

literacy literature. Additionally, the ASK-ASD can be used with a variety of groups to identify gaps in knowledge that can be targeted by educational interventions.

The purpose of the current study was to evaluate the ASK-ASD across samples of parents, teachers, and medical professionals to further evaluate the psychometric properties of the measure as well as to examine the discrepancies in knowledge among these groups.

### Mental Health Literacy

Although few studies have investigated knowledge of ASD, there is an abundance of research on knowledge of other psychological disorders. The term “mental health literacy” (Jorm et al., 1997) refers to both the knowledge and attitudes about mental disorders that can help individuals recognize, manage, or prevent these disorders. Mental health literacy can apply to different specific disorders (e.g., major depressive disorder, schizophrenia), categories of disorders (e.g., anxiety), or can be comprised of general knowledge of mental illness. Whereas research has shown an increase in mental health literacy following large-scale initiatives (e.g., Jorm, Christensen, & Griffiths, 2005), many studies on mental health literacy have revealed an overall low level of knowledge of mental health in community samples (e.g., Bartlett et al., 2006; Jorm et al., 2005).

A number of researchers have examined knowledge of attention-deficit/hyperactivity disorder (ADHD), a psychological disorder in the same diagnostic category as ASD (i.e., neurodevelopmental disorders) that also manifests in childhood (APA, 2013). In particular, there have been a variety of studies that have examined knowledge of ADHD in samples of teachers and others in the academic realm (e.g., Ohan, Cormier, Hepp, Visser, & Strain, 2008). It is particularly important for educators

to have adequate knowledge of ADHD so that they can effectively handle the unique academic, social, and emotional challenges that these students may encounter (Ohan et al., 2008). Furthermore, teachers, particularly those working with younger children, are in an advantageous position to notice potential symptoms of ADHD in their students (Soroa, Gorostiaga, & Balluerka, 2013) and recommend them for assessment. A review of literature concerning teachers' knowledge of ADHD found that teachers appear to have higher knowledge regarding ADHD symptoms and diagnosis compared to their knowledge about treatment of ADHD.

Like ADHD, ASD is a neurodevelopmental disorder that manifests in childhood. Disparities in ASD knowledge have been the target of national awareness efforts, and the assessment of ASD knowledge has been a rapidly progressing field of study (see Harrison, Slane, Hoang, & Campbell, 2016 for a review). Whereas many studies have examined ASD knowledge in various samples, Harrison et al.'s (2016) recent review revealed that over half of the published studies examining this construct used a newly created measure. This abundance of study-specific measures makes it difficult to compare across studies and samples. Thus, there appears to be a need for a psychometrically sound measure of ASD literacy that represents the current diagnostic criteria and prevalence rates for the disorder and that can be utilized across samples and cultures (Harrison et al., 2016).

### *Knowledge of ASD*

Given the increasing prevalence of ASD (Baio et al., 2018), it is imperative that caregivers, educators, and medical professionals have a thorough understanding of the symptoms, causes, risk factors, and treatments of ASD. Although research has examined

ASD knowledge in different samples, there appears to be little agreement regarding the most effective way to assess knowledge (Harrison et al., 2016). One of the most widely used assessments of ASD knowledge is the Autism Survey (Stone, 1987), which was the first known measure to examine beliefs and understanding of the components of ASD—including the etiology, diagnosis, and associated features. The Autism Survey was developed in an effort to explore cross-disciplinary knowledge and beliefs regarding ASD (Stone, 1987). Overall, the Autism Survey consists of items from three broad categories: social emotional features, cognitive features, and general descriptive features; however, these categories were derived theoretically and not through statistical analyses (Campbell, Reichle, & Bourgondien, 1996). The measure is divided into two parts. Part I consists of 21 statements (including common misconceptions of ASD) with which respondents indicate how much they agree on a Likert scale ranging from 1 (fully agree) to 6 (fully disagree). Because these questions reflect opinions, rather than absolutes, Stone compared all respondents to a group of autism specialists (defined as individuals who had engaged in clinical work or research in the field of ASD for five years or more). Part II includes a list 18 behaviors and characteristics of ASD that respondents rate as either required or helpful for an ASD diagnosis.

In her original studies, Stone did not investigate the psychometric properties (e.g., validity, reliability) of the Autism Survey. In 1996, Campbell and colleagues investigated the statistical properties of the Autism Survey in a sample of individuals who work in the field of autism, including teachers, direct-care staff, researchers, and other professionals (e.g., speech therapists, psychologists). In the Campbell et al. study, the total scale of the Autism Survey was found to be adequately internally consistent ( $\alpha = .66$ ). However, only

16 of the 21 items on part I of the survey displayed acceptable item-total correlations of .3 or higher (Campbell et al., 1996; Nunnally, 1978). Campbell et al. recommended the deletion of three of the “rogue” items (i.e., items with item-total correlations less than .30), which improved internal consistency ( $\alpha = .74$ ). The researchers also found that only one of the conceptual groupings used by Stone (i.e., social-emotional features) was confirmed as a factor; the other two conceptual groupings (i.e., cognitive features and general descriptive features) were not well supported as factors. Thus, Campbell and colleagues argued that the Autism Survey appears best suited to measure a unidimensional variable (i.e., knowledge and beliefs about ASD).

Whereas the Autism Survey has been widely used since it was developed, particularly in the United States, it does have some weaknesses (Harrison et al., 2016). Since its creation in 1987, it has been revised multiple times to reflect updated information about ASD, as well as modified diagnostic criteria. However, these later versions have largely been study-specific (rather than a general updated version), and the psychometric properties have not been well-established. Further, few cross-cultural studies have utilized the Autism Survey (Harrison et al., 2016).

*Knowledge of ASD among parents.* It is crucially important that parents have an accurate conception of the symptoms, causes, and correlates of ASD for a variety of reasons. For instance, parents’ misconceptions about the etiology of ASD may lead to feelings of guilt or uncertainty regarding the appropriate treatment for the disorder (Stone & Rosenbaum, 1988). These misconceptions may have potentially dangerous consequences. For example, after the publication of the Wakefield et al. (1998) article linking ASD to the measles, mumps, and rubella (MMR) vaccine, parents of children

with ASD were more likely to attribute regression in skills to vaccination, in spite of evidence against this link (Lingam et al., 2003). This finding indicates that even given scientific evidence to the contrary, parents may maintain incorrect beliefs regarding ASD. Additionally, an increased awareness of early warning signs of ASD, such as behavioral symptoms and developmental markers, may facilitate timelier diagnosis of the disorder (Harrison et al., 2016).

One study compared samples of parents, teachers, and ASD specialists to assess differences in knowledge and understanding of ASD using the Autism Survey (Stone & Rosenbaum, 1988). This study revealed that parents had a variety of misconceptions regarding ASD; for example, parents were less likely to accept that children with autism are intellectually disabled and were more likely to believe that ASD is a childhood disorder that children will outgrow (Stone & Rosenbaum, 1988).

Another study examined the relation between maternal knowledge of ASD and other parenting factors (e.g., self-efficacy, perceived competence; Kuhn & Carter, 2006). To evaluate ASD knowledge in this sample, the researchers created the Autism Knowledge Questionnaire (AKQ), which consisted of 43 true or false items that examined areas such as diagnosis, symptoms, and treatment. In this sample, the researchers found a positive correlation between ASD knowledge and time since diagnosis, suggesting that parents may seek out knowledge about ASD to cope with the challenges of parenting (Kuhn and Carter, 2006). This study also found a positive correlation between ASD knowledge and maternal agency (i.e., maternal engagement in activities to advance their child's development), indicating that mothers with higher knowledge may have been more likely to actively promote their child's development or

that more agentic mothers sought out more information. However, it should be noted that the AKQ demonstrated a ceiling effect in this sample, resulting in a restricted range of scores (Kuhn & Carter, 2006).

An updated version of AKQ was used again in a more recent study that examined cultural differences in knowledge of ASD in a sample of White and Latina mothers of children with an ASD (Ratto, Reznick, & Turner-Brown, 2015). In this study, Latina mothers had significantly less knowledge of ASD, even when controlling for level of education. Further analyses revealed that higher ASD knowledge was associated with decreased time between the child's age when concerns about development were raised and the child's age at the time an ASD diagnosis was received. Thus, this study provides support for the notion that increased knowledge of ASD may help parents better understand when to seek out additional assessment after concerning behaviors or delays are observed. Additionally, these results suggest that there may be cultural differences among parents with regard to ASD knowledge, at least among those who have children with the disorder (Ratto et al., 2015).

Overall, a limited number of studies have examined parental knowledge regarding ASD. Furthermore, the limited literature exploring this construct has apparently focused exclusively on parents of children with ASD (Harrison et al., 2016). Although parents of children with ASD may seek out additional information and knowledge about the disorder after their children are diagnosed, it would be helpful to determine knowledge possessed by a general sample of parents. This information may inform interventions for increasing ASD knowledge and reducing stigma within that group.

*Knowledge of ASD among teachers and educators.* Like parents, those in the academic field, particularly teachers, are in close contact with children in the context in which the symptoms of ASD often become apparent (e.g., peer contact, environmental transitions; Helps, Newsom-Davis, & Callias, 1999). Thus, it is also particularly important that teachers and other individuals in the field of education have an accurate view of ASD, particularly the behavioral features of the disorder.

Teachers' knowledge of ASD has been explored using a variety of measures and samples. As discussed above, one of the first studies of this topic utilized the Autism Survey (Stone, 1987) to compare ASD knowledge among samples of teachers, autism specialists, and parents of individuals with ASD (Stone & Rosenbaum, 1988). In this study, both parents and teachers (compared to ASD specialists) tended to view children with ASD as less cognitively impaired and more intelligent than is evident in the literature. Furthermore, teachers in this study had difficulty distinguishing between childhood-onset schizophrenia and ASD. However, teachers were more likely than parents to acknowledge that ASD is a lifelong disorder, thus revealing somewhat higher knowledge among teachers versus parents regarding certain aspects of the disorder.

In a more recent study, Bain and colleagues (2009) examined teacher candidates' knowledge of interventions for several disorders (e.g., ASD, ADHD, dyslexia), at different timepoints in their teacher education. In this study, participants were asked to evaluate their belief in the efficacy of interventions, each of which was classified by the researchers as either evidence-based, controversial, or anecdotal. They found that teacher candidates were about as likely to endorse controversial treatments as they were to endorse evidence-based treatments across all of the interventions that were evaluated.

The only evidence-based treatment for ASD that was included in this study was picture exchange. Although the vast majority (89%) of the participants believed that picture exchange would work, less than half (39%) had heard of this intervention before participating in this study. Furthermore, anecdotal and controversial interventions were supported by a notably high percentage of teacher candidates. For example, 32% believed that avoiding the measles/mumps/rubella (MMR) vaccine would work as an intervention for ASD. In general, this study found that participants were likely to endorse interventions that were “scientific-sounding,” seemed logical, or had overgeneralized findings (e.g., gluten-free diets), despite the suitability of interventions to the disorder in question.

Overall, whereas teachers appear to have somewhat more knowledge than parents regarding ASD, they do have some gaps in knowledge. For example, teachers appear to frequently overestimate the cognitive capacity of children with ASD (e.g., Helps et al., 1999; Stone & Rosenbaum, 1988), despite studies that have found as high as 55% of school-aged children with ASD have a comorbid intellectual disability (Charman, Pickles, Simonoff, & Chandler, 2010). Additionally, teachers seem to have low knowledge of effective ASD treatments (Bain et al., 2009; Williams et al., 2011).

