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Pediatric healthcare providers' screening practices: Impact of training on early identification of autism

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Pediatric Healthcare Providers' Screening Practices: Impact of Training on Early Identification of Autism

by

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ABSTRACT

This study explored the effectiveness of the Autism System of Care (ASC) trainings by measuring change in pediatric healthcare providers' method of identifying young children at-risk for autism spectrum disorders. The majority of participants were pediatricians working in either hospitals or clinics who voluntarily participated in the training. A pretest-posttest nonequivalent-groups design was used in this study. Pre- and post-test questionnaires were used to measure change in participants' screening practices. Due to a small number of participants, most findings from the study were not statistically significant. The small number of healthcare providers who participated in the ASC training was a major limitation to this study. Therefore, although results revealed that there were minimal gains between pre- and post-test administrations, this may be because of the small number of participants and does not necessarily indicate that the ASC training was not effective. Implications for future research in this area also are addressed.

Chapter 1

Introduction

Statement of the Problem

Autism is a lifelong developmental disability that affects the functioning of the brain and typically appears during the first three years of life. Autism falls under the category of Autism Spectrum Disorders (ASD), which refers to the broad continuum of cognitive and neurobehavioral difficulties present in these individuals (American Psychiatric Association, 2000). The fundamental features of autism are the presence of markedly abnormal or impaired development in communication and social interaction, as well as a distinctly restricted repertoire of behaviors and interests (Chakrabarti & Fombonne, 2001; Klinger, Dawson, & Renner, 2003; Oser & Shaw, 2001). Appearance of the disorder varies greatly depending on the developmental level and chronological age of the individual (Chakrabarti & Fombonne, 2001). The occurrence of autism is thought to be on the rise, with the latest studies finding higher rates than what was found in studies conducted in the 1980s and early 1990s. Earlier studies found that approximately 4 per 10,000 children had autism, while a study in 1998 found that 40 per 10,000 children have autistic disorder, with the number increasing to 67 per 10,000 if all types of autism-like behaviors are included (Yeargin-Allsopp et al., 2003).

Although the exact cause of autism spectrum disorders is still unknown, the literature reports that children with autism spectrum disorders (ASD) show more significant gains when they receive supports and services early on in their development.

However, many children are not being identified as early as possible to obtain the benefits of early intervention (Baird et al., 2000; Scambler, Rogers, & Wehner, 2001). It is estimated that only 50% of children with ASD are diagnosed before kindergarten (Strock, 2004). The diagnosis of ASD may be delayed due to concerns about labeling a child or incorrectly diagnosing a child (Filipek et al., 2000; Oser & Shaw, 2001). Although approximately 25% of children in primary care practice have developmental delays, less than 30% of primary care providers routinely conduct screening tests at well-child visits (Dworkin, 1989; Filipek et al., 2000).

Research indicates that early diagnosis is associated with dramatically better outcomes for individuals with autism because an accurate diagnosis and early identification can provide the basis for building an appropriate and effective educational and treatment program. In addition, early intervention facilitates earlier educational planning, provisions for family supports and education, management of family stress, and the distribution of appropriate medical care (Filipek et al., 2000). Because early educational intervention is the key to helping children with autism develop into competent and productive adults, routine early screenings of children are imperative so that they receive the various services needed in a timely manner. While no one behavioral or communications test can detect autism, several screening instruments such as the Parents' Evaluations of Developmental Status (PEDS), the Checklist for Autism in Toddlers (CHAT), and the Pervasive Developmental Disorder Screening Test (PDDST) have been developed that are now used to identify young children who may be at-risk for ASD (Prater & Zylstra, 2002).

Given that typically developing children demonstrate eye contact, orienting to one's name, joint attention, pretend play, imitation, nonverbal communication, and language development by 18 months of age, experienced professionals can reliably diagnose autism in children as young as 18 months of age (Filipek et al., 1999). In addition, autism-specific screening instruments have been developed for use with children at 18 months of age (e.g., CHAT). Pediatricians generally see young children on a regular basis throughout the first two years of life; therefore, they typically are involved in screening, identifying, and referring patients who are suspected of having an ASD for further evaluation.

Unfortunately, pediatric healthcare providers perceive a number of barriers to the utilization of screening instruments with young children. Several frequently reported barriers include providers' unfamiliarity with the early warning signs of autism, inadequate time to perform developmental screenings during typical well-child visits, and unfamiliarity with screening instruments (Halfon et al., 2001). Therefore, it is imperative that pediatric healthcare providers' knowledge-base of screening instruments and ASD be improved (Filipek et al., 1999). Professionals need to be knowledgeable about the early symptoms of autism as well as the available, score-validated screening instruments so that appropriate screening and referral procedures may occur.

Theoretical Framework

To be most successful in identifying young children with autism spectrum disorders, it is important to use an ecological model of child development, such as Urie Bronfenbrenner's framework, which takes into account biological, sociological, and psychological domains (Sontag, 1996). When using an ecological model, a variety of

measures are utilized in assessing the disorder. From a developmental perspective, the disorder is viewed within a conceptual framework that considers the expectations of children at particular ages. Utilizing the ecological model, the pediatric healthcare provider obtains a developmental history, a medical evaluation, behavioral observation(s), and information related to cognitive functioning and language ability to identify children at-risk for ASD.

In addition, when making decisions that will impact children's continued development, it is of the utmost importance to utilize data-based decision making. The general steps used in data-based decision making are: (a) establish a team, (b) develop a hypothesis, (c) gather data to assess needs, (d) use data to formulate goals, (e) develop a data-based plan, and (f) monitor progress and document success (Yang & Goldstein, 1999). When pediatric healthcare providers utilize an ecological framework to enhance their understanding of child development and employ data-based decision making, their young patients are more likely to receive the early intervention supports and services they need to maximize their development (Filipek et al., 2000).

Purpose of the Study

Although a great deal of research supports the notion that early identification of autism spectrum disorders leads to better outcomes, a large number of children with ASD still are not identified as early as possible. Furthermore, the recent increase in the number of individuals diagnosed with ASD heightens the importance of early identification. To this end, this study attempted to discover the effectiveness of the Autism System of Care (ASC) trainings by measuring change in pediatric healthcare providers' method of

identifying young children at-risk for autism spectrum disorders. Pre- and post-test questionnaires were used to measure change in participants' screening practices.

Research Questions

The following research questions were addressed in this study:

1. What is the effect of the Autism System of Care (ASC) training on use of developmental and autism-specific screening instruments by pediatric healthcare providers?
2. What is the effect of the ASC training on the use of developmental screening instruments in regard to age of patient?
3. What is the effect of the Autism System of Care training on pediatric healthcare providers' perceived barriers to increasing the use of screening instruments and/or referring patients?
4. What is the effect of the Autism System of Care training on pediatric healthcare providers' perceived levels of knowledge related to Autism Spectrum Disorders?
5. What is the effect of the Autism System of Care training on the self-efficacy of pediatric healthcare providers regarding the ability to screen accurately and refer a child suspected of having an Autism Spectrum Disorder?
6. What is the relationship between pediatric healthcare providers' perceived barriers to utilizing screening instruments and their actual use of developmental and autism-specific screening instruments before and after completion of the training?
7. What is the relationship between perceived barriers to utilizing screening instruments and the use of developmental screening instruments in regard to age of patients before and after completion of the training?

Hypotheses

The following research hypotheses were tested in this study: (a) Autism System of Care (ASC) training increases pediatric healthcare providers' routine use of developmental screening instruments and autism-specific screening instruments, (b) ASC training increases pediatric healthcare providers' routine use of developmental screening instruments with patients at younger ages than the ages of patients at screening prior to completion of the training, (c) ASC training decreases pediatric healthcare providers' perceived barriers to the use of screening instruments and/or referring patients, (d) ASC training increases pediatric healthcare providers' general knowledge related to ASD (e.g., early warning signs and score validated screening instruments), (e) ASC training increases pediatric healthcare providers' perceived self-efficacy regarding their ability to screen and refer children suspected of ASD, (f) ASC training decreases pediatric healthcare providers' perceived barriers to utilizing screening instruments while increasing their use of developmental and autism-specific screening instruments, and (g) ASC training decreases pediatric healthcare providers' perceived barriers to utilizing screening instruments while increasing their use of developmental screening instruments with patients at younger ages than the typical age at screening prior to completion of the training.

Significance of the Study

This study provides valuable information about the effectiveness of the Autism System of Care trainings in changing pediatric healthcare providers' method of the early identification of children at-risk for ASD. Because the benefits of early intervention have been well documented in the literature, the early identification of ASD is crucial for

optimal outcomes for these children (Filipek et al., 1999). Young children with ASD and their families will benefit greatly from early intervention services, and pediatric healthcare providers play a critical role in the early identification of these disorders. The Autism System of Care trainings also may play a significant role in enabling pediatric healthcare providers to identify children with ASD early in their development.

Definition of Terms

Autism Spectrum Disorders. Autism Spectrum Disorders (ASD) also are known as Pervasive Developmental Disorders (PDDs). These disorders are typically diagnosed in early childhood and cause pervasive impairment in thinking, feeling, language, and the ability to relate to others (Strock, 2004). There are five disorders, each with different levels of severity, that fall under ASD: (a) autistic disorder (a severe form), (b) pervasive development disorder not otherwise specified (PDD-NOS) (a mild form), (c) Asperger syndrome (a milder form), (d) Rett syndrome (a rare, severe form affecting females), and (e) childhood disintegrative disorder (a rare, severe form) (Strock, 2004).

Early identification. Early identification refers to the detection of ASD and/or other disabilities early on in children's development (Filipek et al., 2000).

Evaluation. An evaluation is the process of determining whether an individual is eligible for early intervention or special education services (Oser & Shaw, 2001).

Screening. A screening is a brief, point-in-time procedure for deciding which individuals need a referral for further assessment (Oser & Shaw, 2001).

Organization of Remaining Chapters

The remaining chapters present information that is pertinent to this study. More specifically, Chapter 2 provides a thorough review of the related literature, discussing

ASD and the process of identification, screening, and diagnosis. Furthermore, the role of pediatric healthcare providers in the early identification of ASD is reviewed, including a discussion of the perceived barriers to early identification and the utilization of screening instruments. Chapter 2 concludes with a discussion of the importance of training to facilitate change in service delivery for pediatric healthcare providers so they are better able to identify young children with ASD. Chapter 3 details the methodology that was used in this study, including sampling, instrumentation, procedures, and data analysis.

Chapter 2

Review of the Related Literature

Overview

This chapter provides a review of the literature relevant to this study. Autism spectrum disorders (ASD) are discussed, including the prevalence/incidence, symptomatology, and potential causes. The importance of early identification and intervention is discussed, as well as the screening and identification processes for ASD, including a review of screening instruments and procedures. The role of pediatric healthcare providers in this process is presented, and both supports for and barriers to the developmental screening process are presented. This chapter concludes with a discussion of the importance of training pediatric healthcare providers in relation to changing practices effectively, thereby better enabling practitioners to identify children with ASD as early as possible.

Autism Spectrum Disorders

Autism, a complex neurodevelopmental disorder that affects the functioning of the brain, is the most prevalent disorder that falls under the category of "Autism Spectrum Disorder" (ASD). Autism is considered a spectrum disorder because the symptoms and characteristics can present themselves in a wide variety of combinations, from mild to severe. Although ASD is defined by a certain set of behaviors, individuals can exhibit any combination of the behaviors in any degree of severity. The diagnostic category of ASD includes five disorders with different levels of severity: (a) autistic

disorder, (b) pervasive developmental disorder--not otherwise specified (PDD-NOS), (c) Asperger syndrome, (d) childhood disintegrative disorder (CDD), and (e) Rett syndrome (American Psychiatric Association [APA], 2000). In the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (Text Revision) (DSM-IV-TR), "autistic disorder" is listed under the heading of "Pervasive Developmental Disorders" (APA, 2000).

Autistic disorder is diagnosed when an individual displays a total of 6 or more of 12 symptoms listed across three major areas: social interaction, communication, and behavior (APA, 2000). Specifically, at least two symptoms must fall under the category of qualitative impairment in social interaction, such as marked impairment in the use of multiple nonverbal behaviors and/or lack of social or emotional reciprocity. At least one symptom must fall under the category of qualitative impairments in communication, such as marked impairment in the ability to initiate or sustain a conversation with others and/or lack of varied, spontaneous make-believe play. Finally, at least one symptom must fall under the section of restricted, repetitive, and stereotyped patterns of behavior, interests, and activities, such as apparently inflexible adherence to specific, nonfunctional routines or rituals and/or stereotyped and repetitive motor mannerisms (APA). In addition, there must be delays or abnormal functioning in at least one of the above mentioned areas (social interaction, language as used in social communication, and symbolic or imaginative play) with onset prior to age 3 years. A diagnosis of Pervasive Developmental Disorder--Not Otherwise Specified (PDD-NOS) is given when children display similar behaviors but do not meet the criteria for autistic disorder (APA, 2000).

This study will focus on two of the disorders, autism and PDD-NOS, because they are two of the more prevalent disorders under the diagnostic category of ASD (Oser & Shaw, 2001). In addition, autistic disorder and PDD-NOS have symptomatology that allow for earlier identification and intervention (Oser & Shaw, 2001). For the purpose of this review of the literature, the author will use the term "autism" to encompass both autistic disorder and PDD-NOS. Additionally, the term "Autism Spectrum Disorder" (ASD) will be used in place of "Pervasive Developmental Disorder" because it is considered to describe more fully the continuum of symptoms presented by young children (Oser & Shaw, 2001).

Prevalence/Incidence

It is important to differentiate prevalence from incidence when discussing the increase in the reported cases of autism. Prevalence refers to the proportion of individuals in a population who suffer from a defined disorder, whereas incidence refers to the number of new cases occurring in a population over a period of time (Fombonne, 2003). It should be noted that both prevalence and incidence estimates will be inflated when the definition of ASD is broadened and diagnostic instruments are improved. Two recent studies (Kaye et al., 2001; Powell et al., 2000) have provided incidence estimates that showed an increasing trend over a brief period of time; however, neither study examined changes in diagnostic criteria or sensitivity of case detection procedures during this time period (Fombonne, 2003). Therefore, the recent increase in rates of prevalence cannot be directly attributed to an increase in incidence of ASD. Further research is needed to test hypotheses accurately on changes in the incidence and prevalence of ASD (Fombonne, 2003).

Although autism was once thought to be a fairly rare disorder, it is more prevalent in the pediatric population than cancer, diabetes, spina bifida, and Down syndrome (Filipek et al., 1999). The apparent increase in the incidence and prevalence of autism spectrum disorders has led to increased concern about the disorder (Chakrabarti & Fombonne, 2001; Yeargin-Allsopp et al., 2003). Early studies conducted by Lotter (1966) and Wing and Gould (1979) found that approximately 4 per 10,000 children had autism, while a study by Bertrand et al. (2001) found that 40 per 10,000 children had autistic disorder, with the number increasing to 67 per 10,000 if all types of autism-like behaviors are included. Similarly, Baird et al. (2000) found a rate of autism of 30.8 cases per 10,000; however, the rate increased to 57.9 cases per 10,000 for all autism spectrum disorders. A number of recent studies have examined the prevalence of ASD, with considerable variability in their results. For instance, Filipek et al. (2000) estimated that ASD occur at a rate of 20 in 10,000 children, whereas Chakrabarti and Fombonne (2001) reported that ASD are estimated to occur in as many as 60 in 10,000 individuals.

Gillberg and Wing (1999) in their meta-analysis found an increase in prevalence, from 4.7 cases per 10,000 in children born prior to 1970, to 11.2 cases per 10,000 in children born in 1970 and later. Although the rise in the number of individuals diagnosed with autism is supported by the literature, it is still unclear whether the increase in autism is strictly due to an increase in prevalence, or if the increase reflects improved awareness and diagnostic instruments available for ASD (Klinger, Dawson, & Renner, 2003). The observation of these noticeably increasing prevalence rates supports the necessity for improved early screening and diagnostic procedures (Filipek et al., 1999).

Autism is approximately four times more prevalent in males than in females, with a male/female ratio of 4.3:1 (Fombonne, 2003). However, the ratio appears to vary with IQ, ranging from 2:1 in those with severe dysfunction to more than 4:1 in those with average IQ scores (Filipek et al., 1999). There are no significant differences in prevalence or symptomatology of ASD when comparing diverse racial, ethnic, and social groups. Furthermore, socioeconomic factors, lifestyle choices, and educational levels do not appear to affect the chances of ASD occurrence, making it an equal-opportunity disorder (Fombonne, 2003). Autism is considered a universal disorder, as studies throughout the world have reported consistent symptomatology, intellectual functioning, gender differences, and socioeconomic factors (Fombonne, 2003; Klinger et al., 2003).