*Knowledge of ASD among medical professionals.* In her measure development study, Stone (1987) used the Autism Survey to evaluate knowledge among pediatricians, clinical psychologists, school psychologists, speech-language pathologists (SLPs), and autism specialists. In this study, autism specialists (defined as researchers and clinicians with at least five years of experience in the autism field) were more likely to recognize that ASD is not an emotional disorder and were better able to differentiate between ASD

and childhood-onset schizophrenia. Furthermore, all other professionals were more likely to believe that children with ASD are not affectionate and do not show any social attachments. Pediatricians, school psychologists, and SLPs were also more likely to endorse incorrect beliefs, such as thinking that children with ASD possess “special talents.” Pediatricians were more likely to endorse the incorrect statement that most children with ASD do not speak (Stone, 1987). However, it should be noted that this study was published over 30 years ago and may not reflect the current status of ASD literacy possessed by pediatricians.

Another study investigated knowledge and attitudes of ASD possessed by three samples: medical professionals likely to work with individuals with ASD (i.e., psychologists, psychiatrists, and SLPs), primary care practitioners (i.e., pediatricians, neurologists, and family practitioners), and a group of professionals who worked at a center for ASD research and treatment (Heidgerken, Geffken, Modi, & Frakey, 2005). In this study, ASD knowledge was measured using the Autism Survey (Stone, 1987), which was updated to reflect criteria from the DSM-IV (APA, 1994). The researchers found all three groups (medical professionals, primary care practitioners, and ASD experts) had comparable knowledge of the diagnostic criteria for ASD, specifically the changes in DSM-IV criteria compared to the DSM-III criteria. However, compared to ASD specialists, primary care practitioners and medical professionals were more likely to maintain incorrect beliefs regarding certain components of ASD. For example, non-ASD experts were less likely to believe that children with ASD share social attachments or affectionate behaviors with their caregivers and peers. Additionally, primary care practitioners and medical professionals endorsed the false notion that ASD is more

prevalent in families of a higher socioeconomic status (Heidgerken et al., 2005). This study suggests that there are still many false beliefs held by individuals in different spheres of the medical field regarding ASD, particularly those who do not frequently work directly with individuals with ASD.

Cascella and Colella (2004) assessed self-ratings of ASD knowledge in a sample of school-based SLPs. In this study, researchers created a measure of perceived knowledge that consisted of 53 statements: 28 general knowledge statements related to ASD and 25 statements specifically related to communication disorders associated with ASD. These statements were reviewed by five other SLPs, as well as two professors in this field, who evaluated each statement for inclusion. For each item, participants rated their perceived knowledge on a four-point Likert scale from minimally knowledgeable to very knowledgeable. Over 75% of the respondents had at least four years of experience working with children with ASD, and over one-third had 10 years or more experience working with children with ASD. Overall, SLPs did not perceive themselves to be very knowledgeable about any of the ASD-related statements, despite having extensive hands-on experience with individuals with ASD. Whereas participants rated themselves as knowledgeable or somewhat knowledgeable for all 28 general ASD items, their ratings for the ASD communication disorders statements ranged from minimally knowledgeable to knowledgeable. However, this study did not examine actual knowledge possessed by SLPs; thus, it is not possible to determine the accuracy of the self-ratings of knowledge endorsed by the participants.

In general, studies of knowledge of ASD among medical professionals have revealed that medical professionals may have adequate knowledge of the disorder. On the

other hand, medical professionals may also persist in holding incorrect beliefs regarding certain aspects of ASD. It would be helpful to have a single measure that is used across samples to better compare knowledge possessed by individuals in different spheres of the medical field. Furthermore, assessing both actual and perceived knowledge in the same sample may inform ways to increase knowledge and decrease false beliefs in this population.

### Perceived and Actual Knowledge

Previous literature indicates that there is often (but not always) a discrepancy between an individual's self-assessment of knowledge and that person's actual knowledge (Park, Gardner, & Thukral, 1988). Assessment of actual and perceived knowledge most often overlap when an individual has no knowledge of a given domain and when an individual has extensive knowledge or expertise in the subject. Thus, the greatest discrepancy between a person's perceived knowledge and actual knowledge may be seen when the person has acquired a limited amount of information but has not obtained an advanced level of knowledge (Park et al., 1988).

### *Actual versus Perceived Knowledge in Other Domains*

Perceived or self-assessed knowledge has been examined in specific samples and occupations. For example, Jansen and colleagues (1995) examined the relation between a performance-based assessment of skills, a written assessment of actual knowledge, and self-assessed perceived knowledge in a sample of general practitioners and trainees. In this study, perceived knowledge was moderately positively correlated with both performance-based knowledge and actual knowledge. The authors of this study concluded that general practitioners are able to generally assess their knowledge and

proficiency in clinical skills. In contrast, Tracey and colleagues (1997) found uniformly low, non-significant correlations between self-assessed knowledge and actual knowledge across all the medical topics that were examined (i.e., diabetes, sexually transmitted diseases, and thyroid diseases). These researchers also examined associations between actual and perceived knowledge of thyroid disease and a variety of demographic variables (e.g., gender, age) and found no significant relations.

Furthermore, the discrepancy between perceived and actual knowledge has been examined for a limited number of diseases in specific samples of the general population. One study evaluated correlations between perceived and actual knowledge of prostate cancer among African-American men (Agho & Lewis, 2001). Researchers found that actual and perceived knowledge of prostate cancer were moderately correlated, and both were significantly related to having health insurance coverage. However, there was a negative relation between certain demographic variables (i.e., lower income levels, younger age, and rural residence) and both perceived and actual knowledge (Agho & Lewis, 2001).

A recent large-scale study examined patients' perceptions of how informed they were about decisions for medications, cancer screening, and elective surgeries (Sepucha et al., 2016). Whereas participants in this study rated themselves as very well-informed about all three procedures, their scores on factual questions about these procedures revealed disparities in their understanding of the harms and benefits involved. Furthermore, participants who self-reported lower education and socioeconomic status were found to be less likely to perceive their deficits in knowledge. Overall, this study revealed that participants' perceptions of being informed were not a reliable assessment

of their actual knowledge of different medical procedures (Sepucha et al., 2016). The results of the study by Sepucha and colleagues, as well as other studies, suggest that it may be valuable to consider actual knowledge in the context of perceived knowledge, as this discrepancy may provide insight into whether or not an individual's behaviors will be impacted by his or her level of knowledge.

Overall, the literature suggests that perceived knowledge and actual knowledge regarding medical disorders among both specific demographic samples and among professionals with more access to relevant knowledge are often moderately related at best and that each should be considered to fully understand the context of individuals' knowledge of such disorders.

#### *Actual versus Perceived Knowledge of ASD*

The discrepancy between perceived and actual knowledge specific to ASD has been examined in a limited capacity, primarily in the educational field (Williams, Schroeder, Carvalho, & Cervantes, 2011). Using measures created specifically for their study, Williams and colleagues examined perceived and actual knowledge of school personnel, which included general education teachers, special education teachers, school counselors, and paraprofessionals. Actual knowledge was assessed using 15 open-ended items that fell into one of three categories: definitions, assessment/diagnosis, and treatment. Perceived knowledge was evaluated using 12 items (e.g., "I am knowledgeable about autism") that participants rated on Likert scales ranging from 1-Strongly Disagree to 5-Strongly Agree. Overall, school personnel rated their actual knowledge of ASD in the average range. School personnel who worked directly with students with ASD rated themselves as significantly more knowledgeable compared to school personnel who did

not work with students with ASD. However, this discrepancy was not reflected in actual knowledge, suggesting that direct contact with students with ASD increases perceived knowledge, but not necessarily actual knowledge (Williams et al., 2011).

Hansen (2015) investigated the relation between perceived and actual knowledge of ASD using A Survey of Knowledge of Autism Spectrum Disorder (ASK-ASD), which was created specifically to assess these constructs. A sample of undergraduate students accurately identified statements about the etiology, prognosis/treatment, epidemiology, diagnosis, and symptoms of ASD as true or false 72% of the time overall. Specifically, participants responded correctly to items on a subscale assessing prognosis and risk factors for ASD about 66% of the time, and they responded correctly to items on a subscale assessing general characteristics of ASD about 73% of the time. For each item, participants rated their level of confidence in their response on a 3-point Likert scale from 1-*Not at all confident* to 3-*Very Confident*. Overall, participants were moderately confident in their responses across all items ( $M = 1.78$ ), and there was a significant correlation between ratings of perceived and actual knowledge. Thus, the participants in this study were able to estimate their actual levels of ASD knowledge somewhat accurately. Although significant, the modest correlation ( $r = .21$ ) between actual and perceived knowledge indicated that a sizable discrepancy in perceived and actual knowledge (i.e., either under-reporting or over-reporting knowledge) exists. Thus, future studies investigating the measurement of knowledge of ASD should include both actual and perceived knowledge to better understand the full context of knowledge of ASD and how it may translate to behaviors.

## A Survey of Knowledge of Autism Spectrum Disorder (ASK-ASD)

The ASK-ASD was created to meet the need for a valid, reliable measure of both perceived and actual knowledge of ASD (Hansen, 2015). In the measure development study, a sample of undergraduate students ( $N = 487$ ) was administered the initial 51 items, each of which related to etiology, epidemiology, symptoms, diagnosis, or prognosis/treatment of ASD. Six experts from a variety of fields, including clinical child psychology, school psychology, occupational therapy, and physical therapy, reviewed these items for comprehensiveness and clarity with connections to ASD. Participants rated each statement as True or False, then rated their confidence in each answer on a Likert scale (1-Not At All Confident, 2-Confident, and 3-Very Confident). This format allowed the ASK-ASD to capture both actual and perceived knowledge at the item level. A random subsample of participants ( $N = 64$ ) was re-administered the ASK-ASD two weeks later to ascertain test-retest reliability.

In the measure development study, eight items were deleted due to negative item-total correlations. An exploratory factor analysis (EFA) was conducted on the remaining 43 items and revealed a two-factor structure of knowledge (General Features and Prognosis/Risk Factors). A total of 28 items were retained on the final measure: 12 items on the Prognosis/Risk Factors subscale (PRFS), and 16 items on the General Features subscale (GFS). The final version of the ASK-ASD had a Flesch-Kincaid reading level of 10.0 and a Flesch Reading ease score of 45.9.

Regarding internal consistency, the ASK-ASD demonstrated alpha coefficients for actual knowledge ranging from .57 to .61 for the total scale and subscales. For

perceived knowledge, alpha coefficients for the total scale and subscales ranged from .80 to .91. These internal consistency estimates are considered adequate for early stages of research (Nunnally, 1978). The ASK-ASD also demonstrated reliability through temporal stability, with significant correlations between total scales at time 1 and time 2,  $r(64) = .63, p < .001$  and  $r(64) = .67, p < .001$ , for actual knowledge and perceived knowledge, respectively. The ASK-ASD also demonstrated construct validity through significant correlations with knowledge of mental health and physical health on the KADDS and the HIV/AIDS knowledge scale, respectively. Overall, the ASK-ASD was supported as a reliable, valid measure of both perceived and actual ASD knowledge in an undergraduate sample (Hansen, 2015). However, further validation work is needed on this measure, particularly with samples beyond an undergraduate sample. In particular, studying the psychometric properties of the ASK-ASD within groups of individuals for which knowledge of ASD is most relevant (i.e., parents, teachers, and medical professionals) is an important step for further validation of this measure and is the focus of the current study.

### Current Study

As discussed above, there is a need in the field of ASD literacy to create a valid, reliable measure of ASD knowledge that can be used across samples. The creation of a psychometrically valid, comprehensive measure of ASD is an important step toward the goal of measuring and improving ASD knowledge in the general public. Further validation of the ASK-ASD will allow its use in research studies to identify specific disparities in ASD knowledge (actual and perceived) and to measure the effectiveness of efforts to improve ASD knowledge.