Symptoms/Indicators

Autism is characterized by pervasive impairment in thinking, feeling, language, and the ability to relate to others. More specifically, impairments in reciprocal communication skills, atypical language development, and a restricted and repetitive range of behaviors are commonly present. It is unclear whether these different areas of development are intrinsically linked, whereby impairment in one area leads to difficulties in other areas. However, Klinger et al. (2003) report that it is probable that a group of deficits, rather than one primary deficit, affect these areas of development in young children.

The social symptoms that are commonly impaired in ASD include the ability to share attention with another individual, to understand another person's emotions (this concept is termed "theory of mind" in the literature), and to engage in pretend play. Because the development of early social abilities is considered to be a precursor to

language development, children with autism also tend to experience a significant delay in this area (Klinger et al., 2003). As both verbal and nonverbal communication skills may be impaired by autism, greater understanding is needed of both normal and abnormal development in this area (Bristol-Power & Spinella, 1999).

Wetherby et al. (2004) examined warning signs of ASD in the second year of life. They found that young children with ASD are likely to be delayed in using words and their vocalizations are likely to lack consonants and to have atypical prosody. In addition, children with ASD are not likely to respond to their name or to instructions even with contextual cues (Wetherby et al.). These children are likely to be delayed in using objects conventionally in play and also are likely to display repetitive movements with their body and/or objects. Moreover, young children with ASD are typically delayed in sharing attention with eye gaze, sharing affect, and drawing others' attention to objects or events of interest (Wetherby et al.). Additionally, gestures of pointing and showing, and a lack of coordination of gestures with eye gaze, facial expression, or vocalizations is evident in children with ASD. However, it is important to note that some of these warning signs also are seen in children with developmental delay (Wetherby et al.).

Numerous studies have demonstrated deficits in joint attention skills of children with ASD. These deficits include difficulties using eye gaze to coordinate attention, following the attentional focus of another person, and drawing another's attention to an object or event of interest (Mundy, Sigman, & Kasari, 1990; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Wetherby, Prizant, & Hutchinson, 1998). Longitudinal research findings suggest that the failure to acquire gestural joint attention may be a core

deficit in ASD and a critical milestone that impairs language development (Mundy et al., 1990; Sigman et al., 1999).

Repetitive behaviors are commonly seen in children with autism, and these behaviors typically fall into one of two categories. The first category comprises lower-level behaviors that present repetitive motor movements; the other category consists of higher-level behaviors in which an individual is insistent on following a specific routine or holds a very narrow range of interests (Turner, 1999). Several other behavioral symptoms are often related to autism. Self-injurious behavior, such as head banging, hair pulling, and hand biting, is typically seen in lower-functioning individuals with autism. In addition, sleep disturbance, eating disturbance, and excessive anxiety also can occur with autism (Klinger et al., 2003).

Potential Causes

Currently, the etiology of autism spectrum disorders is unknown. Therefore, interventions are structured to reduce the interfering symptoms of ASD. Clinicians initially believed autism was caused by cold, rejecting parents from wealthy families. In particular, mothers were often blamed for the child's condition; therefore, the term "Refrigerator Mom" was used to describe these mothers (Bettelheim, 1967). However, this notion does not hold merit in the current literature. Autism was once viewed as a psychogenic disorder; however, compelling evidence now suggests that autism is a disorder of abnormal brain development that is largely genetic. A number of family and twin studies has revealed that genetic factors play a role in the occurrence of ASD (Rutter, 2000).

Nicolson and Szatmari (2003) reviewed the findings from a number of genetic and brain-imaging studies of autism over the past 15 years. The findings were synthesized, and overwhelming evidence was found to support a neurobiological basis for autism. The risk to siblings of children with autism is approximately 50 to 100 times greater than the risk to the general population. However, these statistics only provide evidence that the disorder runs in families. To determine whether the basis of the familial aggregation is environmental or genetic, twin studies must be conducted. Several twin studies have revealed much higher concordance rates for monozygous than dyzygous twins. These findings indicate the presence of significant genetic factors, with heritability estimates greater than 90%, which make ASD the most heritable of the psychiatric disorders (Szatmari, Jones, Zwaigenbaum, & MacLean, 1998). Nicolson and Szatmari (2003) concluded that the likely cause of autism is a genetic defect in the control of neurodevelopment, resulting in structural and functional changes predisposing an individual to autism. Although evidence is continuing to accumulate for an underlying genetic cause for ASD, more research must be conducted in order to determine its etiology. Given that there is currently no biological marker for ASD, screening and diagnosis must be based on behavioral features (Filipek et al., 1999). The consistent use of screening instruments that yield valid information for the detection of children at risk for ASD likely will lead to earlier and improved interventions for children with ASD (Filipek et al., 1999).

Importance of Early Identification and Intervention

The early identification of autism spectrum disorders leads to better gains for these children if supports and services are initiated early on in development. Although

substantial literature provides support for the positive effects of early identification, many children with ASD are not identified nor supported as early as possible to benefit from early intervention services (Oser & Shaw, 2001). Professionals such as developmental pediatricians, child neurologists, and child psychiatrists are typically knowledgeable about ASD and have experience working with children who have these disorders. Therefore, these clinicians are frequently involved in assessing, diagnosing, and treating children with ASD (Oser & Shaw, 2001).

Evidence is growing that demonstrates the effectiveness of intensive early intervention with a significant proportion of young children with ASD (Dawson & Osterling, 1997; Filipek et al., 2000; Oser & Shaw, 2001). Dawson and Osterling (1997) reviewed eight model preschool intervention programs for children with autism that have been operating since the 1980's. The findings suggest that many children with autism who receive early intervention services make significant developmental gains. These gains were measured by the programs in a variety of ways (e.g., IQ scores, developmental scores on standardized tests, observational measures taken in the classroom). Because of the variation in measures used, it is difficult to compare the outcomes of these different programs; therefore, a general analysis of the overall progress of the 150 children in the early intervention programs was completed (Dawson & Osterling, 1997). All of the programs were effective in fostering significant developmental gains, as well as positive school placements (e.g., these children are frequently able to be included in general education classrooms by the time they begin elementary school).

Dawson and Osterling (1997) discovered that as long as certain fundamental program features are present, children tend to have favorable outcomes regardless of the

specific philosophy of the intervention program. Although the majority of children with autism who receive early intervention services make gains, it is still unclear whether the rate of progress is related to child characteristics such as IQ and language ability (Dawson & Osterling, 1997). Children from all eight preschool programs made, on average, an IQ gain of approximately 20 points. Although the majority of the children participating in the program had an IQ score in the mental retardation range (< 70) at the beginning of the program, most of the children responded positively to early intervention, making considerable progress. Dawson and Osterling (1997) concluded that further research must be conducted to determine whether one intervention approach is more effective than another, and to ascertain the most appropriate early intervention program intensity level.

The contention that early experience is important for promoting the most favorable long-term outcomes for children with developmental disabilities has been supported by studies of behavioral outcomes and early intervention in various at-risk populations (Dawson, Ashman, & Carver, 2000). The growing literature in the area of biological research indicates brain development begins prenatally and continues throughout the first few years of life. This information suggests that there may be a "sensitive period" whereby early intervention services would have a significant impact on behavior outcomes for children with ASD (Dawson et al., 2000). As research and policy have emphasized the significance of early experience in the development of young children, new techniques for studying infant behavior and brain activity have been developed. These latest procedures have allowed researchers to learn more about the relationship between biology and behavior in infants and young children. Early

development in children consists of many fundamental “experience expectant” processes, whereby children are anticipated to meet certain milestones (Dawson et al., 2000, p. 706). However, genetic or acquired brain abnormalities in ASD preclude these children from obtaining normal experiences in otherwise normal environments (Dawson et al., 2000).

Dawson et al. (2000) concluded that because the prenatal and early postnatal years represent a sensitive period with respect to the long-term beneficial effects of early intervention on brain and behavioral development, increased efforts at early identification are needed. Although prevention and early intervention efforts should not focus only on the earliest years of development, it is apparent from the extensive research that these efforts should begin as early as possible. Because long-term negative consequences have their greatest influences during early development, with the promotion of optimal prenatal and infant–toddler development, these negative consequences can be minimized or avoided completely. In addition, greater public awareness and education of healthcare providers in regard to the early detection of developmental disorders and how to access appropriate interventions are needed. Providers need to be proficient in the identification of early symptoms of autism so that appropriate screening and referral procedures can occur.

Research indicates that intervention provided before 3.5 years of age has a greater impact than interventions begun after five years of age (Filipek et al., 2000; Harris & Handleman, 2000). Harris and Handleman (2000) conducted a study examining the predictive power of age and IQ at the beginning of an early intervention program using applied behavior analysis. The children who participated in the intervention program at the Douglass Developmental Disabilities Center were examined in a 4- to 6-year follow-

up after they left the preschool. At the start of the program, 27 children with autism between the ages of 31 and 65 months had IQ scores between 35 and 109 on the Stanford Binet. Harris and Handleman found that children with both higher IQ scores (*M* = 78) and younger age at intake (*M* = 42 months) were predictive of being in a general education class after completion of the program. Children who had lower IQ scores (*M* = 46) and were older at intake (*M* = 54 months) were strongly associated with placement in special education classrooms. These results support the necessity for early intervention services for children with ASD. However, Harris and Handleman emphasized that both children with lower IQ scores and older children also showed measurable gains in IQ scores from treatment. Harris and Handleman concluded that although receiving intervention services at a very young age is most beneficial, older children also respond quite favorably to intervention services.

Research on social communication has important implications for earlier identification and intervention in young children with ASD because the skill deficits identified are skills that typically develop during the first 12 to 18 months of life. These findings suggest that there may be a set of pre-linguistic behaviors (e.g., gaze/point following, shared affect, gestures, communicative vocalizations, symbolic play) that are important early indicators of ASD. These behaviors also may help to distinguish children with ASD from both typically developing children and children with other developmental delays (Wetherby et al., 2004).

The substantial effect of early intervention has been dramatically demonstrated in the case of autism spectrum disorders. If intensive behavioral interventions are initiated by 2 years of age, a substantial number of children with autism show remarkable

improvements in their development (Dawson & Osterling, 1997). These findings suggest there is an urgent need to improve early identification so that children with ASD are able to access interventions as early as possible (Wetherby et al., 2004).

The Individuals with Disabilities Education Act (IDEA) was created to ensure that young children with disabilities receive early supports and services. IDEA is a law that guarantees all children with disabilities access to a free and appropriate public education. However, according to the 23rd annual report to congress on the implementation of the IDEA (U.S. Department of Education, 2001)**,** young children with developmental delays, including those with ASD, appear to be under-identified and underserved. In the United States from 1999 to 2000, approximately 1.8% of children under the age of 3 years received early intervention services under the Individuals with Disabilities Education Act (IDEA) Part C; however an estimated 5% of preschoolers were served under Part B of IDEA. These data indicate that a considerable proportion of children under the age of 3 years with developmental delays such as ASD are not identified or fail to receive early intervention services.

Challenges to Early Identification and Intervention

The National Early Childhood Technical Assistance System (NECTAS) has assisted states in identifying and addressing the challenges related to the early identification of children with ASD, including the importance of building the knowledge base on effective practices (Oser & Shaw, 2001). To attend to these challenges, the *NECTAS Forum on ASD* was created. This group of policy-makers identified national issues and promising practices in state early intervention and preschool special education systems. Through the use of focus groups, conference calls, web-based discussion

forums, and survey research, NECTAS identified promising practices in state early intervention and preschool special education systems (Oser & Shaw, 2001). In 1999, a survey to identify challenges to the early identification of ASD was mailed to 126 state-level policy makers. Thirty-five coordinators responded (27.8%), identifying challenges such as developing policies for public awareness and early intervention, involving parents in the identification process, and providing information to parents regarding the process of evaluations. The lack of appropriate tools and techniques available to identify young children with ASD was reported to be a challenge to early identification as well. Information derived from the *NECTAS Forum on ASD* activities will aid in the development of future strategies in early intervention and preschool special education systems (Oser & Shaw, 2001).

The NECTAS Forum on ASD discussed specific challenges and strategies for earlier identification, including (a) raising public and professional awareness, (b) tools for screening, (c) determining eligibility for services, and (d) transition. *Raising public and professional awareness* involves increasing the awareness of warning signs of ASD among primary healthcare providers as well as the public. This awareness can be accomplished by developing an early identification campaign that includes ASD, providing resources and training for primary healthcare providers as well as recent practice parameters, and extending awareness efforts to include places such as schools, child care centers, and child welfare agencies. *Tools for screening* refers to the use of a multi-stage process for early identification, the routine screening for early language development, and the distribution of information on early warning signs for ASD to primary referral sources. The *NECTAS Forum on ASD* also discussed the importance of

awareness and training regarding screening tools (e.g., Checklist for Autism in Toddlers [CHAT]), and the dissemination of information about screening instruments available for milder disorders in the spectrum. *Determining eligibility for services* refers to the development of guidelines for evaluation and assessment procedures. In addition, the NECTAS Forum on ASD recommended more frequent re-evaluations and follow-up of children with ASD, with children diagnosed with PDD-NOS being re-evaluated before the age of 3 years. Finally, *transition* refers to the planning of transitions (e.g., from early intervention program into preschool classroom) as soon as possible, and collectively addressing assessment and evaluation issues among various personnel (e.g., Part C and Part B of IDEA) (Oser & Shaw, 2001).

Screening Instruments and Procedures

Developmental screening is intended to identify young children who may need more comprehensive evaluations to assess their development; therefore, it is recommended by the American Academy of Pediatrics (AAP) that all infants and children are screened for developmental delays or disabilities (AAP, 2001). The use of developmental screening instruments is an efficient way to record observations and help providers identify more children with developmental delays (AAP). Some research suggests that although a number of screening tools are available for identifying ASD in young children, the disorders may often remain unrecognized and undiagnosed because suitable tools for routine developmental screening and autism-specific screening remain unavailable (Filipek et al., 1999).

However, the National Research Council Report on Educating Children with Autism (2001) reviewed several screening instruments for the detection of ASD. The

Checklist for Autism in Toddlers (CHAT) has been score validated, and the Modified Checklist for Autism in Toddlers (M-CHAT), the Ages and Stages Questionnaire (ASQ), and the Pervasive Developmental Disorders Screening Test (PDDST) are in the process of being score validated. In addition, NECTAS reported that developmental screening instruments, such as the Parents' Evaluation of Developmental Status (PEDS), can accurately provide information about their child's development.

Developmental Screening Instruments

Both general developmental and autism-specific score-validated screening instruments can play a significant role in the earlier identification of young children with ASD (AAP, 2001; National Research Council, 2001). General developmental screening instruments have a wide application with children of varying ages, allow flexibility to obtain parental report with minimal assistance, ask more universal questions of parents, and coordinate with typical developmental milestones. However, due to their broad use, these instruments often lack the sensitivity to screen specifically for autism. Therefore, when results of general developmental screening tools raise concern, follow-up with autism-specific screening instruments is required. General developmental screening instruments that were reviewed in the ASC trainings include the Ages & Stages Questionnaire (ASQ; Bricker & Squires, 1999), the Parents' Evaluations of Developmental Status (PEDS; Glascoe, 1998), and Communication and Symbolic Behavior Scales Developmental Profile Infant Toddler Checklist (CSBS DP Infant Toddler Checklist; Wetherby & Prizant, 2002).

Ages & Stages Questionnaire (ASQ). The ASQ uses parental report for children birth to five years of age. The questionnaire can be administered at a number of age

intervals, from 4 to 60 months. The questionnaire takes approximately 10-15 minutes for parents or caregivers to complete, and 2-3 minutes to score. Developmental areas including communication, gross motor, fine motor, problem solving, and social are addressed. The ASQ provides clear drawings and directions for eliciting thoughtful responses, and separate forms for each age range of 10 to 15 items are tied to the well child visit schedule. The ASQ provides pass or fail scores, and has been well-standardized and score validated with good sensitivity and excellent specificity (Filipek et al., 1999).

Parents' Evaluations of Developmental Status (PEDS). The PEDS is a screening and surveillance tool used with children from birth to eight years of age. It allows clinicians to make evidence-based decisions and is designed to detect a wide range of developmental issues as well as various types of parental concerns. The PEDS identifies when to refer for additional screening or monitor developmental progress. The tool promotes collaboration between parents and providers by eliciting parents' concerns. The parents respond to 10 carefully constructed questions, with 90% of parents completing the written questionnaire while waiting for their appointment. Approximately two minutes are needed to score and interpret the results (Filipek et al., 1999). High, moderate, or low-risk scores are obtained for developmental and behavioral problems. The sensitivity for the PEDS ranges from 74%-79% and the specificity ranges from 70%-80% across age levels (Filipek et al., 1999).

Communication and Symbolic Behavior Scales Developmental Profile Infant Toddler Checklist (CSBS DP). The Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP; Wetherby & Prizant, 2002) is a standardized

instrument designed for routine screening and evaluation of communication and symbolic abilities. This tool was designed for children between 12 and 24 months of age to assess typical communication milestones and parental concern regarding development. The CSBS DP was developed based on the Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 1993), which is a more in-depth tool designed for program planning. The CSBS DP is a brief questionnaire consisting of a 24-item Infant-Toddler Checklist for screening that can be completed by a parent. A longer follow-up Caregiver Questionnaire is available as well as a Behavior Sample. The Behavior Sample consists of a face-to-face evaluation of the child interacting with a parent and physician that is videotaped for later analysis. These three components (Checklist, Caregiver Questionnaire, and Behavior Sample) were designed to measure seven pre-linguistic skills. These skills are organized into three composites: the Social composite, including Emotion and Eye Gaze, Communication, and Gestures; the Speech composite, including Sounds and Words; and the Symbolic composite, including Understanding and Object Use (Wetherby et al., 2004).

The CSBS DP has been field-tested nationally, and the findings provide good evidence for score reliability and validity and support the use of the Checklist as a first-level screening and the Behavior Sample as a second-level evaluation following the Checklist (Wetherby & Prizant, 2002; Wetherby et al., 2002). The CSBS DP appears to be effective for the early identification of young children with ASD as it measures pre-linguistic skills that have been identified as deficits in preschoolers with ASD. Therefore, the CSBS DP Checklist and Behavior Sample are appropriate screening and evaluation tools for identifying children with developmental delays at 12 to 24 months of age

(Wetherby et al., 2004). Use of a parent report tool, such as the Infant Toddler Checklist, minimizes the time required of healthcare providers while maximizing the role of the family. In addition, the Checklist provides reasonably accurate information regarding the need to refer a child for a developmental evaluation (Filipek et al., 1999).

Autism-Specific Screening Instruments

Autism-specific screening instruments have been developed exclusively to screen for autism spectrum disorders. In addition, most of these instruments have been designed to concentrate on social and communication impairment in children aged 18 months and older and focus on all three DSM-IV-TR criteria for autism. At this time, there is a lack of highly score-validated autism-specific screening instruments available for children under the age of 18 months. Autism-specific screening instruments that were discussed in the ASC trainings include the Checklist for Autism in Toddlers (CHAT; Baron-Cohen, Allen, & Gillberg, 1992), the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 2001), and the Pervasive Developmental Disorder Screening Test (PDDST; Siegel, 1998).

Checklist for Autism in Toddlers (CHAT). The Checklist for Autism in Toddlers (CHAT) was developed by Baron-Cohen and colleagues in 1992. The CHAT was developed in an effort to move toward earlier screening and identification of young children, 18 months of age, at risk for autism spectrum disorders. The questionnaire comprises two components; the first of which contains nine items reported by parents, such as whether the child ever demonstrates pretend play. The second component includes five items that require a brief, semi-structured observation by a primary care provider at the well-child visit. These components assess parallel functioning in three

main areas: (a) protodeclarative pointing, (b) gaze monitoring, and (c) pretend play. The CHAT takes approximately 10 to 15 minutes to complete. If a child fails the CHAT, it is recommended that the child be re-screened approximately one month later. If the child fails the CHAT for a second time, the child should be referred to a specialist for further evaluation as the CHAT is not a diagnostic tool.

The ease of administration and its demonstrated specificity to symptoms of autism in children 18 months of age are two strengths of the CHAT (Filipek et al., 1999). Findings from Baird et al.'s (2000) study demonstrated that the sensitivity for the CHAT (number of children identified by the CHAT/number of children with autism in the entire sample) was low (e.g., from 20%-35%). However, the specificity (number of children without autism in the group who were not identified by the CHAT/number of children without autism in the sample) was very high (e.g., from 98%-99.8%) (Scambler, Rogers, & Wehner, 2001). Filipek et al. (1999) concluded that the CHAT appeared to be a useful screening tool for identifying children 18 months of age at risk for autism. However, the CHAT appears to be less sensitive to milder symptoms of autism, such as children with Asperger syndrome or PDD-NOS (Filipek et al., 1999). Baron-Cohen et al. (1996) found that the CHAT has a specificity of 98%, but a sensitivity of 38%, and missed many children at 18 months who were later diagnosed with ASD. While the score validity of the CHAT is disappointing, it indicates the need for further research on young children with ASD and provides important clues to early indicators of ASD, based on the children they were able to identify early (Baron-Cohen et al., 1996).

The Modified Checklist for Autism in Toddlers (M-CHAT). Robins, Fein, and Barton (1999) developed the Modified Checklist for Autism in Toddlers (M-CHAT),

which is an extension of the CHAT. The M-CHAT contains the nine parent-report items from the CHAT, and additional items were developed based on symptoms thought to be present in very young children with autism (Robins et al., 2001). The questionnaire consists of 23 (yes/no) items reported by parents, in contrast to the combined parent report and physician observation used in the CHAT. Because the M-CHAT is a parent-only screening instrument, the range of behaviors assessed is larger than on the CHAT (Charman et al., 2001). Robins et al. suggest that the M-CHAT will have better sensitivity at 24 months of age compared to 18 months of age.

Pervasive Developmental Disorder Screening Test (PDDST). Siegel (1998) developed a parental questionnaire that consists of three stages, each targeting a different level of screening to be used in different settings. The first stage is a parent questionnaire aimed for use in primary care settings with children from birth to 36 months of age. The PDDST rates both positive and negative symptoms, and contains a number of items pertaining to regression. In addition, the PDDST examines temperament, sensory responses, motor stereotypies, attention, attachment, and peer interest (Filipek et al., 1999).

Summary

Unlike the CHAT or M-CHAT, the Infant-Toddler Checklist is not designed to screen specifically for ASD, but rather, is designed as a first-level screen for children with a broad array of communication delays. In regard to the Checklist, findings suggest that children with ASD are likely to have low scores on the Social composite of the Checklist and this pattern could be used to indicate the need to conduct an autism-specific screen next, such as the CHAT or M-CHAT (Wetherby et al., 2004). However, there are

not yet sufficient validity data on the CHAT, M-CHAT, or any other parent report tool to support their use as a second-level screen for ASD in the second year of life, and therefore, further research is needed.

Practice Parameters

Pediatric healthcare providers are typically involved in the identification of ASD because they see young children on a regular basis at well-child visits, which occur quite frequently throughout first two years of life (American Academy of Pediatrics [AAP], 2001). These well-child visits present numerous opportunities to identify children with developmental delays or disabilities early in their development. Therefore, physicians can play a key role in the early identification and subsequent early intervention of infants and toddlers with ASD. Although the physician's role emphasizes the monitoring and screening of the development of young children, limited information is available regarding physicians' actual monitoring and screening practices (Filipek et al., 1999; Sices, Feudtner, McLaughlin, Drotar, & Williams, 2003). Given the importance of early identification and practitioners' role in this process, it is problematic that less than 30% of primary care providers conduct regular standardized screening tests at well-child appointments (Dworkin, 1989).

The American Academy of Neurology and Child Neurology Society endorsed a multidisciplinary consensus panel to review the literature on screening and diagnosis of ASD and make recommendations on practice parameters (Filipek et al., 1999). The consensus panel was developed from nominations from a variety of organizations related to ASD, such as the American Academy of Child and Adolescent Psychiatry and the American Academy of Pediatrics. The panel developed a number of recommendations for

the screening and diagnosis of ASD, with two levels of investigation: (a) Routine Developmental Surveillance and Screening Specifically for Autism, and (b) Diagnosis and Evaluation of Autism (Filipek et al., 1999).

The first level consists of the following recommendations:

1. All professionals involved in early child care should be familiar with the symptoms of ASD to recognize potential social, communicative, and behavioral indicators of the need for further diagnostic evaluation.
2. Developmental screenings should be performed at every well-child visit, and at any age thereafter if concerns are raised (recommended screening tools include ASQ, PEDS, and BRIGANCE).
3. Failure to meet the nearly universally present developmental milestones (no babbling by 12 months, no gesturing by 12 months, no single words by 16 months, no 2-word spontaneous phrases by 24 months, any loss of any language or social skills at any age) is an absolute indication to proceed with further evaluations.
4. Level 1 laboratory investigations, such as audiological assessments and lead screens should be conducted.
5. Professionals should be familiar with and use one of the screening instruments for children with autism (e.g., CHAT, PDDST).
6. The social, communication, and play development and behavior of siblings of children with autism need to be carefully monitored.
7. As mandated by IDEA, a referral for early intervention should be initiated by the primary care practitioner, with children under 36 months of age referred to zero-to-three service systems, and children 36 months of age and older referred to the local

school district.

8. Healthcare providers need to increase their comfort levels in talking with families about ASD.
9. Screening tools for older children with milder symptoms of ASD need to be available in educational and recreational settings.

The second level of recommendations deals with diagnostic issues such as who should make the diagnoses (e.g., professionals who specialize in the treatment of ASD), the criteria on which the diagnoses should be based (e.g., DSM-IV-TR), and the level of sensitivity and specificity that the diagnostic instrument should contain (Filipek et al., 1999). The panel concluded that further research is required to identify more precise early warning signs to differentiate accurately children with ASD from other populations. Pediatric healthcare providers are in a key position to detect communication difficulties in young children earlier on by conducting routine developmental surveillance on all patients. The panel recommended that providers perform routine developmental screenings for ASD at each well child visit using standardized instruments that utilize parental report (Filipek et al., 1999).

In addition, the consensus panel suggested that failure to meet any of the following five milestones is a definite indication for further evaluation: (a) no babbling by 12 months, (b) no gesturing by 12 months, (c) no single words by 16 months, (d) no 2-word spontaneous phrases by 24 months, and (e) any loss of any language or social skills at any age. It is also important to monitor other social communication parameters, such as deficits in joint attention and symbolic communication. Limitations in communication development may be the first symptom evident to parents and professionals. The panel

identified several early indicators that would necessitate further evaluation, including the use of sounds, gestures, words, and word combinations. The panel stressed the importance of recognizing that many of these symptoms also may be evident in children with developmental disabilities who do not have ASD, or in children who are delayed, but naturally catch up without intervention (Filipek et al., 1999).

Although the literature indicates that a number of primary care providers are not routinely screening children for developmental disabilities during well-child appointments, research findings suggest that pediatric healthcare providers are aware of the important role that parental report and knowledge of developmental milestones can have on the early identification of children with ASD (Sices et al., 2003). Sices et al. (2003) found that most physicians reviewed developmental milestones and prompted parents for developmental concerns at preventive care visits. However, only approximately one-half of the physicians used a formal developmental screening instrument. Although it is important for physicians to be aware of the possible usefulness of parental report and knowledge of developmental milestones, it is also critical that physicians are knowledgeable about both general developmental screening instruments and autism-specific instruments. Moreover, it is essential that physicians utilize these tools to enable them to identify children with ASD as early as possible (Sices et al., 2003). However, primary referral sources are often unaware of early warning signs for ASD and frequently take a “wait and see” attitude with parents, which contributes to the delay in referral and subsequent identification, as well as a delay in initiating supports and services (Oser & Shaw, 2001).

A limited number of studies has examined physicians' use of screening instruments to identify young children with developmental delays (Sices et al., 2003). Shonkoff, Dworkin, Leviton, and Levine (1979) examined primary care approaches to developmental disabilities. The results revealed that only 19% of pediatricians reported that their approach to a young child with a language delay would include the use of a standardized developmental screening instrument. Furthermore, 38% of pediatricians indicated that they would use a developmental screening instrument if parents raised a concern about possible mental retardation in their 3-year-old child. Dobos, Dworkin, and Bernstein (1994) conducted a similar study 15 years after the study by Shonkoff et al. (1979). Dobos et al. found that 61% of pediatricians reported use of screening instruments with children suspected of developmental delay (e.g., mental retardation). The pediatricians from this study also were more likely to refer these children to be assessed by specialists compared to the participants from Shonkoff et al.'s (1979) investigation.

Although the use of score-validated screening tools is an effective way in which physicians can identify children with developmental delays, research reveals that more than one-half of children with developmental disabilities are not detected before school entry. Furthermore, physicians often under-identify language-related delays and disabilities in young children (Sices et al., 2003). Consistent use of developmental screening tools could significantly improve physicians' ability to detect children with developmental delays. The use of formal instruments to obtain parental concerns, such as the Parents' Evaluation of Developmental Status (PEDS), also could aid physicians in the

early identification of delays and disabilities and guide the referral process (Sices et al., 2003).

Sices et al. (2003) examined how primary care physicians identify young children with developmental delays. A survey was mailed to a national random sample of pediatricians and family physicians, with a total of 540 surveys returned (341 returned by pediatricians and 199 returned by family physicians). Thus, the overall response rate for the survey was 49.3%, which is similar to the average response rate to mail surveys (i.e., 54%) for physicians (Asch, Jedrziewski, & Christakis, 1997). The survey inquired about the methods used during the preventive care visits at 2 years of age to identify children with developmental delays. Information regarding participants' self-reports of current developmental screening practices were obtained, and several hypotheses were tested examining whether reported identification efforts varied depending on physician beliefs. In addition, participants also were queried about factors that may influence their developmental screening procedures. Five-point Likert-type scales were used to determine the priority of developmental screening compared with other components of the preventive care visit. In addition, physicians were asked to give their opinions about seven statements concerning factors that might impact physicians' surveillance or screening practices (Sices et al., 2003).

Findings from this study revealed that during routine preventive care visits with 2-year-old children, most physicians reported using a list of developmental milestones as well as the prompting of parents for specific concerns in multiple areas of the child's development. One-half of the pediatricians and more than one-half of the family physicians reported using some form of score-validated instrument for developmental

screening. Approximately one-half of all the physicians reported that they used a specific score-validated developmental screening instrument as part of their routine practices with children ages 1 to 3 years. Finally, pediatricians and family physicians reported using a similar group of available screening instruments (Sices et al., 2003). It is problematic that even with the research support for early identification and screening practices, many providers are not consistently screening all of their young patients during well-child visits (Filipek et al., 1999). The following section details a number of potential factors that could impede the routine screening of young children for developmental disorders such as ASD.

Barriers to Pediatric Healthcare Providers' Use of Screening Instruments

As noted earlier, given the research support for the benefits of early identification and intervention, it is crucial that children are identified at as early an age as possible. Although there is substantial evidence for symptom onset prior to 18 months of age, many children with ASD are not diagnosed until six years of age (Filipek et al., 1999). There are several hypotheses as to the reasons for the delay between presence of symptomatology and diagnosis in children with ASD.

One hypothesis is that the primary referral sources, such as pediatric healthcare providers, may be unfamiliar with the early warning signs of ASD, and therefore are hesitant to refer these young patients for services. When practitioners are unfamiliar with the warning signs of ASD, or are unfamiliar with the disorders in general, their self-efficacy in relation to identifying young children with ASD may be low. Perceived self-efficacy refers to a person's beliefs about their ability to produce desired outcomes and exercise control over events that affect their lives (Bandura, 1994). When people doubt

their capabilities, they are more likely to shy away from difficult tasks that they view as personal threats (Bandura, 1994). However, when self-efficacy is high, people approach difficult tasks as challenges to be overcome rather than as threats to be avoided. In addition, efficacious persons tend to become deeply engrossed in activities and set challenging goals while maintaining a strong commitment to them (Bandura, 1994). Therefore, it is crucial that practitioners feel confident and knowledgeable in their abilities to screen and identify young children at-risk for ASD.

Another significant dilemma for healthcare providers is that identification must precede the provision of services, and they may be hesitant to recommend a complete evaluation for developmental disabilities for fear it will bring about anxiety in parents. Furthermore, there is warranted concern regarding the emotional impact on the family with the diagnosis of ASD, as some continue to hold the belief that ASD carries a poor prognosis (AAP, 2001; Oser & Shaw, 2001). This apprehension could contribute to the delayed identification of children with milder symptoms, as those with evident delays are more likely to be identified earlier (AAP, 2001).