The current study had three goals. First, the present investigation evaluated the stability of the psychometric properties of the ASK-ASD and provide further support for its (a) factor structure (i.e., confirmatory factor analysis); (b) reliability (i.e., internal consistency, test-retest reliability); and (c) validity (i.e., correlations of ASK-ASD with familiarity, training, and experience), expanding on the initial measure development study (Hansen, 2015). Second, this study examined the performance of the ASK-ASD among parents, teachers, and medical students to determine differences between these groups. Finally, this study identified other variables that relate to perceived and actual knowledge of ASD.

### Hypotheses

It was expected that a confirmatory factor analysis using a combined sample across all participants (i.e., parents, teachers, and medical students) would verify the two-factor structure established in the initial measure validation study (Hypothesis 1). Additionally, it was hypothesized that the previously established psychometric properties of the ASK-ASD would be demonstrated in the combined sample of parents, teachers, and medical students. Specifically, it was expected that the ASK-ASD would demonstrate reliability through internal consistency (Hypothesis 2) and test-retest analyses (Hypothesis 3).

As evidence of construct validity, it was expected that higher levels of knowledge would be correlated to having a child with ASD (Hypothesis 4) and having received training in ASD (Hypothesis 5). It was also hypothesized that ASD knowledge would be positively correlated with working directly with individuals with ASD (Hypothesis 6). Furthermore, as evidence of convergent validity, it was hypothesized that the ASK-ASD

total scale would be moderately positively correlated with an established measure of mental health literacy (Hypothesis 7), a measure of general health literacy (Hypothesis 8), and a measure of knowledge of another neurodevelopmental/psychological disorder (ADHD; Hypothesis 9).

In addition, it was predicted that perceived knowledge would be positively correlated with actual knowledge (Hypothesis 10). It was also hypothesized that medical professionals would have significantly higher ASD knowledge compared to parents and teachers (Hypothesis 11) and that teachers would have significantly higher ASD knowledge than parents (Hypothesis 12).

Finally, exploratory analyses with demographic variables were conducted to examine if any demographics correlated with actual and/or perceived knowledge, or interacted with group (parents, teachers, and medical students) in predicting differences in actual or perceived knowledge.

## CHAPTER II - METHOD

### Participants

Following consent (see Appendixes A through C), the ASK-ASD was administered to a group of parents who had children under the age of 18 years ( $N = 105$ ), a group of teachers ( $N = 80$ ), and a group of medical students ( $N = 142$ ) for a total sample size of 327 participants. This sample size was based on Steven's (2012) recommendation that a sample size of 300 or more is necessary for a confirmatory factor analysis to be able to interpret factors with a small number of low loadings (.40). Given the factor loadings (.30 to .78) in the ASK-ASD development study (Hansen, 2015), an  $N$  of 327 was considered sufficient to conduct the analyses discussed below. Participants were required to be at least 18 years old. A total of 479 participants started the study; however, those who did not complete the ASK-ASD and/or pass quality assurance checks were excluded from analyses, resulting in the final  $N$  of 327 who completed at minimum the demographic forms and ASK-ASD and were included in the CFA. Some participants did not complete all additional measures before terminating the study, which resulted in a smaller sample size for certain analyses. For any analysis with a smaller  $N$  due to missing data or due to inclusion of a group-specific measure, the sample size is noted with the corresponding results. Finally, a subsample of participants ( $N = 78$ ; parent  $N = 21$ , teacher  $N = 16$ , and medical student/resident  $N = 41$ ) took the ASK-ASD again two to three weeks later. Demographic characteristics for the total sample, as well as each group, are presented in Table 1. Group-specific demographic characteristics are presented in Table 2.

Table 1 *Sample Statistics*

Participant Characteristics	Parents ( <i>N</i> = 105)	Teachers ( <i>N</i> = 80)	Med Students ( <i>N</i> = 142)	Test/Retest ( <i>N</i> = 78)
Age	33.92 (10.74)	34.82 (10.05)	27.15 (3.8)	31.68 (9.73)
Gender				
Female	94 (89.5%)	73 (91.3%)	91 (64.1%)	60 (76.9%)
Male	10 (9.5%)	5 (8.2%)	51 (35.9%)	18 (23.1%)
Other	1 (1%)	1 (1.3%)	0 (0%)	0 (0%)
Race				
White	89 (84.8%)	70 (87.5%)	99 (69.7%)	61 (78.2%)
Black	6 (5.7%)	4 (5.0%)	4 (2.8%)	3 (3.8%)
Latino	1 (1.0%)	0 (0%)	11 (7.7%)	4 (5.1%)
Asian	5 (4.8%)	1 (1.3%)	22 (15.5%)	6 (7.7%)
Native American/Pacific Islander	1 (1%)	2 (2.5%)	3 (2.1%)	1 (1.3%)
Middle Eastern/N. African	0 (0%)	0 (0%)	9 (6.3%)	3 (3.8%)
Multiracial	4 (3.8%)	0 (0%)	4 (2.8%)	1 (1.3%)
Children (yes)	105 (100%)	33 (41.3%)	11 (7.7%)	30 (38.5%)
Relationship Status				
Single/Never Married	8 (7.6%)	19 (23.8%)	66 (46.5%)	20 (25.6%)
Short-term relationship	0 (0%)	1 (1.3%)	9 (6.3%)	1 (1.3%)
Long-term relationship	11 (10.5%)	6 (7.5%)	25 (17.6%)	12 (15.4%)
Married	81 (77.1%)	46 (57.5%)	38 (26.8%)	43 (55.1%)
Divorced	5 (4.8%)	5 (6.3%)	3 (2.1%)	2 (2.6%)
Other	0 (0%)	2 (2.5%)	1 (0.7%)	0 (0%)
Education Level				
Less than high school diploma	2 (1.9%)	0 (0%)	0 (0%)	0 (0%)
High school graduate/GED	6 (5.7%)	1 (1.3%)	0 (0%)	1 (1.3%)
Some college	15 (14.3%)	0 (0%)	0 (0%)	1 (1.3%)
Associates degree	7 (6.7%)	0 (0%)	1 (0.7%)	1 (1.3%)
Bachelor's degree	34 (32.4%)	33 (41.3%)	64 (45.1%)	32 (41.0%)
Master's degree	31 (29.5%)	45 (56.3%)	25 (17.6%)	26 (33.3%)
Doctoral degree	7 (6.7%)	0 (0%)	8 (5.6%)	7 (9.0%)
Professional degree	3 (2.9%)	1 (1.3%)	44 (31.0%)	10 (12.8%)

Table 2 *Group-Specific Characteristics*

Group	Characteristics	M (SD) or Frequency (Percentage)
Teachers	How prepared do you feel to teach students with autism/ASD?	
	Extremely prepared	11 (3.4%)
	Moderately Prepared	26 (8.0%)
	Slightly Prepared	26 (8%)
	Neither prepared no unprepared	5 (1.5%)
	Slightly unprepared	3 (0.9%)
	Moderately Unprepared	8 (2.4%)
	Extremely Unprepared	1 (0.3%)
	I have taught students with autism/ASD.	67 (83.75%)
	How many years have you been a teacher?	
Less than 10 years	48 (60.76%)	
10-20 years	29 (36.71%)	
More than 20 years	2 (2.53%)	
Medical Students/Residents	Current year in medical program	
	First year (medical school)	32 (9.8%)
	Second year (medical school)	25 (7.6%)
	Third year (medical school)	33 (10.1%)
	First year (residency)	29 (8.9%)
	Second year (residency)	7 (2.1%)
	Third year (residency)	10 (3.1%)
	Fourth year (residency)	4 (1.2%)
	In what type of degree program are you currently enrolled?	
	M.D.	105 (32.1%)
D.O.	37 (11.3%)	
I have previously worked with children/adults with autism/ASD.	68 (20.8%)	
Parents	I have a child with special needs.	47 (44.30%)
	ASD, Asperger's, or PDD-NOS	25 (23.8%)
	I believe that I know what to do if I think my child has autism/ASD (1 = yes)	72.1%

## Procedure

After obtaining IRB approval (Appendix I), 105 parents and 80 teachers were recruited from communities and schools across the United States through online advertisements, email announcements, and school-based research requests. In addition, 142 medical students and residents were recruited from medical school and residency programs that are accredited through the American Medical Association (AMA). Data collection occurred across two phases: in the first phase, all participants were given the demographic questionnaire (with appropriate supplement, depending on the participant type); ASK-ASD; the KADDs; the MHLS; the PHLKS; and the MCSDS. Additionally, parents were administered the PCOS; teachers were administered the TSES; and medical students/residents were administered the CIPS (described below).

Incentive for completion of the measures, which took approximately 45 minutes, was the chance to win one of three \$25 electronic gift cards within each group. Measures were completed online using the survey creation platform Qualtrics. For quality assurance, bogus items (e.g., “Please answer this question as True and 1-Not at all confident”) were used to ensure subjects read items carefully and did not respond carelessly (Dahlen, 2015). In the second phase, all participants who consented to be contacted ( $N = 212$ ) were invited (within a window of two to three weeks later) to be re-administered the ASK-ASD for test-retest reliability. Those who participated and passed quality assurance checks received one additional entry into the gift card drawing.

### *Measures*

*Demographic Questionnaire* (Appendix D). Participants were administered a demographic form to gather pertinent information including age, gender, racial

identification, household income, and their occupation. Participants were asked whether or not they had children, if they had ever been a teacher, and if they had ever been a medical student. Based on their responses to these questions, participants were asked specific questions to ascertain their familiarity with ASD. The parent-specific supplement (Appendix E) included items ascertaining what (if any) type of training parents had received regarding ASD, their sources of information about ASD (e.g., magazines, books, journals), and whether or not they would know what to do if their child had symptoms of ASD. The teacher-specific supplement (Appendix F) included items about ASD training, class/coursework in ASD, and whether or not they had worked with students with ASD. Similarly, the medical student supplement (Appendix G) included items about ASD training received, sources of knowledge of ASD, and whether or not they had worked with patients with ASD.

*A Survey of Knowledge of Autism Spectrum Disorder (ASK-ASD; Appendix H).* The ASK-ASD (Hansen, 2015) is a 28-item measure of perceived and actual knowledge of ASD that was the target measure for further validation in the current study. Initially, the items were chosen through an extensive literature review. Six experts from a variety of areas, including clinical child psychology, school psychology, occupational therapy, and physical therapy, assessed the item pool for precision of language, relevance, and comprehensiveness. The final version of the ASK-ASD was modified (in terms of item inclusion and content) based on the expert reviewer feedback. It contains two factors that were derived through exploratory factor analysis: Prognosis and Risk Factors (e.g., “With support, therapy, and medication, ASD/Autism can be cured;” coded as false) and

General Factors (e.g., “A common initial concern of ASD/Autism is failure to develop language;” coded as true).

For each participant, the questions on the ASK-ASD were randomly presented. After indicating whether each statement is *True* or *False*, participants rated their confidence in their answer for each item on a Likert scale, with answers: *1-Not at All Confident*, *2-Confident*, and *3-Very Confident*. This format was designed to capture both the actual knowledge and perceived knowledge of each participant at the item level. The readability of the ASK-ASD was assessed on the Flesch-Kincaid readability index (MS Word 2010). The reading ease score was 48.1 out of 100, and the grade level was rated at 9.5, indicating that the ASK-ASD may be administered to a general adult audience.

*Mental Health Literacy Scale* (MHLS). The MHLS (O’Connor & Casey, 2015) was created as a comprehensive measure of mental health literacy. It consists of 35 items that assess the ability to recognize characteristics and correlates of specific psychological disorders (e.g., “If someone experienced a low mood for two or more weeks, had a loss of pleasure or interest in their normal activities and experienced changes in their appetite and sleep then to what extent do you think it is likely they have Major Depressive Disorder?”), attitudes that promote recognition and help-seeking behaviors (e.g., “To what extent do you think it would be helpful for someone to avoid all activities or situations that made them feel anxious if they were having difficulties managing their emotions?”), and knowledge of mental health information, risk factors, and treatments (e.g., “To what extent do you think it is likely that in general in the U.S., women are MORE likely to experience a mental illness of any kind compared to men?”). It consists of a mix of Likert scale responses that range from *Definitely Unwilling* to *Definitely*

*Willing* (5-point scale), *Very Unlikely* to *Very Likely* (4-point scale), or *Strongly Disagree* to *Strongly Agree* (5-point scale), based on the item. In the scale development study, the MHLS was found to have adequate internal reliability ( $\alpha = .87$ ) and test-retest reliability ( $r = .79$ ). The authors also suggested that the MHLS demonstrates construct validity through a significant positive correlation of .23, with the General Help-seeking Questionnaire (GHSQ; O’Conner & Casey, 2015). It should be noted that the MHLS contains a number of items that include terminology that was found in the previous version of the DSM (APA, 1994), rather than the most recent edition.

*Public Health Literacy Knowledge Scale* (PHLKS). The PHLKS (Pleasant & Kuruvilla, 2008) was developed as a valid and reliable measure to evaluate knowledge regarding public health issues. It consists of 17 items concerning knowledge of essential “Facts of Life” (e.g., motherhood, nutrition, immunization), as well as help-seeking behaviors and risk factors for common health concerns. Each item (e.g., “Using mosquito nets helps prevent malaria”) is rated as either *True* or *False*. The PHLKS was derived through expert feedback and participant consultation, and the final version was rated at a 7<sup>th</sup> grade reading level. In the initial development study, the PHLKS demonstrated good internal reliability ( $\alpha = .80$ ) and test-retest reliability ranging from .67 to .89 across four testing sites (i.e., China, Mexico, Ghana, and India). The PHLKS also demonstrated construct validity through a positive correlation with the science literacy scale (Pleasant & Kuruvilla, 2008). In the current study, the PHLKS demonstrated a coefficient alpha of .49, which is considered below the ideal level for data analysis. Thus, analyses utilizing the PHLKS were interpreted cautiously.

*Knowledge of Attention Deficit Disorders Scale* (KADDS). The KADDS (Sciutto

and Feldhamer, 2005) is a 36-item rating scale developed to assess knowledge within an adult, non-ADHD population. The KADDS is comprised of three subscales of ADHD: symptoms/diagnosis, treatment/medication, and associated features. Each item is a statement (e.g., “Current research suggests that ADHD is largely the result of ineffective parenting skills”) that can be designated as True, False, or Do not know, which allows researchers to collect more specific information about a participant’s level of ADHD knowledge.

In the current study, the KADDS allowed for evaluation of the validity of the ASK-ASD by offering a comparison between knowledge of ASD and knowledge of another neurodevelopmental disorder. The KADDS has demonstrated reliability and validity, with authors reporting an average coefficient alpha of .81, ranging from .80 to .90 across five studies. The three subscales were moderately consistent, with alpha scores ranging from .52 to .75. Test-retest correlation scores for the total scale and subscales were moderate to high, with correlation coefficients ranging from .59 to .76. Additionally, the KADDS has demonstrated construct validity in that teachers who have taught students with ADHD score significantly higher on this measure compared to teachers who have not taught students with ADHD (Sciutto and Feldhamer, 2005). When evaluated for readability, the KADDS was assessed as 48.3 out of 100 on the Flesch-Kincaid readability index (MS Word 2010).

*Marlowe-Crowne Social Desirability Scale (MCSDS).* The MCSDS (Marlowe & Crowne, 1960) is a 33-item rating scale that was created to assess participants’ social desirability through their response to questions (answered as *True* or *False*) about behaviors that are culturally and socially desirable, but also improbable (e.g., “I have

never intensely disliked anyone”). Lower scores represent a tendency to respond in a “socially undesirable” direction the majority of the time, whereas higher scores represent a tendency to avoid disapproval by others who read their responses.

In the current study, the MCSDS allowed for exploratory analyses regarding the potential overlap between socially desirable responses and perceived and actual knowledge. In the measure development study, the MCSDS total scale demonstrated reliability through an internal consistency coefficient (Kuder-Richardson 20) of .88. Furthermore, the MCSDS demonstrated construct validity through significant correlations with the Edwards Social Desirability Scale ( $r = .35$ ) and the MMPI L-scale ( $r = .54$ ; Marlowe & Crowne, 1960).

*Parenting Sense of Competency Scale (PSOC)*. The PSOC (Gibaud-Wallston & Wandersman, 1978) is a 17-item rating scale developed to assess parenting sense of competency, which encompasses a parent’s perceived ability to cope with parenting challenges and satisfaction with being a parent (Johnston & Mash, 1989). Each item is a statement (e.g., “Being a parent is manageable, and any problems are easily solved.”), which can be rated on a six-point Likert scale from *1-Strongly Agree* to *6-Strongly Disagree*. Johnston and Mash (1989) examined the psychometric properties of the PSOC and determine that it is comprised of two subscales of parenting self-efficacy: satisfaction (i.e., parenting frustration, motivation, and anxiety) and efficacy (i.e., parent’s ability to solve problems and their perceived capability). In this study, the PSOC demonstrated good internal consistency for the total scale ( $\alpha = .79$ ), as well as each subscale ( $\alpha = .75$  and  $.76$ , respectively). In the current study, the PSOC allowed for evaluation of the relation between ASD knowledge (both actual and perceived) and self-reported parenting

competency and efficacy. The PSOC total scale, which was used for all analyses, demonstrated good internal reliability in the current sample ( $\alpha = .82$ ).

*Teachers' Sense of Efficacy Scale (TSES)*. The TSES (Tschannen-Moran & Woolfolk, 2001) is a 24-item rating scale developed to assess teacher's self-assessed ability to handle classroom behaviors and provide effective instruction. The TSES is comprised of three subscales: efficacy in student engagement (e.g., "How much can you do to get through to the most difficult students?"); efficacy in instructional strategies (e.g., "How well can you respond to difficult questions from your students?"); efficacy in classroom management (e.g., "To what extent can you make your expectations clear about student behavior?"). For every item, each participant rated "how much you can do" on a Likert scale from 1-*Nothing* to 9-*A Great Deal*.

In the current study, the TSES was included for participants who identified as teachers to examine the relation between their sense of teaching efficacy and their knowledge of ASD. The TSES demonstrated construct validity through significantly positive correlations with another measure of teaching efficacy, as well as reliability (internal consistency) with alphas ranging from .87 to .91 across the three subscales (Tschannen-Moran & Woolfolk, 2001).

In the current study, two items were not included in the classroom management subscale due to an error in data collection.

*Clance Imposter Phenomenon Scale (CIPS)*. The CIPS (Clance, 1985) is a questionnaire designed to assess the extent to which an individual is experiencing symptoms associated with the imposter phenomenon. The measure consists of 20 statements (e.g., "I can give the impression that I'm more competent than I really am"),

and participants rate their level of agreement with each statement on a 5-point Likert scale ranging from *1-Not at all true* to *5-Very true*. In the current study, the CIPS was included for exploratory analysis to examine the relation between characteristics of IP and perceived/actual knowledge of ASD.

A later study examined the psychometric properties of the CIPS and found that the total scale demonstrated good internal consistency ( $\alpha = .91$ ). Validity was demonstrated through item analysis, which revealed moderate to high discriminative indices and suggests the CIPS can distinguish participants with high and low characteristics of IP (French, Ullrich-French, & Follman, 2008).

## CHAPTER III - RESULTS

Prior to any analyses, data were screened for inappropriate data (e.g., outliers, out-of-range values). Further, the internal consistency of the ASK-ASD, MHLS, PHLKS, and KADDS was evaluated to confirm that the psychometric properties (e.g., internal consistency, range, descriptive statistics, skewness and kurtosis) of each respective measure were adequate within the sample. One item (i.e., “autism is contagious”) was deleted from the ASK-ASD due to minimal variance within responses (i.e., nearly all respondents answered correctly as false).

Additionally, as noted above, given the low internal consistency coefficient for the PHLKS, as well as the high kurtosis value, analyses involving this measure were interpreted cautiously. Missing variables were scored based on the coding for each measure. Participants who failed quality assurance checks ( $N = 62$ ) were excluded from all analyses.

### Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was performed on the remaining 27 items using the overall combined sample (parents, teachers, and medical students) to assess whether the theoretical two-factor structure, established in a previous study (Hansen, 2015), was consistent with the observed model (Hypothesis 1). In performing a CFA, a theoretical structure is compared to the actual structure, and the level of fit is evaluated based on  $\chi^2$  likelihood value and indices of fit (Hu & Bentler, 1999). The  $\chi^2$  goodness-of-fit statistic examines the size of the difference between the sample and the fitted covariance matrices (Hu & Bentler, 1999). The Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) can range from 0 to 1, and values of .95 or above are

considered indicative of good model fit (Hu & Bentler, 1999). Root mean square error of approximation (RMSEA) values that are close to zero are suggestive of optimal fit, whereas values greater than .06 are considered indicative of poor fit (Hu & Bentler, 1999). M-Plus 6 (Muthén & Muthén, 2011) was used to estimate fit indices for the theoretical two-factor structure, as well as a one-factor structure (Table 3). Error variances were estimated using diagonally weighted least squares (WLSMV), which was designed specifically for ordinal data (Li, 2015). Standardized factor loadings and item difficulties are presented in Table 4.

Table 3 *Fit Indices for Factor Models of the ASK-ASD*

Measure	$\chi^2$	<i>df</i>	CFI	TLI	RMSEA (90% C.I.)	WRMR	AIC = $\chi^2$ - 2df	AIC = $\chi^2 + 2t$
2-factor model	408.30*	323	.49	.44	0.03 (0.02, 0.04)	1.14	-293.7	621.77
1-factor model	514.31*	350	.48	.43	0.04 (0.03, 0.05)	1.30	-236.1	521.9

Note.  $\chi^2$  = chi square goodness of fit statistic; *df* = degrees of freedom; RMSEA = Root-Mean-Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; WRMR = Weighted Root Square Mean Residual; AIC = Akaike information criterion. \* Indicates  $\chi^2$  are statistically significant ( $p < .001$ ).

Table 4 *Factor Structure and Difficulty Level of ASK-ASD*

Item Number	Item Text	Factor 1 (Prognosis/Risk Factors)	Item Difficulty (Percent Correct)
1	Adults can never be diagnosed with ASD/autism.	.29	96.3%
3	If a teacher believes a student has ASD/autism, he or she can give an initial diagnosis.	.26	92.3%

Table 4 (continued).

Item Number	Item Text	Factor 1 (Prognosis/Risk Factors)	Item Difficulty (Percent Correct)
6	There is a specific gene that can be used to identify ASD/autism.	.40	83.2%
9	There is strong evidence for low income as a risk factor for ASD/autism.	.86	78.0%
11	Children with diets higher in sugars and processed foods show an increased risk of developing ASD/autism.	.40	82.6%
12	Most evidence suggests ASD/autism can be caused by vaccines.	.06	92.7%
16	Large-scale studies support a link between season of birth and ASD/autism.	.13	88.7%
18	ASD/autism can be fatal over time.	.55	86.9%
22	With support, therapy, and medication, ASD/autism can be cured.	.28	96.9%
24	All individuals with ASD/autism have lower than average IQs.	.11	96.9%
26	Children with ASD/autism have patterns of play that are similar to their typically-developing peers.	-.12	82.0%
Item Number	Item Text	Factor 2 (General Factors)	Item Difficulty (Percent Correct)
2	An ASD/autism diagnosis is often based on parental interviews and observations of behavior.	.09	83.8%
4	An individual can be diagnosed with both ASD/autism and intellectual disability (previously known as mental retardation).	-.10	93.6%
5	A common initial concern of ASD/autism is failure to develop language.	.29	93.9%
7	ASD/autism is nearly five times as likely to occur in boys as girls.	.15	82.0%
8	Studies estimate the prevalence of ASD/autism in children has risen about 30% since 2008.	.17	85.6%

Table 4 (continued).