Recently, advances have been made in behavioral diagnostic criteria that have lowered the potential age of diagnosis from around 5 years of age to as early as 18 months of age (Filipek et al., 1999). The consideration of additional behaviors not previously thought to be diagnostic, such as motor behaviors, also have helped to lower the potential age of diagnosis, with some research supporting accurate diagnosis at 8 to 12 months of age (Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998).

The diagnostic features that are indicative of ASD typically develop throughout the first two years of life; therefore, ASD should be evident in very young children.

Based on retrospective accounts, most caregivers report that their children with ASD displayed symptoms within the first two years of life (Wimpory, Hobson, Williams, & Nash, 2000). Furthermore, most families express concern to their pediatrician by the time their child is 18 months of age (Howlin & Moore, 1997). Although many children with ASD are not diagnosed until at least three years of age, a diagnosis of ASD at two years of age was found to be associated with the same diagnosis at three years of age or older in the vast majority of children. Therefore, diagnoses of ASD in children two years of age is as reliable (and consistent) as diagnoses made in children three years of age or older (Lord, 1995; Stone et al., 1999). Children with ASD may not be identified during the first two years of life because although some indicators of ASD commonly are present by two years of age (e.g., impairments in social interaction and communication), others are not evident until later. For example, restricted and repetitive activities and interests are common indicators of ASD, yet these behaviors typically are not present until closer to 3 years of age. This delay in the onset of symptomatic behaviors could be a significant factor in the later diagnosis of ASD in a majority of children (Wetherby et al., 2004).

Sices et al. (2003) also examined the barriers to the use of screening instruments for physicians. Findings indicated that less than one-half of physicians agreed that there is adequate time to perform developmental screening during a typical well-child visit. Furthermore, very few agreed that reimbursement for well-child visits is sufficient to cover the time spent on developmental screenings. Pediatricians reported feeling confident in their care of a child diagnosed with a developmental delay more than twice as often as family physicians. Pediatricians also were twice as likely as were family physicians to agree that sufficient resources exist in their communities to address the

needs of children with delays. Finally, pediatricians also were two times as likely as were family physicians to report that they possess the clinical expertise to identify most children with developmental delays without the use of a developmental screening instrument (Sices et al., 2003).

In summary, findings from this study indicate that most physicians rely on lists of developmental milestones and/or prompting for parental concern to identify children with developmental delays. Physicians also reported time and reimbursement as significant barriers to the use of screening instruments. The authors from this study concluded that although the barriers to developmental screening in primary care are significant, most physicians are aware of the value of early intervention services for young children with developmental delays (Sices et al., 2003).

Halfon et al. (2001) also conducted a study to examine the barriers to the early identification of developmental disabilities. In 2000, a survey was administered to members of the American Academy of Pediatrics (AAP) to identify relevant barriers to the timely identification of developmental issues in primary care practice. More specifically, they sought to ascertain the barriers to the use of score-validated screening instruments. In regards to children birth through 35 months of age, participants were asked to describe the barriers to the provision of developmental assessments during pediatric health supervision as a function of practice characteristics. Halfon et al. found that 94% of the participants agreed that pediatricians should inquire about children's development. In addition, 80% of the participants felt confident in their ability to advise parents; however, 65% reported less adequate training, and only 36% agreed that there was adequate time for developmental assessments (Halfon et al., 2001).

Insufficient time to administer screening instruments (80%) and reimbursement issues (56%) were the most frequently cited barriers to utilizing formal developmental screening instruments (Halfon et al., 2001). Participants also reported barriers such as lack of available staff to assist with developmental assessments (51%), unfamiliarity with coding for reimbursement (46%), lack of developmental diagnostic and treatment services (34%), and lack of training (28%) (Halfon et al., 2001). Unfamiliarity with screening instruments and lack of referral programs also were viewed by pediatricians as significant barriers to the use of developmental screening instruments (Halfon et al., 2001).

Although a number of barriers to the use of screening instruments were reported by providers, there are ways in which these barriers can be overcome. Because insufficient time to administer screening instruments was reported as the most significant barrier to screening practices, it is important to note that score-validated parent questionnaires may be used to minimize the time needed by providers to administer screening instruments (Halfon et al., 2001). In addition, parental concern about a child's development also may be a reliable predictor of developmental delays. It would be beneficial to ascertain the extent to which primary healthcare providers are utilizing parental report questionnaires for developmental screening. As Halfon et al. found, a wide variation exists in the reported practice in the utilization of score-validated screening instruments in primary care. Thus, future research needs to be conducted on the early identification of children with developmental delays.

In the survey conducted by Halfon et al. (2001), approximately one-half of the physicians reported that they use a score-validated developmental screening instrument in

their practices. However, although physicians report that they are using a variety of methods to identify children with delays, a significant number rely only on lists of developmental milestones or prompting for parental concern. In addition, because providers do not have adequate time to administer screening instruments, when they are utilized it is likely that they are not used in a standardized manner, which diminishes their score validity (Halfon et al., 2001). The increased use of parent questionnaires that yield valid scores (e.g., ASQ, PEDS) will ameliorate the time constraint providers' face, which is a significant barrier to their use of screening instruments. Additionally, as providers continue to cite reimbursement as a central barrier to the utilization of developmental screening instruments, this issue needs to be addressed at a policy level (Halfon et al., 2001).

Importance of Training for Providers in Identifying Children with ASD

The American Academy of Pediatrics (AAP) developed practice guidelines that recommend routine developmental screening and surveillance to be conducted specifically for autism on all children. Routine developmental screening first would identify children at risk for any type of atypical development, and also would identify those specifically at risk for autism (AAP, 2001). However, a number of healthcare providers do not feel comfortable utilizing developmental screening instruments because of a lack of training. In addition, they may not know how to implement these guidelines successfully to perform accurate developmental screenings with young patients (Halfon et al., 2001). Therefore, healthcare providers would benefit from specific guidance on how to incorporate routine developmental screenings into their practices because a lack of guidance may result in the delay of identification and appropriate intervention services

(AAP, 2001). When children with developmental delays or disabilities are identified and receive treatment early, the negative impact on the functioning of both the children and the families may be greatly reduced.

It is critical that trainings address the barriers that prevent healthcare providers from routinely using developmental screening instruments with their patients, such as time constraints and reimbursement issues. There are continuing efforts to increase awareness of ASD in practitioners, including knowledge of developmental milestones, warning signs for development that is not following expected trajectories, and score-validated screening instruments (Oser & Shaw, 2001). Because of the importance of receiving appropriate training to identify young children with developmental disabilities, it is problematic that the majority of pediatric healthcare providers are not routinely using developmental screening tools.

Halfon et al. (2001) found that family physicians reported substantially lower self-efficacy to support children with developmental delays/disabilities compared to pediatricians. In addition, family physicians also perceived community resources as being less available to support these children compared to reports from pediatricians. These findings underline the importance of providing all healthcare providers who work with children specific educational interventions. These specific interventions should be tailored to improving confidence in managing children with developmental delays/disabilities, as well as increasing their awareness of available community resources. Furthermore, interventions also could help to improve the availability of resources within some communities (Halfon et al., 2001).

Summary

Autism is a neurodevelopmental disability that affects the functioning of the brain and typically appears during the first three years of life. The primary features of autism are the presence of abnormal or impaired development in communication and social interaction, and a restricted repertoire of behaviors and interests. Because the etiology of autism spectrum disorders (ASD) is unknown, interventions for individuals with ASD are developed to reduce the interfering symptoms. Given the recent increases in the number of children diagnosed with ASD, it is crucial that children are identified early on so that they receive the services needed (Filipek et al., 1999; Oser & Shaw, 2001).

Growing evidence demonstrates the effectiveness of intensive early intervention with a significant proportion of young children with ASD (Dawson & Osterling, 1997; Filipek et al., 2000; Oser & Shaw, 2001). Dawson et al. (2000) found that as the prenatal and early postnatal years represent a sensitive period for brain and behavioral development, increased efforts at early identification and intervention are needed. Negative consequences for individuals with ASD can be minimized or avoided completely with the promotion of optimal prenatal and infant-toddler development, as long-term consequences have their greatest influence during early child development.

It is recommended by the American Academy of Pediatrics (AAP) that all infants and children are screened for developmental delays or disabilities (AAP, 2001). The National Research Council Report on Educating Children with Autism (2001) reviewed several screening instruments for the detection of ASD. The Checklist for Autism in Toddlers (CHAT) has been score validated, and the Modified Checklist for Autism in Toddlers (M-CHAT), the Ages and Stages Questionnaire (ASQ), and the Pervasive

Developmental Disorders Screening Test (PDDST) currently are in the process of being score validated. In addition, NECTAS reported that developmental screening instruments, such as the Parents' Evaluation of Developmental Status (PEDS), can accurately provide information about children's development. Greater public awareness and education of healthcare providers in regard to the early detection of developmental disorders and how to access appropriate interventions are needed. Providers need to be proficient in the identification of early symptoms of autism so that appropriate screening and referral procedures can occur.

The NECTAS Forum on ASD discussed strategies for earlier identification, including raising public and professional awareness, tools for screening, determining eligibility for services, and transitioning. The early identification of children with developmental disabilities requires that healthcare providers are familiar with score-validated screening instruments. It is also critical that they feel comfortable discussing parental concerns, and that they are knowledgeable about referral resources in their communities (AAP, 2001). Although the physician's role emphasizes the screening of the development of young children, limited data are available regarding physicians' actual monitoring and screening practices (Filipek et al., 1999; Sices, Feudtner, McLaughlin, Drotar, & Williams, 2003). It is problematic that less than 30% of primary care providers conduct regular standardized screening tests at well-child appointments, given the importance of early identification and healthcare providers' role in this process (Dworkin, 1989).

The American Academy of Pediatrics (AAP) developed practice guidelines that recommend routine developmental screening and surveillance to be conducted

specifically for autism on all children. Routine developmental screening first would identify children at risk for any type of atypical development, and also would identify those specifically at risk for autism (AAP, 2001). However, a number of healthcare providers do not feel comfortable utilizing developmental screening instruments because of a lack of training. In addition, they may not know how to implement these guidelines successfully to perform accurate developmental screenings with young patients (Halfon et al., 2001). Healthcare providers would benefit from guidance on how to incorporate routine developmental screenings into their practices because a lack of guidance may result in the delay of identification and appropriate intervention services (AAP, 2001). When children with developmental delays or disabilities are identified and receive treatment early, the negative impact on the functioning of both the children and the families may be greatly reduced. Future research is needed to examine the effectiveness of trainings for healthcare providers regarding screening practices and early identification of ASD.

Chapter 3

Method

Participants

The participants in this study were pediatric healthcare providers who practiced medicine and resided in the state of Florida. Selected participants attended one of three field-test training sessions held throughout Florida. The number of pediatricians currently practicing in the state of Florida is approximately 3,423 (American Academy of Pediatrics [AAP], 2000). All geographic locations throughout Florida were considered for the settings of the training, with the expectation that each of the three training sessions would be held in three different geographic areas, with at least one location defined as rural, and at least one location defined as urban. The participants were recruited to participate in the training sessions from the following geographic regions: Clewiston, Jacksonville, and Tampa, Florida. These geographic areas were selected because of availability and interest in the ASC training in these locations. More specifically, the first training session was held on Wednesday, May 4, 2005 at the University of South Florida, Florida Mental Health Institute from 6:00 p.m. to 7:00 p.m. The second training session was held on Wednesday, May 18, 2005 at the Duval County Health Department from 3:00 p.m. to 4:00 p.m. The third training session was held on Wednesday, June 1, 2005 at the Hendry Regional Medical Center from 12:00 p.m. to 1:00 p.m. A fourth training session at the University of South Florida, Florida Mental Health Institute was added in an attempt to obtain more participants to complete the ASC training. Unfortunately, no

participants took part in this last training session. The criteria for participation in the ASC training session were: (a) residence in the state of Florida and (b) provision of services to the pediatric population. Therefore, variability in age, gender, race, geographic location, profession, setting of practice, years in practice, and number of trainings completed related to ASD was expected.

Selection of Participants

Participants were selected based on their professional roles and the geographic location where they practiced medicine. One major goal of this training focused on reducing barriers to screening by problem solving ways in which to change practice; therefore, the main aim was to recruit pediatricians and pediatric nurse practitioners because they are most likely to be in the position to facilitate change within their practices. Furthermore, the primary interest of this study was in the screening practices of physicians because research demonstrates that the majority of physicians (i.e., 86%) indicate they are predominantly responsible for developmental screening and/or surveillance (Sices et al., 2003). However, registered nurses and other pediatric healthcare professionals also were recruited for participation in the ASC training.

Prior to the recruitment of any participants, approval for this study was obtained from the University of South Florida Institutional Review Board (IRB) to ensure the ethical treatment of the participants in this study. Pediatric healthcare providers were recruited to participate in the ASC training by contacting department chairs in the division of pediatrics via telephone. In addition, three flyers detailing the learning objectives of the training sessions were developed by the ASC workgroup (see Appendix A). These flyers were electronically mailed to the workgroup for dissemination to

practitioners via email. For the first training, flyers also were posted on the University of South Florida campus. Additionally, workgroup members distributed the flyers at the Hillsborough County Pediatrics Society (HCPS) Meeting on April 20, 2005, and the HCPS meeting on April 21, 2005. For the second training, flyers were disseminated by a pediatrician who practices medicine in Jacksonville, Florida. For the third training, flyers were disseminated both via electronic mailings and postings at the Hendry Regional Medical Center and the Hendry County Health Department in Clewiston, Florida. Physicians who participated in the ASC training received one Continuing Medical Education (CME) credit, and nurse practitioners who participated received one Continuing Education Unit (CEU).

The pediatric healthcare providers were invited to participate in one of the three ASC trainings based on location. The original goal was to train a minimum of 100 pediatric healthcare providers throughout the state of Florida, as stipulated by the grant that funded the ASC trainings. Unfortunately, this goal was not obtained because only 36 practitioners completed the ASC training. To obtain a statistical power of .80 for detecting a medium effect size for comparing the two experimental locations at the .05 level of significance, using a repeated measures analysis of variance (ANOVA), a minimum of 40 participants was needed (Cohen, 1988). Practitioners who agreed to participate in the ASC training were placed in one of two experimental groups based on their geographic location (i.e., rural or urban). It was hoped that there would be approximately the same number of participants who attended each of the three training sessions and who participated in the study. Pre- and post-test analyses were conducted to determine if there were statistically significant differences among the three training

groups and whether any of the groups could be collapsed. All training participants were invited to participate in this study, with the expectation that virtually all participants in the trainings would complete the pre-test questionnaire. However, it was expected that approximately 50 participants would complete both the pre- and post-questionnaire because research demonstrates the average response rate to mail surveys for physicians is 54% (Asch et al., 1997).

Practitioners in the state of Florida who had not participated in the ASC trainings were asked to take part in the control group. These pediatric healthcare providers were contacted via mailings to their places of employment describing the goals and purpose of the study. These participants met the same criteria of the participants in the experimental group (e.g., practicing medicine in the state of Florida, and working with the pediatric population). The researcher attempted to contact approximately 50 providers, with the goal of obtaining a minimum of 25 participants for the control group. Attempts were made to recruit participants for the control group from the same three geographic regions as participants in the experimental group. Questionnaires were mailed multiple times, as necessary, to attain at least 25 participants in the control group to ensure that the sample size was large enough to obtain adequate statistical power.

The sampling scheme used for this study represented non-random, convenience sampling. The participants were arranged into one of three groups based on geographic location and participation in the ASC training. The groups were as follows: (a) rural-experimental group, (b) rural-control group, (c) urban-experimental group. Participants in the control group were recruited from a region in central Florida. Because the participants

were assigned to training groups based on their geographic location and participation in the ASC trainings, they were not randomly assigned to the three groups.

Research Design

This study utilized a quasi-experimental research design. Specifically, the type of quasi-experimental design was a pretest-posttest nonequivalent-groups design (Best & Kahn, 2003). Quasi-experimental designs provide the researcher control of when and to whom the measurement is applied; however, participants were not randomly assigned to experimental and control treatments. Therefore, the equivalence of the groups could not be assured (Best & Kahn). The pretest-posttest nonequivalent-groups design is commonly used when experimental and control groups are naturally assembled groups (Best & Kahn). This design was used because it was the most feasible design for this study. The researcher did not have any influence over the assignments of participants to the experimental group and the control group; therefore, similarity across groups with respect to important characteristics, such as knowledge of ASD or use of screening instruments could not be controlled.