Item Number	Item Text	Factor 2 (General Factors)	Item Difficulty (Percent Correct)
13	At one time, scientists believed ASD/autism was caused by lack of parental interest and motherly warmth.	.18	85.3%
14	Children with older parents have a higher risk of developing ASD/autism.	.52	58.7%
15	Problems at birth (e.g., fetal distress, breech presentation) have been linked to ASD/autism.	.49	53.2%
17	Many scientists believe that ASD/autism is a product of uneven brain development.	.29	60.9%
19	Early intervention can alleviate symptoms of ASD/autism and lead to improvements in IQ, language, and social behaviors.	.11	95.1%
20	About 75% of individuals with ASD/autism also meet criteria for obsessive-compulsive disorder.	.52	73.1%
21	One common treatment for ASD/autism is Applied Behavior Analysis.	-.06	96.3%
23	About 25% of individuals with ASD/autism remain nonverbal throughout their lives.	.31	80.1%
25	An early symptom of ASD/autism is a failure to attend to facial expressions, gestures, and speech	.16	96.9%
27	Individuals with ASD/autism have difficulty interacting socially.	-.39	97.9%
28	Individuals with ASD/autism rarely form intimate relationships, even with their parents.	-.21	68.4%

The theoretically-based two-factor model had a significant chi-square value,  $\chi^2(349) = 507.77, p = <.001$ . The Root Mean Square Error of Approximation (RMSEA) of the resulting model was 0.04, with 90% certainty that the RMSEA falls between 0.03 and 0.04. The Comparative Fit Index (CFI) was 0.49, and the Tucker-Lewis Index (TLI) was 0.45. Akaike's Information Criteria (AIC) was calculated using two formulations

(Schermelele-Engel, Moosbrugger, & Müller, 2003):  $\chi^2 - 2df$  (AIC = -190.23) and  $\chi^2 + 2t$  (AIC = 621.77). For this model, the RMSEA value suggested a good fit, but the significant  $p$ -value for the  $\chi^2$  is considered outside the range of acceptable values (Schermelele-Engel, Moosbrugger, & Müller, 2003).

Given the mixed findings for the two-factor model, a one-factor model was explored to evaluate which model displayed the best fit. The one-factor model also had a significant chi-square value,  $\chi^2(350) = 514.31$ ,  $p = <.001$ . The Root Mean Square Error of Approximation (RMSEA) of the resulting model was 0.04, with 90% certainty that the RMSEA falls within 0.03 and 0.05. The Comparative Fit Index (CFI) was 0.48, and the Tucker-Lewis Index (TLI) was 0.43. The AIC was again calculated using two formulas:  $\chi^2 - 2df$  (AIC = -236.10) and  $\chi^2 + 2t$  (AIC = 521.9). Again, although the RMSEA value is indicative of a good fit, the significant  $p$ -value for the  $\chi^2$  is considered indicative of a poor model fit. Further, the two calculations for the AIC were not helpful, as the two calculations presented contradictory indicators for best model fit.

### Reliability

Reliability was assessed two ways: internal consistency and temporal stability. To test internal consistency (Hypothesis 2), alpha coefficients were calculated for total perceived and actual knowledge, as well as all subscales. Alpha values for the total sample are presented in Table 5, and alpha values for each group, as well as the test-retest sample, are presented in Table 6.

#### *Internal consistency*

For actual knowledge, alpha values at time 1 ranged from .26 to .40. These values are lower than expected and are below acceptable values for measure reliability

(Nunnally & Bernstein, 1994). Alpha values for perceived knowledge ranged from .79 to .91 and are considered indicators of good internal consistency. Similar alpha values were found at the second administration of the ASK-ASD, as well as when the time 1 sample was divided by group (Table 6).

#### *Temporal Stability*

To evaluate reliability through temporal stability (Hypothesis 3), the ASK-ASD was re-administered to a subsample of randomly selected subjects ( $N = 78$ ) after 2 to 3 weeks. Internal consistencies were reexamined by calculating the alpha coefficients for the subscales and the total scale from the second administration as another estimate of internal consistency of the measure (Hypothesis 2; Table 6). For actual knowledge, these values ranged from .18 to .37 for perceived knowledge from .77 to .90 for perceived knowledge.

Table 5 *Descriptive Statistics of ASK-ASD (Total Sample)*

		<i>N</i>	Number of Items per Scale	<i>M</i>	<i>SD</i>	Potential Range	Actual Range	Skewness	Kurtosis	Cronbach's Alpha
Actual Knowledge	PRFS	327	11	.89	.12	0-1	.45-1.0	-1.06	.76	.40
	GFS	327	16	.82	.11	0-1	.50-1.0	-.42	-.08	.28
	TOTAL	327	27	.84	.08	0-1	.59-1.0	-.60	.31	.26
Perceived Knowledge	PRFS	321	11	2.07	.39	1-3	1-3	-.07	.008	.79
	GFS	319	16	1.85	.38	1-3	1-3	.23	.21	.87
	TOTAL	318	27	1.94	.36	1-3	1-3	.07	.34	.91

Note. ASK-ASD = A Survey of Knowledge of Autism Spectrum Disorder; PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale

Table 6 *Descriptive Statistics of ASK-ASD (Separated by Group and Time)*

	Parents (N = 105)				Teachers (N = 80)			Med Students/Residents (N = 142)			Test/Retest (Time 2) (N = 78)		
	Scale	M	SD	Coefficient Alpha	M	SD	Coefficient Alpha	M	SD	Coefficient Alpha	M	SD	Coefficient Alpha
Actual Knowledge (ASK-ASD)	PRFS	.88	.13	.48	.91	.10	.27	.88	.12	.41	.89	.12	.37
	GFS	.80	.11	.36	.82	.10	.26	.82	.10	.24	.84	.09	.21
	Total	.84	.09	.43	.86	.07	.28	.84	.07	.06	.86	.07	.18
Perceived Knowledge (ASK-ASD)	PRFS	2.10	.39	.80	2.05	.45	.87	2.05	.36	.75	2.07	.38	.77
	GFS	1.87	.37	.86	1.88	.40	.90	1.83	.38	.86	1.86	.37	.86
	Total	1.97	.35	.90	1.95	.40	.94	1.92	.35	.90	1.94	.35	.90

Note. ASK-ASD = A Survey of Knowledge of Autism Spectrum Disorder; PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale

Bivariate correlations were calculated between the first and second administrations and provided a test-retest coefficient for the individual subscales and the total scale. Total scales and subscales were correlated across time 1 and time 2. These statistics are presented in Table 7. All paired scales and subscales across timepoints were significantly correlated ( $r$  coefficients ranging from .38 to .80 ( $p < .001$ )). Intraclass correlation coefficients (ICCs) were calculated between time 1 and time 2 administrations of each of the subscales and the total scale to examine internal consistency (Table 8). Average measures ICCs between time 1 and time 2 ranged from .55 to .87 ( $p < .001$ ) and were indicative of moderate to good temporal reliability (Koo & Li, 2016).

*Table 7 Intraclass Correlation Coefficients between Time 1 and Time*

		Time 2		
		PRFS	GFS	Total Scale
Actual Knowledge (Time 1)	PRFS	.69***	--	--
	GFS	--	.69***	--
	Total	--	--	.55***
Perceived Knowledge (Time 1)	PRFS	.87***	--	--
	GFS	--	.87***	--
	Total	--	--	.89***

Note. ASK-ASD = A Survey of Knowledge of Autism Spectrum Disorder; PRFS = Prognosis/Risk Factors Subscale; GFS =

General Features Subscale. \*\*\* $p < .001$

A paired-samples  $t$ -test also examined the difference between the first and second administration of the ASK-ASD. These data are presented in Table 9.

Both actual and perceived knowledge total scales and subscales were compared at time 1 and time 2. Total perceived knowledge was significantly different from time 1 to time 2,  $t(75) = 2.91, p = .005$ . Additionally, the perceived knowledge factor 2 (GFS) was significantly different from time 1 to time 2,  $t(75) = 2.61, p = .01$ . The other 4 pairs were non-significant, indicating there was no significant change between the first and second administration.

*Table 8 Paired Sample t-tests, Time 1 and Time 2*

		Time 1	Time 2	<i>t</i> -value
		<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>t</i> (75)
Actual Knowledge	PRFS	.89 (.12)	.89 (.12)	-.46
	GFS	.84 (.11)	.84 (.09)	.45
	Total	.86 (.07)	.86 (.07)	.06
Perceived Knowledge	PRFS	2.06 (.37)	2.13 (.39)	2.46
	GFS	1.84 (.37)	1.91 (.38)	2.61*
	Total	2.91 (.35)	2.00 (.36)	2.91**

Note. PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale. All analyses were conducted with N = 78.

†trend,  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ .

In addition, change scores were calculated for total actual knowledge by subtracting each participant's time 2 score from their time 1 score. This correlation was non-significant,  $r = .16$ ,  $p = .17$ , indicating that time elapsed does not relate to the change in total actual knowledge score between the first and second administration of the ASK-ASD.

## Validity

### *Construct Validity*

To test Hypotheses 4 through 6 regarding construct validity, having a child with ASD (Hypothesis 4), participation in training in ASD (Hypothesis 5), and experience working with individuals with ASD (Hypothesis 6)—all coded 0 = no, 1 = yes—were correlated with the total perceived and actual knowledge scales. These correlations are presented in Table 10. Having a child with ASD was not significantly correlated with actual or perceived knowledge (total scales and subscales). Participating in ASD training

was significantly positively correlated with perceived knowledge total scale and both subscales. Additionally, experience with individuals with ASD was significantly positively correlated with actual knowledge total scale and both subscales, as well as total perceived knowledge and perceived knowledge GF subscale.

#### *Convergent validity*

To assess convergent validity (Hypotheses 7 through 9), correlations between the ASK-ASD and a measure of mental health literacy (i.e., correlating the ASK-ASD total scales with the MHLS total scale; Hypothesis 7), a measure of general health knowledge (i.e., correlating the ASK-ASD total scales with the PHLKS total scale; Hypothesis 8), and a measure of ADHD knowledge (i.e., correlating the ASK-ASD total scales with the KADDS total scale; Hypothesis 9) were examined. Descriptive statistics for these additional measures are presented in Table 10, and the correlations between the measures and the ASK-ASD total scales and subscales are presented in Table 11.

The ASK-ASD actual knowledge total scale was significantly positively correlated with knowledge of ADHD,  $r = .15, p < .01$ ; general health literacy,  $r = .22, p < .001$ ; and general mental health literacy,  $r = .23, p < .001$ , providing support for all three of these hypotheses. Additionally, the perceived knowledge total scale was significantly positively correlated with knowledge of ADHD,  $r = .41, p < .001$ , and general mental health literacy,  $r = .14, p = .02$ .

Further, correlations between the ASK-ASD perceived knowledge and actual knowledge subscales and total scales were assessed for Hypothesis 10. These correlations are presented in Table 12. Perceived and actual knowledge were significantly positively correlated for the total knowledge, the PRF, and the GF subscale. These

correlations indicate that participants were largely able to accurately assess their actual levels of ASD knowledge.

Table 9 Descriptive Statistics for Additional Measures

Scale	<i>N</i>	Items per Scale	<i>M</i>	<i>SD</i>	Potential Range	Actual Range	Skewness	Kurtosis	Cronbach's Alpha
PSOC	87	17	51.32	10.82	17-102	25-80	-0.24	0.31	.82
TSES: SE	60	8	4.08	.51	1-9	3-5	.03	-.84	.83
TSES: Inst.	60	8	4.25	.52	1-9	3-5	-.43	-.15	.87
TSES: CM	60	6	4.31	.46	1-6	3.17-5	-.64	-.23	.78
CIPS	105	20	79.63	24.33	20-100	28-133	0.22	-0.57	.90
KADDS	303	39	20.35	6.94	0-39	0-33	-.62	-.05	.87
MHLS	271	35	134.55	13.83	35-160	36-159	-2.61	15.80	.85
PHKLS	268	17	15.77	1.43	0-17	7-17	-1.95	6.56	.49
MCSDS	261	33	15.65	5.87	0-33	2-33	.03	-0.04	.83

Note: PSOC = Parenting Sense of Competency Scale; TSES = Teacher Self-Efficacy Scale; SE = Student Engagement; Inst. = Instruction; CM = Classroom Management; CIPS = Clance Imposter

Phenomenon Scale; KADDS = Knowledge of Attention Deficit Disorders Scale; MHLS = Mental Health Literacy Scale; PHKLS = Public Health Knowledge Literacy Scale; MCSDS = Marlowe-

Crowne Social Desirability Scale.

Table 10 *Convergent and Construct Validity of the ASK-ASD*

		MHLS Total (N = 271)	PHLKS Total (N = 268)	KADDS Total (N = 303)	MC Total (N = 260)	Having a child with ASD (N = 105)	Have received ASD training (N = 324)	Experience with patients or students with ASD (N = 223)
Actual Knowledge	PRFS	.11	.22***	.15**	-.19**	.20	.08	.16*
	GFS	.19**	.10	.06	.05	-.06	.02	.14*
	Total	.23***	.22***	.15**	-.08	.07	.07	.23**
Perceived Knowledge	PRFS	.14*	.09	.33***	-.04	.02	.24***	.11
	GFS	.13*	-.02	.40***	.07	.05	.30***	.19**
	Total	.14*	.02	.41***	.02	.04	.29***	.17**

Note. ASK-ASD = A Survey of Knowledge of ASD; MHLS = Mental Health Literacy Scale; KADDS = Knowledge of Attention Deficit Disorders Scale; PHLKS = Public Health Knowledge

Literacy Scale; PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale. a Coded 0 = no, 1 = yes. \* p < .05. \*\* p < .01. \*\*\* p < .001.

Table 11 *Bivariate Correlations between ASK-ASD Total Scales and Subscales*

	1	2	3	4	5	6
1. Actual Knowledge PRFS	--					
2. Actual Knowledge GFS	-.07	--				
3. Actual Knowledge Total	.58***	.78****	--			
4. Perceived Knowledge PRFS	.32***	.02	.21***	--		
5. Perceived Knowledge GFS	.12**	.16***	.21***	.76***	--	
6. Perceived Knowledge Total	.21***	.11	.22***	.92***	.96***	--

Note. ASK-ASD = A Survey of Knowledge of Autism Spectrum Disorder; PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale; N = 327. \*  $p < .05$ . \*\*  $p < .01$

#### Tests for Group Differences

To investigate group differences (Hypotheses 11 and 12), a factorial analysis of variance (ANOVA) was conducted with three levels of group (parents, teachers, and medical students). Main effects for parents, teachers, and medical students were examined to test the hypotheses for group differences. The parent group  $M = .84$ ,  $SD = .09$ ; teacher group  $M = .86$ ,  $SD = .07$ ; and the medical students/residents group  $M = .84$ ,  $SD = .07$ . The main effect of group on the total knowledge score of the participant was non-significant,  $F(1, 327) = 1.81$ ,  $p = .17$ . Given the non-significant main effect, group contrast *post hoc* tests were not examined.

#### Exploratory Analyses

Another primary goal of the study was to investigate variables that significantly relate to perceived and actual knowledge of ASD. These analyses were considered exploratory and no *a priori* hypotheses were made. These correlations are presented in Table 12. Exploratory analyses revealed that having children was significantly correlated with actual knowledge total scale and

GFS. Age and biological sex were significantly positively correlated with actual knowledge PRFS and being married was positively correlated with actual knowledge total scale. Level of education was correlated with actual knowledge PRFS, such that higher levels of education were associated with higher actual ASD knowledge on this subscale. No significant correlations were found between the group-specific measures (i.e., parenting competence, teaching efficacy, and characteristics of the imposter phenomenon) and actual knowledge of ASD (see Table 13). Socially-desirable responding was significantly negatively correlated with actual knowledge PRFS, suggesting that individuals who endorsed fewer socially desirable responses had higher levels of actual ASD knowledge in some areas.

Hierarchical multiple regression analyses were conducted to determine the relative and unique contributions of expected predictors of total actual knowledge and total perceived knowledge. The first analysis examined the impact of group membership on total ASD knowledge. Given the significant correlations described above, the following characteristics were entered as covariates: biological sex, having children, income, level of education, and socially desirable responding. Two covariates, having children and income, were significantly related to total actual ASD knowledge,  $F(1, 256) = 3.48, p = .06$  and  $F(1, 256) = 5.34, p = .02$ , respectively. The overall model (presented in Table 14) was significant,  $F(7,256) = 2.72, p = .01$ , suggesting that when accounting for demographic factors that are correlated with knowledge, the group in which a participant belonged did have an effect on actual ASD knowledge (total scale).

Table 12 *Exploratory Correlations between ASK-ASD and Demographics*

		Race (White = 1, Other = 0)	Has Child(ren)	Number of Children	Biological Sex (Male = 1)	Age	Annual Income	Married (Married = 1)	Level of Education
Actual Knowledge	PRFS	.06	-.02	.03	-.14**	.03	.12**	.08	.12**
	GFS	.08	.13**	-.05	-.02	-.04	.06	-.09	.02
	Total	.10	.10	-.02	-.10	-.02	.12**	-.02	.12**
Perceived Knowledge	PRFS	.01	.04	-.01	-.03	.05	.04	-.02	.11*
	GFS	-.03	.04	-.03	-.04	-.03	.04	-.03	.04
	Total	-.01	.04	-.03	-.03	.05	.02	-.03	.07

*Note.* ASK-ASD = A Survey of Knowledge of Autism Spectrum Disorder; PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale; \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

Table 13 *Exploratory Correlations between ASK-ASD and Group-specific Characteristics*

		PSOC ( <i>N</i> = 86)	TSES: SE ( <i>N</i> = 60)	TSES: CM ( <i>N</i> = 60)	TSES: Inst. ( <i>N</i> = 60)	CIPS ( <i>N</i> = 105)
Actual Knowledge	PRFS	.16	.07	.14	.21	.07
	GFS	.002	.07	.001	.05	-.07
	Total	.09	.04	.12	.15	-.01
Perceived Knowledge	PRFS	-.01	.13	.19	.19	.04
	GFS	-.06	.19	.09	.24*	.04
	Total	-.04	.17	.15	.23*	.02

Note. ASK-ASD = A Survey of Knowledge of Autism Spectrum Disorder; PRFS = Prognosis/Risk Factors Subscale; GFS = General Features Subscale; MCSDS = Marlowe-Crowne Social Desirability Scale; PSOC = Parenting Sense of Competency Scale; TSES = Teacher Self-Efficacy Scale; SE = Student Engagement; Inst. = Instruction; CM = Classroom Management; CIPS = Clance Imposter Phenomenon Scale. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

Table 14 Results of One-way ANCOVA Examining Group Membership and ASD

*Knowledge*

Source	Type III Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
Corrected Model	0.107 <sup>a</sup>	7	0.2	2.72	.01
Intercept	5.73	1	5.73	1024.25	.00
Male (1 = yes)	0.01	1	0.01	1.88	.17
Having children (1 = yes)	0.02	1	0.02	3.48	.06
Income	0.03	1	0.03	5.34	.02
Education	0.02	1	0.02	2.80	.10
Socially Desirable Responding	0.00	1	0.00	0.62	.43
Group	0.01	2	0.01	1.08	.34
Error	1.39	248	0.01		
Total	185.46	256			
Corrected Total	1.49	255			

## CHAPTER IV – DISCUSSION

The main purpose of this study was to examine the performance of the ASK-ASD in a sample of parents, teachers, and medical students/residents to evaluate the psychometric properties of this measure. Analyses to explore reliability and validity included exploration of the factor structure identified in the measure development study (Hansen, 2015); performance of the ASK-ASD over time; and the relation between the ASK-ASD and measures of general mental health literacy, knowledge of another neurodevelopmental disorder, and general health literacy. The relation among perceived ASD knowledge, actual ASD knowledge, and socially desirable responding was examined, as were group-specific characteristics (i.e., parenting efficacy, teaching efficacy, and characteristics of the imposter phenomenon). Finally, the correlation among perceived and actual knowledge of ASD and various demographic characteristics was investigated.

It was expected that the ASK-ASD would demonstrate reliability and validity as a measure of perceived and actual knowledge of ASD. First, it was hypothesized that a CFA using a combined sample (i.e., parents, teachers, and medical students) would verify the two-factor structure established in the initial measure validation study. However, the CFA demonstrated mixed results with regards to the two-factor structure. The value of RMSEA, which is indicative of how well the model might fit a covariance matrix at the population level, was considered good. On the other hand, the significant chi-square and the values of CFI and TLI were considered indicative of poor model fit (Hooper, Coughlan, & Mullen, 2008). Given these findings, a one-factor structure was explored, but produced similar fit indices. For all other hypotheses (i.e., examining reliability,

validity, and group differences), both the two original subscales and the total scale were considered.

Additionally, it was hypothesized the ASK-ASD would demonstrate reliability through internal consistency (Hypothesis 2) and test-retest analyses (Hypothesis 3). Hypothesis 2 was not well-supported, as the ASK-ASD actual knowledge scale and subscales demonstrated poor internal consistency and alpha values were below what is typically considered acceptable for reliability (Nunnally, 1994). However, the alpha values for perceived knowledge ranged from .79 to .91 and are considered good indications of internal consistency. Furthermore, it should be noted that some recent articles encourage researchers to interpret alpha values cautiously for binary items (e.g., Panayides, 2013; Raykov, Dimitrov, & Asparouhov, 2010), such as those used on the actual knowledge total and subscales.

Hypothesis 3, that the ASK-ASD would demonstrate test-retest reliability, was mostly supported. Total scales and subscales for both perceived and actual knowledge were significantly positively correlated across time 1 and time 2. Intraclass correlation coefficients across the first and second administrations were also significantly positive for actual and perceived knowledge total scales and subscales. These findings were consistent with the temporal stability demonstrated by the measure in the initial development study and provides support for the notion that the ASK-ASD reliably captures an individual's level of perceived and actual ASD knowledge across time (Hansen, 2015).

It was hypothesized that the ASK-ASD would demonstrate construct validity by correlating actual knowledge and perceived knowledge with having a child with ASD

(Hypothesis 4), participation in ASD training (Hypothesis 5), and experience with an individual with ASD (Hypothesis 6). Hypothesis 4, that having a child with ASD would be positively correlated with actual ASD knowledge, was not supported. Actual and perceived knowledge total scale and subscales were not significantly correlated with having a child with ASD. This may indicate that having a child with ASD does not necessarily increase an individual's perceived or actual knowledge of ASD. Whereas previous studies have typically found relatively high levels of knowledge among parents of children with ASD or related disorders (e.g., Kuhn & Carter, 2006), it is difficult to make comparisons due to the lack of previous literature that directly compares parents of children with an ASD with who do not have a child with ASD.

Hypothesis 5, that participation in ASD training would increase perceived and actual knowledge, was partially supported. Although none of the actual knowledge total scale or subscales were correlated with ASD training, perceived knowledge total scales and subscales were significantly positively correlated with having received ASD training. These results indicate that participating in ASD training is associated with participants' increased confidence in their knowledge of ASD, but not necessarily their actual knowledge. Additionally, these correlations are consistent with those found in the measure development study, in which having received ASD training was also correlated with perceived (but not actual) knowledge of ASD (Hansen, 2015). These findings suggest that undergoing training in ASD may increase an individual's confidence in their knowledge of the disorder, but it does not necessarily translate to increased understanding. It should also be noted that an

extremely wide variety of “training” was endorsed by participants in this study, from “I read a few articles online” to “I am a pediatric neurologist.”