Variables

Several dependent and independent variables were measured in this study. The dependent variables were the strength of barriers pre- and post- training, screening tools utilized (both general and autism-specific), perceived levels of general knowledge related to ASD, and self-efficacy of participants in relation to accurate screening practices. The independent variable in this study was the type of training: Autism System of Care training (i.e., experimental group) versus no training (i.e., control group).

Instrument

Pediatric Healthcare Provider Self-Report Questionnaire

The Pediatric Healthcare Provider Self-Report Questionnaire was developed by the principal investigator for the purpose of this study. This measure was designed to assess the effect of the Autism System of Care training on pediatric healthcare providers' change in practice regarding the method of ASD early identification. The questionnaire contains a total of four sections: (a) general knowledge of Autism Spectrum Disorders, (b) use of screening instruments, (c) perceived barriers to utilization of screening instruments, and (d) demographic information. The first three sections of the questionnaire were covered in the ASC trainings.

The first section of the Pediatric Healthcare Provider Self-Report Questionnaire, entitled "General Information," contains a total of six items. The first four items in this section assess perceived levels of knowledge of ASD, such as knowledge of autism-specific screening instruments and knowledge of early warning signs of ASD. These items utilize a four-point rating scale (1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent), asking participants to rate their levels of knowledge by circling the most appropriate number that corresponds with their perceived levels of knowledge. An example of an item is, "How would you assess your overall knowledge of early warning signs of ASD?" The scale used for this section is the Perceived Knowledge Scale, which is divided into two parts. The first part contains four items utilizing a four-point rating scale (i.e., 1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent). The response for each item is summed to generate a total scale score. The scores range from 4 to 16, with high scores indicating the participant perceives herself/himself to have excellent knowledge related to ASD. The

last two items in this section assess participants' self-efficacy regarding their ability to screen and refer children suspected of having an ASD. The format of the last two items is open-ended, with participants asked to indicate the age, in months, at which they believe children can be accurately screened and referred for Autism Spectrum Disorders, and the age at which they believe they themselves can accurately screen and refer children suspected of having Autism Spectrum Disorders.

The second section, entitled "Screening Patterns," contains three subsections related to use of screening instruments. The screening instruments included in the questionnaire are the same instruments that were chosen for review in the ASC training sessions. These instruments were selected for the training sessions based upon two factors known to impact their use: (a) time to administer the instrument and (b) cost of the instrument (Halfon et al., 2001). For all three subsections, participants were asked to indicate on a five-point rating scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Usually, 5 = Always) how often they use each individual screening tool, and how often they use developmental screening tools with patients in different age groups.

Subsection A contains items regarding participants' use of three general developmental screening instruments, including the Ages & Stages Questionnaire (ASQ), Parent's Evaluation of Developmental Status (PEDS), and Communication and Symbolic Behavior Scales Developmental Profile: Infant-Toddler Checklist (CSBS DP). Subsection B has items regarding use of the following three autism-specific screening instruments: the Checklist for Autism in Toddlers (CHAT), the Modified Checklist for Autism in Toddlers (M-CHAT), and the Pervasive Developmental Disorder Screening Test (PDDST). The Screening Scale corresponds with Subsections A and B in the second

section (i.e., Screening Patterns). The developmental subscale consists of three items utilizing a five-point rating scale (i.e., 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Usually, 5 = Always). The response for each item is summed to generate a total subscore. The scores for this subscale range from 3 to 15, with high scores indicating frequent use of developmental screening instruments. The autism-specific subscale contains three items utilizing the same five-point rating scale as the developmental subscale. The scores from this subscale also range from 3 to 15, with high scores indicating frequent use of autism-specific screening instruments. The total screening scale (i.e., developmental scale and autism-specific scale) ranges from 6 to 30.

Subsection C contains items regarding how often participants use developmental screening instruments in relation to seven age ranges of patients. Ages were grouped in either 6- or 12-month increments, based on the recommended ages for well-child visits (e.g., 0-6 months, 7-12 months, 13-18 months, 19-24 months, 25-36 months, 37-48 months, and older than 48 months) (AAP, 2001). The Age of Screening Scale corresponds with Subsection C from the Screening Patterns section, and each item from this scale was assessed individually.

The third section of the instrument assesses the perceived impact of potential barriers on participants' use of screening instruments. Potential barriers were developed by reviewing the literature on barriers related to the use of developmental screening instruments and the referral of patients suspected of ASD for further evaluation. Participants were asked to indicate on a four-point Likert-type scale (1 = Unlikely, 2 = Somewhat Unlikely, 3 = Somewhat Likely, 4 = Very Likely) the extent to which specific barriers (n = 7) were likely to impact their ability to screen or refer patients for further

evaluation. An example of an item in this section is, “Insufficient information regarding referral resources.” The Barriers Scale is the fourth scale on the questionnaire. The responses were summed to yield a total scale score. Scores from this scale range from 7 to 28, with high scores indicating the potential barriers are very likely to impede use of screening instruments.

The fourth and final section of the questionnaire contains nine items that elicit demographic information. The following information was gleaned: (a) age, (b) gender, (c) race, (d) location of practice, (e) profession, (f) setting of practice, (g) years in practice, (h) number of trainings completed related to Autism Spectrum Disorders, and (i) number of trainings completed related to changing practice/service delivery. For number of years in practice, and number of trainings completed related to both ASD and changing practice/service delivery, participants were asked to write in the appropriate number. For all other demographic items, multiple-choice options were provided (e.g., for race: White [Non-Hispanic], Black/African American, Hispanic, Asian/Pacific Islander, Native American, Multi-Racial/Ethnic, Other). The Pediatric Healthcare Provider Self-Report Questionnaire is presented in Appendix B.

The Pediatric Healthcare Provider Self-Report Questionnaire was reviewed by an expert panel to assess its content-related validity. The panel comprised group members who developed the ASC trainings (n = 6), including pediatricians (n = 3), professors from related fields (n = 2), and the director of an autism center in the region (n = 1). No members from the expert panel participated in this study. Copies of the questionnaire were distributed to the expert panel to obtain feedback on each of the items. The researcher conducted semi-structured interviews with members of the expert panel to

review the items on the questionnaire. The panel believed that the first draft of the questionnaire was too long with 47 items, and as a result, participants might be less likely to complete the questionnaires. Therefore, the panel recommended removing 12 items from the questionnaire that were not as strongly related to the content of the ASC trainings as the remaining items. The panel also suggested reducing the length of the questionnaire so that the 35 items fit onto two pages. These changes were made, and the final version of the copy was distributed to the panel and was subsequently approved by all panel members.

The questionnaire was completed both prior to and approximately two to three months after completion of the training session. This time frame was chosen after discussion with several pediatricians from the expert panel. It was agreed among the panel members that two to three months was an appropriate time period to measure change in screening practices for pediatric healthcare providers. Approximately one week following the initial mailing of the post-test questionnaire, a follow-up postcard was sent to participants to remind them to complete and return the post-test questionnaire. Approximately two weeks following the reminder postcard, the post-test questionnaire was resent to all participants who had not returned the completed post-test questionnaire. Two weeks after the second mailing of the post-test questionnaire, a final reminder postcard was sent to participants who had not returned the completed post-test questionnaire.

Procedures

The procedures for this study included the researcher identifying the content to be disseminated in the Autism System of Care trainings, developing the Pediatric Healthcare

Provider Self-Report Questionnaire based on the content of the trainings, and obtaining approval from the Institutional Review Board. After the training materials were developed and finalized by the ASC group members, the researcher developed the questionnaire based on the content that was to be included in the Autism System of Care training sessions.

The Autism System of Care training was developed from a one year extension grant that was funded by the Florida Developmental Disabilities Council. The previous grant (i.e., year one) surveyed pediatricians throughout Florida, and based on the results of the survey responses, it was determined that a need existed in Florida to provide more information about early screening and referring for ASD. The Autism System of Care training sessions were one hour in length, and were structured as workshops for the participants. The locations of the training sessions were: (a) Clewiston, FL, (b) Jacksonville, FL, and (c) Tampa, FL. Two pediatricians involved in the development of the ASC training facilitated the training sessions. One of the presenters is a developmental pediatrician who practices medicine in Pinellas County, Florida. The other presenter is a general pediatrician who practices medicine in Duval County, Florida. Both physicians had considerable knowledge related to ASD and the importance of early identification. The goal of the training was to improve pediatric healthcare providers' screening practices for the early identification of children with ASD. Therefore, the sessions included a brief overview of ASD (e.g., definition, areas of impairment, and etiology), a review of the warning signs of ASD, and a review of common screening instruments. In addition, a discussion regarding the importance of early screening and identification and the barriers to routine screening practices occurred. Finally, a model for

improving screening practices was discussed, and participants were asked to create aim statements for changing their practices and develop the next steps to initiate these changes. The presenters utilized a PowerPoint presentation to ensure that the same material was presented to all participants in the three training sessions. Each session included a PowerPoint presentation and individual and small group activities related to the material in the presentation. In addition, participants received handouts containing the slides from the presentation, as well as handouts containing additional information regarding screening instruments. To ensure that all learner objectives were covered in each of the training sessions, an implementation checklist was developed by the researcher (see Appendix C). The implementation checklist contained 27 items directly from the PowerPoint presentation. The researcher indicated the extent to which each item was covered by placing a checkmark in either the "Yes," "Partially," or "No" column.

In regard to the questionnaires, arbitrary identification numbers created by the researcher were included on the actual questionnaire forms to ensure anonymity. A cover sheet was attached to each questionnaire (i.e., pre- and post-test questionnaires) detailing the purpose of the study and expressing gratitude for participation in the study. In addition, the cover sheet included information regarding an incentive for completing and returning the post-test questionnaire. When a post-test questionnaire was returned, the identification number on the questionnaire was entered into a drawing. There were two $25 gift certificates awarded; one to a participant who completed the ASC training and one to a participant from the control group. Participants were asked to include their names and email addresses on the bottom of the pre-test cover letter to receive summaries of individual and/or overall results from the study. The email addresses also were used to

contact the two winners from the drawings. Participants were asked to provide their names on the cover sheets for the pre-test questionnaire only. The cover sheets attached to the post-test questionnaires did not require participants to provide their names.

Each questionnaire cover sheet contained a unique identification number and was attached to a questionnaire with the corresponding identification number. The cover sheets attached to the pre-test questionnaires subsequently was detached by the researcher to separate identifying information (i.e., names) from the completed questionnaires. The identification numbers on the pre-test questionnaire cover sheets were used to match participants' names to the corresponding pre-test questionnaires. The post-test questionnaire utilized the same identification number as the pre-test questionnaire for each individual participant.

A sign-in sheet was posted at each training session. When participants arrived for the trainings, they were asked to sign in and provide their current mailing addresses. Immediately prior to the training session, the researcher distributed the pre-test questionnaires to the participants and collected the completed questionnaires and cover sheets before the start of the session. A master list of participants was created to match each participant's name with his/her unique identification number and corresponding pre-test questionnaire. The post-test questionnaires, along with a return addressed, stamped envelope, were mailed to the participants approximately 8 to 12 weeks after completion of the training. These questionnaires contained only the unique identification numbers printed on the cover sheets and questionnaires. Therefore, the participants were able to return the post-test questionnaires without any identifying information.

The researcher matched the post-test questionnaires' identification numbers with the corresponding pre-test questionnaires' identification numbers. Once the pre- and post-test questionnaires were matched, all identifying information was removed and discarded. All data obtained from the questionnaires were accessible only to the researcher and were stored in a locked file cabinet. The control group completed the questionnaire twice, during the same time period as the experimental groups. That is, the control group completed the first copy of the questionnaire (pre-test) sometime between April and May of 2005, which was the time period for the three ASC training sessions. Participants in the experimental groups and the control group completed the post-test in July or August of 2005. Once all questionnaires were returned, the researcher conducted analyses, interpreted the results, and presented the findings.

Analyses

Pre-Test Analyses

Once all pre-test questionnaires were completed by the participants and returned to the researcher, the data were analyzed. Descriptive statistics were computed for both pre- and post-test data pertaining to all of the scales. In addition, descriptive statistics were computed for the participants' demographic information. Next, an exploratory factor analysis was conducted to examine the construct-related validity of scale scores, and to reduce the number of items within each scale by grouping items that were moderately to highly correlated with one another (Fraenkel & Wallen, 2003). For each scale and subscale that emerged from the factor analysis, score reliability coefficients were computed using Cronbach's alpha for each treatment group (i.e., control and experimental groups) and as a whole (Glass & Hopkins, 1996).

To assess regional differences in responses at pre-test, a series of independent samples *t*-tests was used to compare participants from the rural areas and those from urban areas across the subscales that comprised the three main sections of the questionnaire (e.g., perceived levels of knowledge and self-efficacy, screening practices, and perceived barriers). The urban and rural groups were not differentiated if no statistically significant differences emerged. In addition, to examine pre-existing differences between treatment groups, a series of independent samples *t*-tests was used to compare participants from the experimental group and those from the control group across the subscales that comprised the three main sections of the questionnaire. If no statistically significant different emerged between the experimental and control groups, then it was assumed that the experimental groups and control groups did not differ on the outcome variables prior to the intervention.

To determine the relationship between pediatric healthcare providers' perceived barriers to utilizing screening instruments and their actual use of screening instruments before completion of the ASC training, a Spearman rank correlation coefficient was conducted on the pre-test measures. A 5% level of significance was used to test this relationship. An effect size was interpreted if statistical significance was found. Cohen's (1988) criteria were used to interpret effect sizes (i.e., .1 = small, .3 = medium, .5 = large).

Post-Test Analyses

The following research questions were addressed in this study:

Research question 1. What is the effect of the Autism System of Care (ASC) training on use of developmental and autism-specific screening instruments by pediatric

healthcare providers? To address this question**,** a 2 X 2 repeated-measures ANOVA was conducted. The repeated-measures ANOVA was conducted to determine if there was a statistically significant difference in outcomes between the experimental group and control group. In addition, the results from the repeated-measures ANOVA indicated whether there was a statistically significant difference in outcomes between the two time points (i.e., pre-test and post-test), as well as if there was a statistically significant interaction between group and time (Maxwell & Delaney, 1990). The repeated-measures ANOVA, also called a split-plot design, is especially valuable for comparing groups across time longitudinally (Maxwell & Delaney, 1990). The between-subjects factor in this analysis was group (i.e., experimental group vs. control group). The within-subjects factor was time (i.e., pre-test and post-test). Because two outcomes (i.e., dependent measures) were of interest, namely, use of developmental screening instruments (Range = 3 to 15), and use of autism-specific screening instruments (Range = 3 to 15) two sets of 2 X 2 repeated-measures ANOVA were conducted.

Research question 2. What is the effect of the ASC training on the use of developmental screening instruments in regards to age of patient? To address this question, Wilcoxon's signed rank test was undertaken. A 5% level of significance (i.e., alpha level of .05) was used (Glass & Hopkins, 1996). Bonferroni's adjustment was used to keep alpha level of significance at 5% (Glass & Hopkins, 1996).

Research question 3. What is the effect of the Autism System of Care training on pediatric healthcare providers' perceived barriers to increasing the use of screening instruments and/or referring patients? Two sets of 2 X 2 repeated-measures ANOVA were conducted to address this question. The between-subjects factor in this design was

group (i.e., experimental group vs. control group) and perceived levels of barriers were the dependent variables, whose pre- and post-measures served as the within-subjects factor.

Research question 4. What is the effect of the Autism System of Care training on pediatric healthcare providers' perceived levels of knowledge related to Autism Spectrum Disorders? A 2 X 2 repeated-measures ANOVA was conducted to address this research question. The between-subjects factor was group (i.e., experimental group vs. control group) and perceived levels of knowledge were the dependent variables, whose pre- and post-measures served as the within-subjects factor.

Research question 5. What is the effect of the Autism System of Care training on the self-efficacy of pediatric healthcare providers regarding the ability accurately to screen and refer a child suspected of having an Autism Spectrum Disorder? Two separate 2 X 2 repeated-measures ANOVAs were conducted to address the fourth research question. The between-subjects factor was group (i.e., experimental group vs. control group) and perceived levels of self-efficacy of participants were the dependent variables, whose pre- and post-measures served as the within-subjects factor.