Hypothesis 6, that experience working with individuals with ASD (as a teacher or physician) would be significantly correlated with ASD knowledge, had mixed results. Experience was significantly positively correlated with one actual knowledge subscale (PRFS), as well as perceived knowledge total scale and one subscale (GFS). This pattern was not consistent with the findings in the measure development study, in which experience with individuals with ASD was significantly positively correlated with subscales and total scales of both perceived and actual knowledge (Hansen, 2015). On the other hand, these mixed results were consistent with a previous finding in the literature that teachers who have worked directly with children with ASD are not always more knowledgeable than those who have not (Williams et al., 2011). Thus, it may be interpreted that teachers and physicians who have experience working with individuals with ASD perceive themselves as being more knowledgeable overall; however, that perception may be limited to specific aspects of the disorder (i.e., prognosis and risk factors).

Hypotheses 7, 8, and 9 involved evaluation of the convergent validity of the ASK-ASD through correlations between the ASK-ASD total knowledge scales and measures of mental health literacy, general health literacy, and knowledge of another neurodevelopmental disorder, respectively. These hypotheses received mixed support. Whereas total perceived knowledge was significantly positively correlated with both mental health literacy and knowledge of another neurodevelopmental disorder, no significant correlations were found between these measures and the ASK-ASD actual

knowledge total scale. These findings suggest that increased knowledge of mental health in general, as well as knowledge of a specific neurodevelopmental disorder, is linked to higher perceived but not actual knowledge of ASD. These results contrast to the measure development study, in which both perceived and actual knowledge of ASD was significantly positively correlated with knowledge of another neurodevelopmental disorder (Hansen, 2015).

Additionally, although not hypothesized, there were significant positive correlations between one actual knowledge subscale (PRFS) and measures of general health literacy and knowledge of another neurodevelopmental disorder. Further, there was a significant negative correlation between the actual knowledge GFS subscale and general mental health literacy. These findings indicate that the ASK-ASD demonstrates convergent validity with other knowledge measures in some areas of knowledge (e.g., risk factors, long-term prognosis), but not others (e.g., diagnostic procedures, comorbidities).

Hypothesis 10, that perceived knowledge and actual knowledge total scales and subscales would be correlated, was fully supported. In the current sample, participants were able, at least to some extent, to assess their own levels of knowledge. However, it should be noted that these correlations were low to moderate (ranging from .16 to .32), suggesting participants had more confidence in their responses for some aspects of ASD knowledge than others. These findings are consistent with the measure development study, in which participants were largely able to assess their own levels of knowledge but the correlations were low (Hansen, 2015).

It was also hypothesized that medical professionals would have significantly

higher ASD knowledge compared to parents and teachers (Hypothesis 11), and that teachers would have significantly higher ASD knowledge than parents (Hypothesis 12). These hypotheses were not supported, as there was no effect of group on actual ASD knowledge. Thus, it appears that parents, teachers, and medical students/residents possess similar levels of actual ASD knowledge as assessed through the ASK-ASD. A review of the literature suggests that few, if any, studies have compared ASD knowledge among these three groups.

Finally, exploratory analyses with demographic variables were conducted to examine if any demographics predicted actual or perceived knowledge, or interacted with group (parents, teachers, and medical students) in predicting differences in actual or perceived knowledge. Perceived knowledge was not significantly correlated with any of these variables. Significant correlations were found between actual knowledge (total scale) and having children. The actual knowledge PRF subscale was significant correlated with education and annual income, such that higher levels of these variables were linked to higher ASD knowledge. Further exploration revealed significant negative correlations between actual knowledge (PRF subscale) and socially desirable responding.

Given these significant correlations, these variables were entered as covariates in the model examining the impact of group membership on total actual ASD knowledge. The resulting model was significant, suggesting that these variables may help explain, at least in part, how group membership (i.e., if a participant identified as a parent, teacher, or medical student/resident) may impact ASD knowledge.

## Limitations and Directions for Future Studies

A significant limitation of the current study was related to the poor internal consistency for actual knowledge of ASD. Given that the reliability coefficients were below an acceptable level, further measure development should involve improving internal reliability estimates. However, as noted above, there is an effort in the field of psychometrics to explore alternative measures of internal consistency besides Cronbach's alpha, as this statistic can be influenced by a number of factors (e.g., number of items in a scale, dimensionality; Vaske, Beaman, & Sponarski, 2017). Moreover, Cronbach's alpha often represents an underestimation of reliability, and it has been argued by some researchers that Cronbach's alpha should not be used as a measure of internal consistency, as it was not designed as such (e.g., Sijtsma, 2008).

Other limitations were related to sampling. Although the goal was to collect even numbers of parents, teachers, and medical students/residents (i.e., roughly 100 participants per group), the finalized sample contained nearly twice as many medical students/residents as teachers. This discrepancy may be explained by the difficulties recruiting teachers and parents as compared to medical students/residents. Moreover, nearly 500 participants began taking the survey, but only a portion of those individuals completed the surveys and passed quality assurance checks. Future data collection may focus on novel ways to recruit parents and teachers, including offering a larger incentive for participation, which may increase the diversity and scope of the sample collected. The web-based, self-report nature of data collection was another limitation. Participants completed all surveys online and may have had the chance to search for answers to respond to actual knowledge questions on the ASK-ASD. In the future, it may be helpful

to monitor participants as they complete the study to confirm all data collected are accurate representations of participants' actual ASD knowledge.

Finally, it would be ideal for future studies to include another validated measure of ASD knowledge to which to compare the ASK-ASD. For example, a measure such as the AKQ could be included to further explore the validity of the ASK-ASD.

### Conclusions

As the prevalence and visibility of ASD continues to grow, a reliable, valid measure that assess perceived and actual knowledge of the disorder will be valuable in a number of settings. In particular, it would be helpful to have a measure that can be used to make comparisons across different samples and groups. The current study sought to advance the initial measure development study by examining the psychometric properties of ASK-ASD in a sample of parents, teachers, and medical students/residents. Although some psychometrics properties were maintained in the current sample, there were mixed findings across nearly all of the hypotheses. Future research should continue to explore the performance of this measure in large, diverse samples. Moreover, it may be helpful to expand the items on the ASK-ASD such that the measure captures a wider scope of ASD knowledge, while ensuring that all items remain up-to-date with the current literature.

## APPENDIX A – Parent Informed Consent Form

Title of Research Project: Validation of the ASK-ASD in a Sample of Parents, Teachers, and Medical Students.

Purpose: We invite you, as a parent of a 4- to 18-year-old child, to participate in a research project examining a newly-developed measure regarding knowledge of autism spectrum disorder (ASD) as well as how this measure relates to other mental health and medical diagnoses. Findings will be used to evaluate the ASD knowledge tool developed for this study, obtain normative data, and determine its appropriateness for use in later studies. Additionally, this study will evaluate individual characteristics and factors associated with different levels of ASD knowledge.

Procedures: Participants will complete several surveys, with a focus on their knowledge of mental health and medical disorders. Completion of the study should take approximately 60 minutes or less. Quality assurance checks will be used to make sure that participants are reading each question carefully and answering thoughtfully. Participants who do not pass these checks will NOT be eligible for incentives or be included in the study.

In phase two of the study, approximately 25% of participants will be randomly selected and asked to retake one questionnaire within the next few months (for an additional incentive; see below). There is no guarantee that a participant will be contacted to participate in phase two. Likewise, participation in phase two is completely voluntary; incentives for phase one are not affected by participation in phase two. If you are not interested in being contacted to complete phase two, you can opt out at the end of this study. Doing so will exclude you from consideration in the random selection for phase two. Completion of phase two will take approximately 10 to 15 minutes.

Potential Risks: There are no associated risks with this project.

Potential Benefits: As an incentive for completing the study, your name will be placed in a drawing for a chance to win one of three \$25 gift cards to a retail store or restaurant. Your name will be placed into one drawing for phase I, and you will receive an additional entry after completion of phase II.

Voluntary Participation: Participation in this research project is entirely voluntary. You may withdraw from the research project at any time or skip a particular item and will not be penalized for doing so. However, you must complete most of the items in order for your data to be included in the study and to be eligible for the gift card drawing.

Confidentiality: All data collected and analyzed for this study will be kept strictly confidential. Names will be separated from all data for storage and analysis, which will use only research identification numbers. Only the principle investigator, research assistants, and supervisors will have access to this data set. Otherwise, no one else will be

able to see or use the information. Names and any other identifying information will not be linked to any findings, results or reports. The results of the project will focus on the overall findings, and no specific participant information will be released.

Participant's Assurance: Whereas no assurance can be made concerning results that may be obtained (since results from investigational studies cannot be predicted) the researcher will take every precaution consistent with the best scientific practice. Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Questions concerning the research should be directed to Laura Hansen at (205) 531-1080, Dr. Tammy Barry at 509-335-1583, or Dr. Sara Jordan at 601-266-4587. This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

I have read, understood, and printed a copy of the above consent form and agree to participate in this study.

- ✓ Yes—Please enter your name: \_\_\_\_\_
- ✓ No

## APPENDIX B Teacher Informed Consent Form

Title of Research Project: Validation of the ASK-ASD in a Sample of Parents, Teachers, and Medical Students.

Purpose: We invite you, as a teacher of a pre-kindergarten through 12<sup>th</sup> grade student, to participate in a research project examining a newly-developed measure regarding knowledge of autism spectrum disorder (ASD) as well as how this measure relates to other mental health and medical diagnoses. Findings will be used to evaluate the ASD knowledge tool developed for this study, obtain normative data, and determine its appropriateness for use in later studies. Additionally, this study will evaluate individual characteristics and factors associated with different levels of ASD knowledge.

Procedures: Participants will complete several surveys, with a focus on their knowledge of mental health and medical disorders. Completion of the study should take approximately 60 minutes or less. Quality assurance checks will be used to make sure that participants are reading each question carefully and answering thoughtfully. Participants who do not pass these checks will NOT be eligible for incentives or be included in the study.

In phase two of the study, approximately 25% of participants will be randomly selected and asked to retake one questionnaire within the next few months (for an additional incentive; see below). There is no guarantee that a participant will be contacted to participate in phase two. Likewise, participation in phase two is completely voluntary; incentives for phase one are not affected by participation in phase two. If you are not interested in being contacted to complete phase two, you can opt out at the end of this study. Doing so will exclude you from consideration in the random selection for phase two. Completion of phase two will take approximately 10 to 15 minutes.

Potential Risks: There are no associated risks with this project.

Potential Benefits: As an incentive for completing the study, your name will be placed in a drawing for a chance to win one of three \$25 gift cards to a retail store or restaurant. Your name will be placed into one drawing for phase I, and you will receive an additional entry after completion of phase II.

Voluntary Participation: Participation in this research project is entirely voluntary. You may withdraw from the research project at any time or skip a particular item and will not be penalized for doing so. However, you must complete most of the items in order for your data to be included in the study and to be eligible for the gift card drawing.

Confidentiality: All data collected and analyzed for this study will be kept strictly confidential. Names will be separated from all data for storage and analysis, which will use only research identification numbers. Only the principle investigator, research assistants, and supervisors will have access to this data set. Otherwise, no one else will be able to see or use the information. Names and any other identifying information will not

be linked to any findings, results or reports. The results of the project will focus on the overall findings, and no specific participant information will be released.

Participant's Assurance: Whereas no assurance can be made concerning results that may be obtained (since results from investigational studies cannot be predicted) the researcher will take every precaution consistent with the best scientific practice. Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Questions concerning the research should be directed to Laura Hansen at (205) 531-1080, Dr. Tammy Barry at 509-335-1583, or Dr. Sara Jordan at 601-266-4587. This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

I have read, understood, and printed a copy of the above consent form and agree to participate in this study.