Research question 6. What is the relationship between pediatric healthcare providers' perceived barriers to utilizing screening instruments and their actual use of developmental and autism-specific screening instruments before and after completion of the training? To address this research question, two Spearman rank (order) correlation coefficients were conducted (i.e., for pre- and post-test scores) to determine the degree of relationship between each pair of scores (Fraenkel & Wallen, 2003). The independent variables were level of perceived barriers, and the dependent variables were (a) use of

developmental screening instruments (Range = 3 to 15), and (b) use of autism-specific screening instruments (Range = 3 to 15).

Research question 7. What is the relationship between perceived barriers to utilizing screening instruments and the use of developmental screening instruments in regard to age of patients before and after completion of the training? To address this research question, a series of Spearman rank correlation coefficients was computed for both pre- and post-test scores. The independent variable was level of perceived barriers and the (seven) dependent variables were the frequency of use of developmental screening instruments in regard to seven age ranges of children. The Bonferroni adjustment was used to control for the inflation of Type I error. Specifically, a Bonferroni-adjusted alpha value of .007 (i.e., .05/7) was used to reflect the fact that seven correlations were computed.

Chapter 4

Results

Treatment of the Data

The data were entered into an Excel spreadsheet by the researcher and another school psychology graduate student following the completion of both the pre-test and post-test questionnaires. Each score was entered for every participant on each individual item. Missing data were coded as a blank space in the Excel document. The researcher and another school psychology graduate student checked the data by randomly selecting participants' identification numbers and matching the data in the database to the entrees completed by hand by the randomly selected participant. Additionally, extreme values were checked across each participant for each item to ensure that the data were entered correctly. Inter-rater reliability was 100%.

Missing Data Analysis

At pre-test a total of 49 pediatric healthcare providers participated, comprising 25 in the experimental group and 24 in the control group. At post-test a total of 26 pediatric healthcare providers participated, consisting of 13 in the experimental group and 13 in the control group. This represented an overall completion rate of 53.1%, a completion rate of 52% for the experimental group and 54.2% for the control group.

Of those who completed the study, only one item was not completed by one person in the experimental group (i.e., item asking to indicate the age at which they believe they are able to screen a child suspected of having an ASD). For the control

group, every item was completed by all participants. For the repeated measures analysis of variance (ANOVA), a sample size of 40 was needed to detect a statistically significant difference between the experimental and control group with a power coefficient of .80 at the 5% level of significance. Because the post-test sample size was 26 the statistical power for the repeated measures ANOVA was below the desired level. The power also was low for the correlation analyses (i.e., Spearman rank).

Pre-Test Analyses

After all data were transferred from the Excel spreadsheet into an SPSS data editor file, the data were analyzed. Descriptive statistics were computed for both pre- and post-test data (see Table 1). In addition, descriptive statistics were computed for the participants' demographic information (see Table 2). Next, a series of exploratory factor analyses was conducted to examine the underlying structure of the items within each section and to reduce the dimensionality of the items within each section by grouping items that were moderately to highly correlated with one another (Fraenkel & Wallen, 2003).

Table 1

Descriptive Statistics for Pre-Test and Post-Test Data

Variable	Pre-Test Only (n = 23) (%)	Pre-Test and Post-Test (n = 26) (%)	Chi Square (df)
Age			3.78 (4)
<30	21.7	23.1	
31-40	26.1	26.9	
41-50	26.1	30.8	
51-60	13.0	19.2	
>60	13.0	0.0	
Gender			2.37 (1)
Male	39.1	19.2	
Female	60.9	80.8	
Race			3.04 (5)
White (Non-Hispanic)	69.6	80.8	
Black/African American	8.7	3.8	
Hispanic	8.7	11.5	
Asian/Pacific Islander	4.3	3.8	
Native American	0.0	0.0	
Multi-Racial/Ethnic	4.3	0.0	
Other	4.3	0.0	
Location of Practice			2.92 (2)
Rural	34.8	19.2	
Suburban	34.8	26.9	
Urban	30.4	53.8	
Other	0.0	0.0	
Profession			6.10 (4)
Pediatrician	69.6	73.1	
Family Practice	4.3	3.8	
Registered Nurse	4.3	0.0	
Nurse Practitioner	8.7	23.1	
Other	13.0	0.0	
Setting of Practice			5.77 (4)
Hospital	21.7	19.2	
Clinic	26.1	34.6	
Private Practice	17.4	15.4	
University-Affiliated Center	17.4	30.8	
Other	17.4	0.0	

* $p < .05$

Table 1 (Continued)

Descriptive Statistics for Pre-Test and Post-Test Data

Variable	Pre-Test Only (%) (n = 23)	Pre-Test and Post-Test (%) (n = 26)	Chi Square (df)
Years in Practice			19.72 (20)
1-10	56.3	61.4	
11-20	17.4	22.9	
21-30	17.3	11.4	
31-40	8.6	3.8	
ASD Trainings			7.22 (6)
0	45.5	64.0	
1-3	36.3	36.0	
4-5	13.6	0.0	
Change in Practice Trainings			2.28 (4)
0	73.7	75.0	
1-3	21.1	25.0	
4-7	5.3	0.0	

* $p < .05$

Table 2

Demographic Characteristics of Experimental and Control Groups at Pre-Test

Variable	Experimental (%) (n = 25)	Control (%) (n = 24)	Total (%) (n = 49)
Age			
<30	4.0	41.7	22.4
31-40	20.0	33.3	26.5
41-50	36.0	20.8	28.6
51-60	28.0	4.2	16.3
>60	12.0	0.0	6.1
Gender			
Male	32.0	25.0	28.6
Female	68.0	75.0	71.4
Race			
White (Non-Hispanic)	64.0	87.5	75.5
Black/African American	8.0	4.2	6.1
Hispanic	16.0	4.2	10.2
Asian/Pacific Islander	4.0	4.2	4.1
Native American	0.0	0.0	0.0
Multi-Racial/Ethnic	4.0	0.0	2.0
Other	4.0	0.0	2.0
Location of Practice			
Rural	44.0	8.3	26.5
Suburban	12.0	50.0	30.6
Urban	44.0	41.7	42.9
Other	0.0	0.0	0.0
Profession			
Pediatrician	72.0	70.8	71.4
Family Practice	8.0	0.0	4.1
Registered Nurse	4.0	0.0	2.0
Nurse Practitioner	4.0	29.2	16.3
Other	12.0	0.0	6.1
Setting of Practice			
Hospital	4.0	37.5	20.4
Clinic	52.0	8.3	30.6
Private Practice	20.0	12.5	16.3
University-Affiliated Center	8.0	41.7	24.5
Other	16.0	0.0	8.2

Table 2 (Continued)

Demographics Characteristics of Sample at Pre-Test as a Function of Treatment Group

Variable	Experimental (%) (n = 25)	Control (%) (n = 24)	Total (%) (n = 49)
Years in Practice			
1-10	36.0	83.3	59.2
11-20	36.0	4.2	20.4
21-30	20.0	8.3	14.3
31-40	8.0	4.2	6.1
ASD Trainings			
0	32.0	75.0	53.1
1-3	48.0	20.8	34.7
4-5	8.0	4.2	6.1
Change in Practice Trainings			
0	40.0	91.7	65.3
1-3	32.0	8.4	20.3
4-7	4.0	0.0	2.3

Exploratory Factor Analyses

The first exploratory factor analysis was conducted on the items pertaining to the General Knowledge section (see Table 3). Using the eigenvalue-greater-than-one rule, one factor was extracted, explaining 62.19% of the variance (Kaiser, 1958).

Table 3

Exploratory Factor Analysis for General Knowledge Scale Items (Pre-Test)

Item	Factor 1	Communality Coefficient
Knowledge Area		
Autism Spectrum Disorders	**.999**	.999
Early Warning Signs of ASD	**.821**	.673
Developmental Screeners	**.413**	.170
Autism-Specific Screeners	**.545**	.297
Trace	2.487	2.14
% of variance explained	62.19	62.19

n = 49

Note: All bolded coefficients within this factor had effect sizes greater than the cut-off value of 0.3 recommended by Lambert and Durand (1975).

The second exploratory factor analysis was conducted on the Screening Patterns section. Table 4 presents the results from this analysis. The factor analysis revealed two factors. The three items in Subsection A represented one factor, and the three items in subsection B represented another factor. The first factor was named Screening Patterns: Developmental scale, and this factor explained 49.19% of the variance. The second factor was named Screening Patterns: Autism-Specific scale, and this factor explained 24.44% of the variance. The total scale explained 73.63% of the variance.

Table 4

Exploratory Factor Analysis for Screening Scale Items (Pre-Test)

Item	Factor 1	Factor 2	Communality Coefficient
Ages & Stages*	.367	**.483**	.367
PEDS*	.088	**.833**	.701
CSBS DP*	.136	**.823**	.695
CHAT**	**.968**	.089	.944
M-CHAT**	**.983**	.145	.986
PDDST**	**.454**	.208	.249
Trace	2.948	1.467	3.943
% of variance explained	49.14	24.44	73.582

n = 49

Note: All bolded coefficients within this factor had effect sizes greater than the cut-off value of 0.3 recommended by Lambert and Durand (1975), and had larger coefficients than in the other factor.

* represent developmental screening instruments
** represent autism-specific screening instruments

The final exploratory factor analysis was conducted on the Potential Barriers section. This factor analysis revealed two factors. The first two items (i.e., Insufficient time and Lack of staff to assist with screenings) in the Potential Barriers section represented one factor and, therefore, these items were labeled as *Potential Barriers: Time and Personnel Assistance scale*. This factor explained 41.54% of the variance (Kaiser, 1958). The next four items in the section (i.e., Insufficient information regarding referral resources, Cost of screening instruments, Inadequate reimbursement, and Concern regarding emotional impact on the family) represented another factor, and these

items were labeled as *Potential Barriers: Financial and Emotional Costs scale* (see Table 5). This factor explained 18.42% of the variance. The total scale explained 59.96% of the variance. The last item in the section (i.e., Belief that clinical impression is sufficient) was not highly correlated with either factor; therefore, this item was removed from the scale.

Table 5

Exploratory Factor Analysis for Potential Barriers Items (Pre-Test)

Item	Factor		Communality Coefficient
	1	2	
Insufficient Time	**.989**	.143	.999
Lack of Staff	**.733**	.151	.560
Insufficient Info. (referral resources)	.344	**.510**	.378
Cost of Instruments	-.015	**.651**	.424
Inadequate Reimbursement	.249	**.840**	.767
Concern regarding emotional impact	.106	**.440**	.204
Belief that clinical impression sufficient	.234	.283	.135
Trace	2.908	1.290	3.469
% of variance explained	41.54	18.420	59.958

n = 49

Note: All bolded coefficients within this factor had effect sizes greater than the cut-off value of 0.3 recommended by Lambert and Durand (1975), and had larger coefficients than in the other factor.

Score Reliability of Pre-Test Measures

For each scale and subscale, score reliability coefficients were computed using Cronbach's alpha for each treatment group (i.e., control and experimental groups) and as a whole. For the General Knowledge scale, Cronbach's alpha was computed for (a) Pre-

test scores from participants in the experimental group and the control group combined, (b) Pre-test scores from participants in the experimental group only, and (c) Pre-test scores from participants in the control group only. The same procedures were carried out for the remaining scales on the questionnaire. Overall, the Cronbach's alpha was high for scores pertaining to all measures except for the Screening Patterns: Developmental scale for the control group and the Potential Barriers: Financial and Emotional Costs scale for the control group (see Table 6).

Table 6

Score Reliabilities (Cronbach's Alpha) for all Measures by Treatment Group: Pre-Test

Scale	Experimental	Control	All
General Knowledge	.70	.84	.78
Screening Patterns: Developmental	.83	.49	.74
Screening Patterns: Autism-Specific	.92	.72	.84
Screening Patterns: Age of Patient	.99	.99	.99
Potential Barriers: Time & Personnel	.84	.88	.86
Potential Barriers: Fin. & Emot. Costs	.82	.43	.72

n = 49

Assessing Group Equivalence

Urban versus rural. To determine whether there was a difference in participants' scores based on geographic region (i.e., urban versus rural), independent samples *t*-tests were conducted. Prior to conducting these analyses, the normality assumption was evaluated. Tables 7 and 8 present the skewness and kurtosis coefficients for each of the pre-test scales for the urban and rural samples, respectively. According to Onwuegbuzie and Daniel (2002), (a) standardized skewness (i.e., skewness divided by its standard error) and kurtosis coefficients (i.e., kurtosis divided by its standard error) that lie within ±2 suggest no serious departures from normality; (b) coefficients outside this range but

within the ±3 boundary signify slight departures from normality; and (c) standardized coefficients outside the ±3 range indicate important departures from normality.

For the urban group, the standardized skewness and kurtosis coefficients indicated that the following five scales did not depart from normality: (a) General Knowledge, (b) Screening Patterns: Developmental, (c) Screening Patterns: Age of Patient, (d) Potential Barriers: Time & Personnel Assistance, and (e) Potential Barriers: Financial & Emotional Costs (see Table 7). In contrast, the Screening Patterns: Autism-specific scale scores were both extremely positively skewed and indicated a leptokurtic distribution (i.e., more peaked than the normal distribution). This finding was confirmed by the histograms (not presented).

For the rural group, both the Screening Patterns: Developmental Scale scores and Screening Patterns: Autism-Specific scale scores deviated from normality; both were extremely positively skewed and indicated leptokurtic distributions (see Table 8). Because the assumption of normality was violated for at least one group with respect to the Screening Patterns: Developmental and Screening Patterns: Autism-Specific scales, a nonparametric independent samples *t*-test (i.e., Mann-Whitney) was used for these two scales. The Bonferroni adjustment was used to control for the inflation of Type I error. Specifically, a Bonferroni-adjusted alpha value of .008 (i.e., .05/6) was used. The results of these *t*-tests are presented in Table 9. From these results it can be seen that for the General Knowledge scale, a statistically significant difference was found between urban and rural participants. For the remaining scales, no statistically significant difference was found between urban and rural participants.

Table 7

Skewness and Kurtosis Coefficients for Pre-Test Scales: Urban Group (*n* = 8)

	General Knowledge	Screening Patterns: Developmental	Screening Patterns: Autism-Specific	Screening Patterns: Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
Skewness	-.37	1.17	3.02	.73	-1.09	.33
Std. Error of Skewness	.52	.52	.52	.54	.52	.52
Standardized Skewness	-.71	2.25	5.81	1.35	-2.10	.63
Kurtosis	.37	.77	8.45	-.82	.47	-1.49
Std. Error of Kurtosis	1.01	1.01	1.01	1.04	1.01	1.01
Standardized Kurtosis	.37	.76	8.37	-.79	.47	-1.48

Table 8

Skewness and Kurtosis Coefficients for Pre-Test Scales: Rural Group (*n* = 15)

	General Knowledge	Screening Patterns: Developmental	Screening Patterns: Autism-Specific	Screening Patterns: Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
Skewness	.96	2.35	2.48	-.10	-.43	-.48
Std. Error of Skewness	.43	.43	.43	.43	.43	.43
Standardized Skewness	2.23	5.47	5.77	-.23	-1.00	-1.12
Kurtosis	.82	6.18	5.69	-1.46	-.78	-.44
Std. Error of Kurtosis	.83	.83	.83	.83	.83	.83
Standardized Kurtosis	.99	7.45	6.86	-1.76	-.94	-.53

Table 9

T-Tests Comparing Participants' Scores Based on Geographic Region: Pre-Test (*n* = 49)

Scale	*Urban* *M*	*SD*	*Rural* *M*	*SD*	*t*-value	*U**	*p*-value
General Knowledge	9.00	2.08	7.27	2.03	2.88		.006
Screening (Developmental)	4.68	2.08	4.07	2.10		221.50	.131
Screening (Autism-specific)	3.53	1.61	3.43	1.01		263.50	.493
Screening (Age of Patient)	16.89	10.52	19.93	10.06	-.998		.324
Barriers (Time & Personnel)	6.53	1.81	5.77	1.89	1.395		.170
Barriers (Cost)	9.95	4.21	10.27	2.43	-.337		.738

* *U* denotes Mann-Whitney's test statistic.