- ✓ Yes—Please enter your name: \_\_\_\_\_
- ✓ No

## APPENDIX C Medical Student/Resident Consent Form

Title of Research Project: Validation of the ASK-ASD in a Sample of Parents, Teachers, and Medical Students.

Purpose: We invite you, as a medical student or resident, to participate in a research project examining a newly-developed measure regarding knowledge of autism spectrum disorder (ASD) as well as how this measure relates to other mental health and medical diagnoses. Findings will be used to evaluate the ASD knowledge tool developed for this study, obtain normative data, and determine its appropriateness for use in later studies. Additionally, this study will evaluate individual characteristics and factors associated with different levels of ASD knowledge.

Procedures: Participants will complete several surveys, with a focus on their knowledge of mental health and medical disorders. Completion of the study should take approximately 60 minutes or less. Quality assurance checks will be used to make sure that participants are reading each question carefully and answering thoughtfully. Participants who do not pass these checks will NOT be eligible for incentives or be included in the study.

In phase two of the study, approximately 25% of participants will be randomly selected and asked to retake one questionnaire within the next few months (for an additional incentive; see below). There is no guarantee that a participant will be contacted to participate in phase two. Likewise, participation in phase two is completely voluntary; incentives for phase one are not affected by participation in phase two. If you are not interested in being contacted to complete phase two, you can opt out at the end of this study. Doing so will exclude you from consideration in the random selection for phase two. Completion of phase two will take approximately 10 to 15 minutes.

Potential Risks: There are no associated risks with this project.

Potential Benefits: As an incentive for completing the study, your name will be placed in a drawing for a chance to win one of three \$25 gift cards to a retail store or restaurant. Your name will be placed into one drawing for phase I, and you will receive an additional entry after completion of phase II.

Voluntary Participation: Participation in this research project is entirely voluntary. You may withdraw from the research project at any time or skip a particular item and will not be penalized for doing so. However, you must complete most of the items in order for your data to be included in the study and to be eligible for the gift card drawing.

Confidentiality: All data collected and analyzed for this study will be kept strictly confidential. Names will be separated from all data for storage and analysis, which will use only research identification numbers. Only the principle investigator, research assistants, and supervisors will have access to this data set. Otherwise, no one else will be

able to see or use the information. Names and any other identifying information will not be linked to any findings, results or reports. The results of the project will focus on the overall findings, and no specific participant information will be released.

Participant's Assurance: Whereas no assurance can be made concerning results that may be obtained (since results from investigational studies cannot be predicted) the researcher will take every precaution consistent with the best scientific practice. Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Questions concerning the research should be directed to Laura Hansen at (205) 531-1080, Dr. Tammy Barry at 509-335-1583, or Dr. Sara Jordan at 601-266-4587. This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

I have read, understood, and printed a copy of the above consent form and agree to participate in this study.

APPENDIX D Demographic Form

1) What is your current age?

2) Please indicate which group below most accurately describes your racial identification (check all that apply):

- Asian
- Black
- Latino/Hispanic (Non-White)
- Middle Eastern/North African
- Native Hawaiian or Pacific Islander
- White
- Multiracial (please specify if you choose): \_\_\_\_\_
- Not listed (please specify if you choose): \_\_\_\_\_

3) What is your biological sex?

- Male
- Female
- Intersex
- Not listed (please specify if you choose): \_\_\_\_\_

4) What is your sexual orientation?

- Heterosexual/straight
- Gay or Lesbian
- Bisexual
- Asexual
- Pansexual
- Queer
- Not listed (please specify if you choose): \_\_\_\_\_

5) With what religion or spiritual practice (if any) do you identify?

6) Please estimate your household's annual income (if you are supported by your parents, please designate their income level):

- Less than \$10,000
- \$10,000 to \$19,999
- \$20,000 to \$29,999
- \$30,000 to \$39,999
- \$40,000 to \$49,999
- \$50,000 to \$59,999
- \$60,000 to \$69,999
- \$70,000 to \$79,999
- \$80,000 to \$89,999
- \$90,000 to \$99,999
- \$100,000 to \$109,999
- \$110,000 to \$119,999
- \$120,000 to \$129,999
- \$130,000 to \$139,999
- \$140,000 to \$149,999
- \$150,000 to \$159,999
- \$160,000 to \$169,999
- \$170,000 to \$179,999
- \$180,000 to \$189,999
- \$190,000 to \$199,999
- \$200,000 or more

7) What is your current relationship status?

- Single/never married
- Long-term relationship (1+ years)
- Married
- Widowed
- Divorced
- Separated

8) What is your primary/first language?

- English
- Other (please specify): \_\_\_\_\_

9) Do you have children?

- Yes
- No

9B) How many child(ren) do you have?

- 1
- 2
- 3
- 4
- 5
- 6 or more

9B) Please designate the age of each child: \_\_\_\_\_

10) What is your current occupation?

11) Are you currently a teacher (a person whose job is to teach students about certain subjects) OR have you ever been a teacher in the past?

- Yes
- No

12) Are you currently a medical student OR have you ever been a medical student in the past?

- Yes
- No

13) Please select the state in which you have a permanent address.

- |                                  |                                   |
|----------------------------------|-----------------------------------|
| <input type="radio"/> Alabama    | <input type="radio"/> Connecticut |
| <input type="radio"/> Alaska     | <input type="radio"/> Delaware    |
| <input type="radio"/> Arizona    | <input type="radio"/> Florida     |
| <input type="radio"/> Arkansas   | <input type="radio"/> Georgia     |
| <input type="radio"/> California | <input type="radio"/> Hawaii      |
| <input type="radio"/> Colorado   | <input type="radio"/> Idaho       |

- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska
- Nevada
- New Hampshire
- New Jersey
- New Mexico
- New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma
- Oregon
- Pennsylvania

## APPENDIX E Parent-Specific Supplement

- I have taken classes/had coursework at the college/university level about autism/ASD.
- I have received training/information about autism/ASD.
  - If yes: please describe your training.
- I would be interested in receiving autism/ASD training.
- I have read books about autism/ASD.
- I have read magazines about autism/ASD.
- I have read research journals about autism/ASD.
- I believe that I know what to do if I think my child has autism/ASD.
- Do you have a child with special needs?
  - If previous answer is yes: Please indicate what type of special needs your child has:

APPENDIX F Teacher-Specific Supplement

	YES	NO
I have taken classes/had coursework at the college/university level about autism/ASD.		
I have received training/information about autism/ASD through professional development.		
If yes: please describe the training that you have received.		
I would be interested in receiving autism/ASD training.		
I have read books about autism/ASD.		
I have read magazines about autism/ASD.		
I have read research journals about autism/ASD.		
I feel adequately prepared to teach students with autism/ASD.		
I have taught students with autism/ASD.		
If previous answer is yes: How many students with autism/ASD have you taught?		

How many years have you been a teacher? \_\_\_\_\_

What grade or grades do you teach? \_\_\_\_\_

What subject or subjects do you teach?

APPENDIX G Medical Student-specific Supplement

	YES	NO
I have taken classes/had coursework at the undergraduate/college level about autism/ASD.		
I have taken classes/had coursework at the graduate/professional level about autism/ASD.		
I have received training/information about autism/ASD through professional development.		
If yes: please describe the training that you have received.		
I would be interested in receiving autism/ASD training.		
I have read books about autism/ASD.		
I have read magazines about autism/ASD.		
I have read research journals about autism/ASD.		
I feel adequately prepared to work with children/adults with autism/ASD.		
I have received training about autism spectrum disorder (ASD).		
I have previously worked with children/adults with autism/ASD.		
If previous answer is yes: Please describe the context in which you worked with children/adults with autism/ASD		

What was your undergraduate major? \_\_\_\_\_

What year are you in medical school?

APPENDIX H ASK-ASD

Please designate the following statements regarding Autism Spectrum Disorder as True or False. For each answer, please indicate how confident you are of the accuracy of your response.

	Please Designate These Statements as True or False.		Please Rate Your Confidence in Your Answer.		
	True	False	Not at all confident	Confident	Very Confident
1. Adults can never be diagnosed with ASD/Autism.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. An ASD/Autism diagnosis is often based on parental interviews and observations of behavior.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. If a teacher believes a student has ASD/Autism, he or she can give an initial diagnosis.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. An individual can be diagnosed with both ASD/Autism and intellectual disability (previously known as mental retardation).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. A common initial concern of ASD/Autism is failure to develop language.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. There is a specific gene that can be used to identify ASD/Autism.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. ASD/Autism is nearly five times as likely to occur in boys as girls.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Studies estimate the prevalence of ASD/Autism in children has risen about 30% since 2008.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. There is strong evidence for low income as a risk factor for ASD/Autism.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. ASD/Autism is contagious.	<input type="radio"/>				
11. Children with diets higher in sugars and processed foods show an increased risk of developing ASD/Autism.	<input type="radio"/>				
12. Most evidence suggests ASD/Autism can be caused by vaccines.	<input type="radio"/>				
13. At one time, scientists believed ASD/Autism was caused by lack of parental interest and motherly warmth.	<input type="radio"/>				
14. Children with older parents have a higher risk of developing ASD/Autism.	<input type="radio"/>				
15. Problems at birth (e.g., fetal distress, breech presentation) have been linked to ASD/Autism.	<input type="radio"/>				
16. Large-scale studies support a link between season of birth and ASD/Autism.	<input type="radio"/>				
17. Many scientists believe that ASD/Autism is a product of uneven brain development.	<input type="radio"/>				
18. ASD/Autism can be fatal over time.	<input type="radio"/>				
19. Early intervention can alleviate symptoms of ASD/Autism and lead to improvements in iq, language, and social behaviors.	<input type="radio"/>				
20. About 75% of individuals with ASD/Autism also meet criteria for obsessive-compulsive disorder.	<input type="radio"/>				

21. One common treatment for ASD/Autism is applied behavior analysis.	<input type="radio"/>				
22. With support, therapy, and medication, ASD/Autism can be cured.	<input type="radio"/>				
23. About 25% of individuals with ASD/Autism remain nonverbal throughout their lives.	<input type="radio"/>				
24. All individuals with ASD/Autism have lower than average IQs.	<input type="radio"/>				
25. An early symptom of ASD/Autism is a failure to attend to facial expressions, gestures, and speech.	<input type="radio"/>				
26. Children with ASD/Autism have patterns of play that are similar to their typically-developing peers.	<input type="radio"/>				
27. Individuals with ASD/Autism have difficulty interacting socially.	<input type="radio"/>				
28. Individuals with ASD/Autism rarely form intimate relationships, even with their parents.	<input type="radio"/>				

## APPENDIX I – IRB Approval Letter



THE UNIVERSITY OF  
**SOUTHERN MISSISSIPPI**

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### **INSTITUTIONAL REVIEW BOARD**

118 College Drive #5147 | Hattiesburg, MS 39406-0001

Phone: 601.266.5997 | Fax: 601.266.4377 | [www.usm.edu/research/institutional.review.board](http://www.usm.edu/research/institutional.review.board)

### **NOTICE OF COMMITTEE ACTION**

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: R17110105

PROJECT TITLE: Validation of the ASK-ASD in a Sample of Parents, Teachers, and Medical Students

PROJECT TYPE: Renewal of a Previously Approved Project

RESEARCHER(S): Laura Hansen

COLLEGE/DIVISION: College of Education and Human Sciences

SCHOOL: Psychology

FUNDING AGENCY/SPONSOR: N/A

IRB COMMITTEE ACTION: Expedited Review Approval

PERIOD OF APPROVAL: 11/20/2018 to 11/19/2019

**Edward L. Goshorn, Ph.D.**  
**Institutional Review Board**

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