Experimental versus control. To determine whether there was a difference in the selected outcomes between the experimental and control groups, a series of independent samples *t*-tests was conducted. Prior to conducting this analysis, the normality assumption was evaluated. Tables 10 and 11 present the skewness and kurtosis coefficients for each of the pre-test scales for the experimental and control samples, respectively. For the experimental group, the standardized skewness and kurtosis coefficients indicated that the following four scales did not depart from normality: (a) General Knowledge, (b) Screening Patterns: Age of Patient, (c) Potential Barriers: Time & Personnel Assistance, and (d) Potential Barriers: Financial & Emotional Costs Scale. In contrast, the Screening Patterns: Developmental scale was positively skewed and the Screening Patterns: Autism-specific scale scores were both extremely positively skewed and had a leptokurtic distribution (i.e., more peaked than the normal distribution). This finding was confirmed by the histograms. For the control group, only the Screening Patterns: Autism-Specific scale scores deviated from normality. Because the assumption of normality was violated for at least one group with respect to the Screening Patterns:

Developmental scale and the Screening Patterns: Autism-specific scale, a nonparametric independent samples *t*-test (i.e., Mann-Whitney) was used for these two scales. The results of these *t*-tests are presented in Table 12. These data indicate that no statistically significant differences emerged.

Table 10

Skewness and Kurtosis Coefficients for Pre-Test Scales: Experimental Group (*n* = 25)

	General Knowledge	Screening Patterns: Developmental	Screening Patterns: Autism-Specific	Screening Patterns: Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
Skewness	-.12	1.69	3.54	.60	-.95	.14
Std. Error of Skewness	.46	.46	.46	.47	.46	.46
Standardized Skewness	-.26	3.64	7.62	1.28	-2.05	.30
Kurtosis	-.48	2.47	12.00	-1.02	-.03	-1.54
Std. Error of Kurtosis	.90	.90	.90	.92	.90	.90
Standardized Kurtosis	-.54	2.74	13.30	-1.11	-.04	-1.71

Table 11

Skewness and Kurtosis Coefficients for Pre-Test Scales: Control Group (*n* = 24)

	General Knowledge	Screening Patterns: Developmental	Screening Patterns: Autism-Specific	Screening Patterns: Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
Skewness	1.02	1.32	2.12	-.18	-.37	-.50
Std. Error of Skewness	.46	.46	.46	.47	.46	.46
Standardized Skewness	2.22	2.87	4.61	-.38	-.80	-1.09
Kurtosis	1.25	.32	3.84	-1.37	-.80	.18
Std. Error of Kurtosis	.92	.92	.92	.92	.92	.92
Standardized Kurtosis	1.36	.35	4.17	-1.49	-.87	.20

Table 12

T-Tests Comparing Participants' Scores Based on Treatment Group: Pre-Test (*n* = 49)

	Experimental		*Control*				
Scale	*M*	*SD*	*M*	*SD*	*t*-value	*U**	*p*-value
General Knowledge	8.60	2.18	7.25	2.05	2.23		.030
Screening (Developmental)	4.64	2.46	3.96	1.60		257.50	.325
Screening (Autism-specific)	3.40	1.41	3.54	1.10		254.50	.157
Screening (Age of Patient)	16.88	10.19	20.71	10.12	-1.31		.198
Barriers (Time & Personnel)	6.32	1.93	5.79	1.82	.986		.329
Barriers (Cost)	8.32	3.41	8.29	2.05	.035		.972

* U denotes Mann-Whitney's test statistic.

Check of Normality Assumptions for Post-Test Scores

Urban and rural. The skewness and kurtosis coefficients were computed for each of the post-test scales for the urban and rural samples, respectively. For the urban group, the standardized skewness and kurtosis coefficients indicated that the following four

scales did not depart from normality: (a) Screening Patterns: Developmental, (b) Screening Patterns: Age of Patient, (c) Potential Barriers: Time & Personnel Assistance, and (d) Potential Barriers: Financial & Emotional Costs. In contrast, the General Knowledge scale scores had a leptokurtic distribution (i.e., more peaked than the normal distribution) and the Screening Patterns: Autism-specific scale scores were both positively skewed and had a leptokurtic distribution. This finding was confirmed by the histograms (not presented). For the rural group, none of the six scales departed from normality.

Experimental and control. Tables 13 and 14 present the skewness and kurtosis coefficients for each of the post-test scales for the experimental and control groups, respectively. For the experimental group, the standardized skewness and kurtosis coefficients indicated that the following five scales did not depart from normality: (a) General Knowledge, (b) Screening Patterns: Developmental, (c) Screening Patterns: Age of Patient, (d) Potential Barriers: Time & Personnel Assistance, and (e) Potential Barriers: Financial & Emotional Costs. In contrast, the Screening Patterns: Autism-specific scale scores were positively skewed. This finding was confirmed by the histograms (not presented). For the control group, none of the six scales departed from normality.

Table 13

Skewness and Kurtosis Coefficients for Post-Test Scales: Experimental Group (*n* = 25)

	General Knowledge	Screening Patterns: Developmental	Screening Patterns: Autism-Specific	Screening Patterns: Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
Skewness	-.03	-.11	1.98	.53	-1.24	.22
Std. Error of Skewness	.62	.62	.62	.62	.62	.62
Standardized Skewness	-.05	-.17	3.20	.85	-2.02	.36
Kurtosis	1.55	-1.57	2.98	-1.07	2.01	-1.11
Std. Error of Kurtosis	1.19	1.19	1.19	1.19	1.19	1.19
Standardized Kurtosis	1.30	-1.31	2.51	-.90	1.69	-.93

Table 14

Skewness and Kurtosis Coefficients for Post-Test Scales: Control Group (*n* = 24)

	General Knowledge	Screening Patterns: Developmental	Screening Patterns: Autism-Specific	Screening Patterns: Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
Skewness	.05	.80	1.34	-.14	-1.52	-.30
Std. Error of Skewness	.62	.62	.62	.62	.62	.62
Standardized Skewness	.07	1.30	2.18	-.22	-2.46	-.49
Kurtosis	-.98	-.62	1.42	-1.00	1.70	-1.00
Std. Error of Kurtosis	1.19	1.19	1.19	1.19	1.19	1.19
Standardized Kurtosis	-.82	-.52	1.19	-.84	1.42	-.84

Post-Test Analyses

Score Reliability of Measures

For each scale and subscale, score reliability coefficients were computed using Cronbach's alpha for each treatment group (i.e., control and experimental groups) and as a whole. For the General Knowledge scale, Cronbach's alpha was computed for (a) Post-test scores from participants in the experimental group and the control group combined, (b) Post-test scores from participants in the experimental group only, and (c) Post-test scores from participants in the control group only. The same procedures were carried out for the remaining scales on the questionnaire. Overall, the Cronbach's alpha was high for all measures except for the General Knowledge scale for the experimental group and the Screening Patterns: Developmental for both groups and the groups combined (see Table 15).

Table 15

Score Reliabilities (Cronbach's Alpha) for all Measures by Treatment Group: Post-Test

Measure	Experimental	Control	All
General Knowledge	.41	.82	.77
Screening Patterns: Developmental	.08	.63	.41
Screening Scale (subsection B)	.76	.89	.84
Screening Patterns: Age of Patient	.99	.99	.99
Potential Barriers: Time & Personnel	.94	.83	.88
Potential Barriers: Fin. & Emot. Costs	.82	.73	.77

n = 26

The first research question in this study was: What is the effect of the Autism System of Care (ASC) training on use of developmental and autism-specific screening

instruments by pediatric healthcare providers? To answer the first part of this research question (i.e., effect of ASC training on use of developmental screening instruments), a 2X2 repeated measures ANOVA was conducted. Box's *M* test indicated that the assumption of equality of the covariance matrices was not violated ($M = 5.24$, $p > .05$). The repeated measures ANOVA revealed no statistically significant interaction between time and treatment group ($F[1, 24] = 1.17$, $p > .05$). Further, no statistically significant main effect due to time was found ($F[1, 24] = 0.13$, $p > .05$). Finally, no statistically significant difference was found (i.e., the between-subjects main effect) between the treatment and control group ($F[1, 24] = 4.92$, $p > .05$). The experimental group's scores decreased (i.e., indicating a decline in the use of developmental screening instruments) whereas the control group's scores increased—not a desirable outcome. However, these changes were not statistically significant. Additionally, while the mean score for the experimental group decreased from 5.15 ($SD = 2.64$) at pre-test to 4.85 ($SD = 1.41$) at post-test, the effect size associated with this decline was .15 which may be considered small and representing chance.

To answer the second part of this research question (i.e., effect of ASC training on use of autism-specific screening instruments), a 2X2 repeated measures ANOVA was computed. Box's *M* test indicated that the assumption of equality of the covariance matrices appeared to be violated ($M = 11.95$, $p < .05$). However, the fact that the sample sizes were equal did not give cause for concern (Stevens, 2002). The repeated measures ANOVA revealed no statistically significant interaction between time and treatment group ($F[1, 24] = 1.07$, $p > .05$). Further, no statistically significant main effect due to time was found ($F[1, 24] = 4.76$, $p > .05$). Finally, no statistically significant difference

was found (i.e., the between-subjects main effect) between the treatment and control group ($F[1, 24] = 0.71$, $p > .05$). Both the experimental and control groups' scores increased in a similar fashion; therefore, the change was not statistically significant.

The second research question from this study was: What is the effect of the ASC training on the use of developmental screening instruments in regard to age of patient? To address this question, a Wilcoxon's signed rank test was computed. The results of this test are presented in Table 16. No statistically significant effect was found for any of the age ranges.

Table 16

Wilcoxon Test for Screening Patterns: Age of Patients Scale Scores: Pre- and Post-Test

Age	Positive	Negative	Ties	*Z*	*p*-value
0-6 months	5	1	7	-1.63	.10
7-12 months	6	1	6	-1.89	.06
13-18 months	5	1	7	-1.63	.10
19-24 months	6	1	6	-1.89	.06
25-36 months	6	1	6	-1.89	.06
37-48 months	4	2	7	-.33	.74
Older than 48 months	3	2	8	.00	1.00

($n = 49$)

The third research question from this study was: What is the effect of the Autism System of Care training on pediatric healthcare providers' perceived barriers to increasing the use of screening instruments and/or referring patients? To address this question, two 2 X 2 repeated-measures ANOVAs were computed. Box's *M* test indicated that the assumption of equality of the covariance matrices was not violated ($M = 4.26$, $p > .05$). For the Potential Barriers: Time & Personnel Assistance Scale, the repeated measures ANOVA revealed no statistically significant interaction between time and

treatment group (F[1, 24] = 1.71, p > .05). Further, no statistically significant main effect due to time was found (F[1, 24] = 0.00, p > .05). Finally, no statistically significant difference was found (i.e., the between-subjects main effect) between the treatment and control group (F[1, 24] = 1.69, p > .05).

For the Potential Barriers: Financial & Emotional Costs Scale, Box's M test indicated that the assumption of equality of the covariance matrices was not violated (M = 6.97, p > .05). The repeated measures ANOVA revealed no statistically significant interaction between time and treatment group (F[1, 24] = 3.21, p > .05). Further, no statistically significant main effect due to time was found (F[1, 24] = 1.37, p > .05). Finally, no statistically significant difference was found (i.e., the between-subjects main effect) between the treatment and control group (F[1, 24] = 0.31, p > .05). For both scales, the experimental group scores decreased (i.e., indicating that the set of barriers decreased their likelihood to impede the use of screening instruments) whereas the control group scores increased—a desirable outcome. However, these changes in scores were not statistically significant.

The fourth research question was: What is the effect of the Autism System of Care training on pediatric healthcare providers' perceived levels of knowledge related to Autism Spectrum Disorders? A 2 X 2 repeated-measures ANOVA was conducted to address this question. Box's M test indicated that the assumption of equality of the covariance matrices was not violated (M = 0.79, p > .05). The repeated measures ANOVA revealed no statistically significant interaction between time and treatment group (F[1, 24] = 1.13, p > .05). Both the experimental and control groups' scores increased slightly from pre- to post-test; however, these increases in scores were not

statistically significantly different from each other. However, a statistically significant main effect due to time was found (F[1, 24] = 6.67, $p < .05$; $\omega^2 = .18$). The effect size associated with the time main effect was small to moderate. Specifically, across groups, general knowledge of ASD was higher after the intervention (M = 8.42, SD = 2.08) than before (M = 7.77, SD = 2.20). Also, a statistically significant difference was found (i.e., the between-subjects main effect) between the treatment and control group (F[1, 24] = 11.39, $p < .05$; $\omega^2 = .29$). The effect size associated with this difference was moderate. Specifically, across the pre-test and post-test, the experimental group (M = 9.23, SE = .48) rated their general knowledge of ASD to be higher than did the control group (M = 6.96, SE = .48).

The fifth research question addressed in this study was: What is the effect of the Autism System of Care training on the self-efficacy of pediatric healthcare providers regarding their ability to screen accurately and refer a child suspected of having an Autism Spectrum Disorder? To answer this research question, two separate 2 X 2 repeated-measures ANOVAs were conducted. Box's M test indicated that the assumption of equality of the covariance matrices was not violated (M = 1.98, $p > .05$). With regard to the item, "Please indicate the age at which you believe *it is possible* to accurately screen and refer a child suspected of having an Autism Spectrum Disorder," the repeated measures ANOVA revealed no statistically significant interaction between time and treatment group (F[1, 23] = 0.64, $p > .05$). Further, no statistically significant main effect due to time was found (F[1, 23] = 0.77, $p > .05$). Finally, no statistically significant difference was found (i.e., the between-subjects main effect) between the treatment and control group (F[1, 23] = 3.09, $p > .05$).

With regard to the item "Please indicate the age at which you believe *you are able to* accurately screen and refer a child suspected of having an Autism Spectrum Disorder," another repeated measures ANOVA was conducted. Box's *M* test indicated that the assumption of equality of the covariance matrices was not violated ($M = 3.75$, $p > .05$). The repeated measures ANOVA revealed no statistically significant interaction between time and treatment group ($F[1, 22] = 0.60$, $p > .05$). Further, no statistically significant main effect due to time was found ($F[1, 22] = 0.48$, $p > .05$). However, a statistically significant difference was found (i.e., the between-subjects main effect) between the treatment and control group ($F[1, 22] = 7.13$, $p < .05$; $\omega^2 = .20$). The effect size associated with this difference was moderate. Specifically, across the pre-test and post-test, the experimental group ($M = 17.34$, $SE = 2.06$) believed that they could accurately screen a child suspected of having an ASD at a lower age than did the control group ($M = 24.81$, $SE = 1.89$).

The sixth research question was: What is the relationship between pediatric healthcare providers' perceived barriers to utilizing screening instruments and their actual use of developmental and autism-specific screening instruments before and after completion of the training? To address this research question, two Spearman rank (order) correlation coefficients were conducted (i.e., for pre- and post-test scores). For pre-test scores, no statistically significant relationship was found between barriers associated with time and personnel assistance and (a) use of developmental screening instruments ($r_s = .10$, $p > .05$), and (b) use of autism-specific screening instruments ($r_s = .11$, $p > .05$). Further, no statistically significant relationship was found between barriers associated with financial and emotional costs and (a) the use of developmental screening

instruments (r_s = .13, p > .05), and (b) the use of autism-specific screening instruments (r_s = .05, p > .05).

For post-test scores, no statistically significant relationship was found between barriers associated with time and personnel assistance and (a) use of developmental screening instruments (r_s = -.26, p > .05), and (b) use of autism-specific screening instruments (r_s = -.12, p > .05). Further, no statistically significant relationship was found between barriers associated with financial and emotional costs and (a) the use of developmental screening instruments (r_s = -.12, p > .05), and (b) the use of autism-specific screening instruments (r_s = -.31, p > .05).

The seventh and final research question from this study was: What is the relationship between perceived barriers to utilizing screening instruments and the use of developmental screening instruments in regard to age of patients before and after completion of the training? To address this final research question, a series of Spearman rank correlation coefficients was computed for both pre- and post-test scores. Specifically, a Bonferroni-adjusted alpha value of .007 (i.e., .05/7) was used to reflect the fact that seven correlations were computed. No statistically significant relationship was found between barriers associated with time and personnel assistance and barriers associated with financial and emotional costs and the age of patients screened for both pre- and post-test scores. Tables 17 and 18 present the Spearman rank correlation coefficients for pre-test and post-test scores, respectively.

Table 17

Spearman Rank Correlation Coefficients: Pre-Test (*n* = 49)

Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
0-6 months	-.13	.09
7-12 months	-.12	.10
13-18 months	-.10	.06
19-24 months	-.11	.03
25-36 months	-.15	-.03
37-48 months	-.13	-.02
Older than 48 months	-.15	-.08
* $p < .05$		

Table 18

Spearman Rank Correlation Coefficients: Post-Test (*n* = 26)

Age of Patient	Potential Barriers: Time & Personnel Assistance	Potential Barriers: Financial & Emotional Costs
0-6 months	-.13	-.09
7-12 months	-.13	-.10
13-18 months	-.15	-.07
19-24 months	-.15	-.07
25-36 months	-.16	-.11
37-48 months	-.21	-.14
Older than 48 months	-.29	-.21
* $p < .05$		

Chapter 5

Discussion

Summary of Study

The present study was conducted to explore the effectiveness of the Autism System of Care (ASC) trainings by measuring change in pediatric healthcare providers' methods of identifying young children at-risk for autism spectrum disorders (ASD). The principal investigator developed pre- and post-test questionnaires to measure change in participants' screening practices in relation to ASD. This study was novel because it was a pilot study whereby the researcher developed a questionnaire based specifically on the ASC training to determine the training's effect on participants' methods of identifying children with ASD. A pretest-posttest nonequivalent-groups design was used. This design was chosen because the experimental and control groups were naturally assembled groups, and therefore, such a design was the most practical one for this study. In addition, this design enabled the researcher to gain insight on potential changes over time among the participants in the experimental group and the control group. In this chapter, a summary of results is presented, implications of the results are discussed, limitations are examined, and suggestions for future research are provided.

Summary of Results

Prior to examining the highlights from Chapter 4, it is important for the reader to put the findings from this study in the proper context. Based on the limited number of participants who completed the ASC trainings, and subsequently, completed both the pre-

and post-test questionnaires, it is difficult to determine if the relative lack of change from pre- to post-test was due to an ineffectual training, or if the lack of change is due mainly to the relatively small sample size in the study. Unfortunately, no statistically significant differences were found when examining the pre- and post-test scores of the participants. Therefore, the hypotheses presented in the introduction of this document that stated that the ASC trainings would impact participants' practices in relation to ASD and early screening were not confirmed.

Notable findings from the measures. The results from the measures administered in this study produced some interesting findings. Although these findings were not statistically significant, it is believed that the findings are clinically significant. For the experimental group and the control group, scores on the General Knowledge scale were higher at post-test compared to pre-test scores. In other words, participants from the experimental group and the control group tended to rate their knowledge of autism spectrum disorders higher on the post-test than their ratings on the pre-test. This was an encouraging finding as a primary goal of the study was to increase participants' knowledge of autism spectrum disorders. As cited in the section of this document that reviews the related literature, there are significant implications for children with ASD who are identified at young ages. The outcome for these children is significantly improved when they are identified and receive supports and services early in their development (Dawson et al., 2000; Dawson & Osterling, 1997; Filipek et al., 2000; Oser & Shaw, 2001; Wetherby et al., 2004).

Other notable findings from the study revealed that across the pre- and post-test scores, the experimental group rated their general knowledge of ASD to be higher than

did the control group, and they believed they could accurately screen a child suspected of having an ASD at a lower age than did the control group. However, this finding is likely due to the differences in experience between the two groups. That is, the average number of years in practice for the participants in the experimental group was 17.6 years, whereas the average number of years in practice for the control group was only 6.4 years. Although it was hoped that the experimental group and the control group would be similar in all demographic variables for the purposes of this study, it is encouraging to find that in this study practitioners' knowledge of ASD was associated with increased with experience. This finding indicates a need for more instruction early on in physicians' training regarding autism spectrum disorders and the importance of early identification and intervention. Material on ASD and various developmental and autism-specific screening measures could be incorporated in didactic trainings throughout medical school and/or residency training programs. Potential barriers to implementing these "best practices" also could be addressed early in physicians' training to increase their ability to overcome these frequent barriers to early screening.

The pre-test examination of score reliabilities for each scale exhibited important results. The Cronbach's alpha was high for scores on all scales except for the Screening Patterns: Developmental scale and the Potential Barriers: Financial and Emotional Costs scale for the control group. The Screening Patterns: Developmental scale assessed participants' frequency of use of developmental screening instruments, and the Potential Barriers: Financial and Emotional Costs scale assessed the potential financial barriers and emotional barriers (e.g., impact of diagnosis on family) to utilizing screening instruments. However at post-test, the Cronbach's alpha was moderate for the Developmental scale

and high for the Potential Barriers: Financial and Emotional Costs scale for the control group. Therefore, the scores on these scales were included in this study.

Sixth question. For post-test scores, no statistically significant relationship was found between barriers associated with time and personnel assistance and (a) use of developmental screening instruments, and (b) use of autism-specific screening instruments. Further, no statistically significant relationship was found between barriers associated with financial and emotional costs and (a) the use of developmental screening instruments, and (b) the use of autism-specific screening instruments. Although none of these relationships were statistically significant, it should be noted that two of these correlations (i.e., the use of developmental screening instruments and time and personnel assistance barriers, and the use of autism-specific screening instruments and the financial and emotional costs barriers) appear to represent a non-trivial (i.e., moderate) association.

Seventh question. At pre-test, the relationship between Potential Barriers: Time and Personnel Assistance and the use of developmental screening instruments at each age level of patients (e.g., 0-6 months, 7-12 months) was both statistically non-significant and small. However, the fact that all seven correlations were negative is notable because it suggests a consistent inverse relationship between these two variables regardless of the age of the patient. Furthermore, although at post-test the relationship between both Potential Barriers scales and the use of developmental screening instruments at each age level of patients was non-significant and small, it is notable that all 14 correlations were negative.

Implementation integrity. The design of this study was selected with the intention that the implementation would be consistent and stable across training sessions. Fortunately,

no deviations from the original plan occurred, as 100% of the components were fully covered across the three training sessions. Therefore, the implementation integrity in this study was strong as each participant did receive the same type of training.

Effectiveness of the intervention. Overall, the results of this study revealed no statistically significant effects from the ASC trainings based on participants' responses to the Pediatric Healthcare Provider Self-Report Questionnaire. However, because of the small sample size, it cannot be definitively known whether these results were due to the lack of effectiveness of the trainings. Directions for future interventions and research will be discussed later in this chapter.

Implications of the Results

Although this study did not produce statistically significant findings regarding the effect of the ASC trainings on pediatric healthcare providers' practice, some implications from this study have emerged. For example, it is important to point out that there were positive changes in participants' scores from pre- to post-test. For example, on average, participants from the experimental group and the control group rated their use of autism-specific screeners higher at post-test as compared to pre-test. Furthermore, when examining use of developmental screening instruments regarding age of patient, on average, participants in the experimental group screened patients in all age categories more frequently than did participants from the control group. This trend might suggest that the ASC training had an impact on the practitioners' screening practices. After completion of the training whereby participants learned about the importance of early identification and use of screening instruments with all young patients, these practitioners increased their frequency of use of screening instruments with patients of all ages.

However, there were differences between experimental group and control group regarding frequency of use of screening instruments at pre-test. This finding may be partly explained by the difference in years in practice between the experimental group and the control group as participants in the experimental group had significantly more years in practice compared to the control group. Through experience practicing medicine, practitioners may become more aware of the need for screening their young patients. Given the substantial literature that supports the positive effects of early identification of children with ASD, it is encouraging that experienced practitioners are screening their patients. However, if practitioners understand the importance of early identification early in their own training, more practitioners will be able to identify more children earlier in their development.

When examining perceived barriers to screening children, participants in the experimental group had a slight change in pre- to post-test scores which indicated a decreased likelihood of the barriers preventing the utilization of screening instruments. Specifically, on the Potential Barriers: Time & Personnel Assistance scale, scores decreased from 6.77 to 6.38 for the experimental group. On the Potential Barriers: Financial & Emotional Costs scale, scores decreased from 8.62 to 7.15 for the experimental group. For the control group, scores on both of these scales actually increased slightly from pre- to post-test (i.e., 5.62 to 6.00, and 8.23 to 8.54, respectively). This is a positive trend because it suggests that the ASC training may have had an effect on participants' perceived barriers to utilizing screening instruments with their patients. In other words, after completion of the training, participants did not rate the barriers as high in terms of hindering screening practices.

Participants from the experimental group and the control group had changes in scores on the General Knowledge scale, and although the changes were not statistically significant, there was a positive trend. For example, experimental group scores increased from 8.77 to 9.69 from pre- to post-test, indicating an increase in their perceived knowledge of ASD. The control group scores increased, from 6.77 to 7.15, indicating a slight increase in their perceived knowledge of ASD as well. Because there was an increase on the General Knowledge scale for the experimental group and the control group, this suggests that participants from both groups had an increase in their knowledge related to ASD. This may indicate that practitioners are gaining knowledge regarding ASD from multiple sources. It would be advantageous to ascertain in what capacity practitioners are acquiring this knowledge so that these efforts can be strengthened and continued.

Limitations

Although the initial intent of the Autism System of Care grant was to increase awareness of ASD and autism-specific screeners, the objective of the grant changed during the course of the funding year. A Health Care Task Force was responsible for the funding and was the main driver of changing the focus of the grant. Therefore, the focus switched from autism-specific information and screening instruments to general developmental screening instruments and changing practice. Therefore, the training sessions ultimately focused less on autism-specific instruments, and more on general developmental screeners and changing screening practice. This change in focus may explain in part why statistically significant changes were not found through this study.

The original goal of the study was to secure a minimum of 100 professionals to participate in the ASC trainings, and subsequently in this study. It was anticipated that virtually all participants in the trainings would complete the pre-test questionnaire. However, it was expected that approximately 50 participants would complete both the pre- and post-questionnaire because research demonstrates the average response rate to mail surveys for physicians is 54% (Asch et al., 1997). Unfortunately, although the grant for the ASC trainings specified that a minimum of 100 practitioners would be trained, this number was not obtained. Therefore, the number of potential participants available for this study was decreased significantly. Out of the 36 total practitioners who participated in the ASC trainings, 25 completed the pre-test questionnaire and 13 completed both the pre- and post-test questionnaires. Although this study acquired a very similar response rate compared to the average response rate for physicians (52% versus 54%), the small overall sample size was a significant limitation of this study. If a larger initial number of practitioners had completed the ASC training, this would have been an adequate response rate and might have produced some more statistically significant results.

Although Halfon et al. (2000) found that 65% AAP members surveyed reported less than adequate training, oftentimes it is difficult to attract physicians to trainings for a multitude of reasons. One primary reason is lack of time to fit a training session into an already busy work schedule. The literature indicates that less than half of physicians agree that there is adequate time to perform developmental screenings during typical well-child visits (Sices et al., 2003). Another difficulty may stem from the belief that one

can identify children with developmental delays without the use of screening instruments and therefore, they do not need additional training (Sices et al., 2003).

Several methods were implemented in an attempt to attract participants. To address the issue of time constraints, the trainings were scheduled at times that were thought to be most convenient for practitioners, such as in the evening after their work day was complete, or during their lunch hour. To address the potential belief that practitioners already are knowledgeable about ASD and early screening instruments, pediatricians who took part in the ASC workgroup attempted to communicate the importance of the ASC trainings to colleagues. Furthermore, in an attempt to acquire more participants, physicians were awarded one Continuing Medical Education (CME) credit for completing the ASC training. Registered nurses and nurse practitioners who completed the training were awarded one Continuing Education Unit (CEU). In addition, a complimentary dinner was provided at each training. However, based on the small number of pediatric healthcare providers who participated in the Autism System of Care training, it is apparent that more must be undertaken to attract providers to trainings that will enable them to improve their current practices. The small sample size was a threat to external validity because the findings cannot be generalized to the population. Also, the small sample size limited statistical power and therefore made it difficult to find statistically significant results.

Another limitation of this study was the method by which participants were placed in groups (i.e., experimental and control). Random selection and assignment were not possible in the current study because participants who registered for the ASC training were automatically placed in the experimental group, whereas the control group consisted

of those practitioners who were not invited to participate in the ASC training for the singular reason that the trainings were not held near their geographic region. Therefore, the study cannot claim a true experimental design; thus the study utilized a quasi-experimental design. Differential selection of participants, also known as selection bias, presented a threat to internal validity because there was an important distinction between participants from the experimental group and participants from the control group (Best & Kahn, 2003). That is, there was a statistically significant difference in both age and number of years in practice between the two groups, with participants in the experimental group being older and possessing more years in practice compared to the control group. This difference between groups could have impacted the results of this study; therefore, it cannot be determined definitively whether the outcome data obtained from the groups were due to the ASC training, selection bias, or a combination of the two factors.

Furthermore, it is important to point out some discrepancies in the demographics of the participants from this study. Significantly more women participated in the training compared to men (71.4% vs. 28.6%). In addition, the participants were predominately White (Non-Hispanic) and defined themselves as pediatricians (75.5% and 71.4%, respectively). Because of the skewed demographics, the results of this study may not generalize to other types of pediatric healthcare providers (e.g., males, non-Whites, and nurse practitioners).

It is important to mention that this was a pilot of the Autism System of Care training. Therefore, it is hypothesized that issues may arise with the suitability of the material to be presented in the training. Specifically, it may be beneficial to obtain feedback from participants to determine which material was least effective and could be

removed from the training, and what was most effective and could therefore be expanded. Also, it would be advantageous to obtain feedback regarding the group and individual activities. Then, as needed, the ASC training could be reworked so that it is most effective in supporting practitioners in changing their practices. Finally, instrumentation may have been a threat to the internal validity of this study. Because the questionnaire was designed to obtain information from participants via self-reports, the accuracy of the data cannot be verified or known with complete confidence. However, the score reliability of each scale was assessed via Cronbach's alpha. Also, construct-related validity was examined via factor analysis.

Considerations for Future Research

First and foremost, to determine whether the Autism System of Care training is truly effective in facilitating pediatric healthcare providers to change their practice regarding early screening, the trainings must be carried out with a larger number of participants. It also could be beneficial to have the participants complete the post-test questionnaire at an additional time several months following the original post-test administration. As the literature has shown, change is a slow process; therefore, it is likely that more significant changes would occur over a longer duration of time. Furthermore, in addition to the use of a pre- and post-test questionnaire, qualitative data could be collected through semi-structured interviews with participants to ascertain supplementary information regarding their knowledge of ASD, self-efficacy, use of screening instruments, and the potential barriers to the routine use of these instruments.

Given the importance of early identification and intervention for children with developmental delays such as autism spectrum disorders, it is critical that professionals

who are in the position to identify these children obtain the knowledge and resources necessary to provide children with the supports and services needed as early in their development as possible. Based on the results of this study, it is unclear whether or not the ASC trainings would have been effective had there been a larger sample size. However, based on previous literature on the effectiveness of trainings in changing practice, it may be beneficial to consider other methods of changing practice.

An effectual start may be to incorporate training regarding ASD, early warning signs, and the importance of early, routine screening into medical school training as well as residency training programs. This effort could involve the combination of didactic training as well as supervisors and chief residents modeling these "best practices" with the use of routine, early screenings of all children. Furthermore, information regarding the importance of early identification of ASD could be disseminated during Grand Rounds, journal clubs, and other types of meetings with medical students and residents. This information also could be disseminated and discussed at national conferences and through newsletters, brochures, or handouts.

Final Thoughts

The evaluation of the Autism System of Care training provided the principal investigator with a novel opportunity to understand the effect that the intervention had on pediatric healthcare providers' practice. While the results of the study did not suggest that the ASC trainings had any major impact on practitioners' screening practices with young children, encouraging trends were found through the study. It is critical that pediatric healthcare providers are armed with the knowledge and resources necessary to identify children with developmental delays early in their development. An abundance of

literature supports the positive impact of early identification and intervention on young children's developmental outcomes. Although it is recommended by the American Academy of Pediatrics (AAP) that all infants and children are screened for developmental delays or disabilities (AAP, 2001), the literature points out a number of barriers that prevent practitioners from carrying out these "best practices."

It is quite clear that changes must occur for practitioners to use developmental screeners routinely with their young patients. To assist practitioners with this change, knowledge and practical support must be provided. Therefore, it may first be necessary to identify and overcome the barriers to acquiring this knowledge and support, whether in the form of trainings or otherwise. Then, the barriers to utilizing screening instruments to identify children with ASD and other developmental disabilities can be dismantled, and change in practice can truly take place.

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Appendices

FLORIDA DEVELOPMENTAL DISABILITIES COUNCIL, INC.

Statewide Autism System of Care

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Screening and Surveillance of Autism and Related Disabilities
How to Change One's Clinical Practice

Presenter

Quimby E. McCaskill, M.D., MPH, FAAP
Assistant Professor of Pediatrics
Associate Director of the Community Pediatrics Training Initiative
at the University of Florida

6 p.m. to 7 p.m., Wednesday, May 4, 2005
University of South Florida- Florida Mental Health Institute Westside A & B
13301 Bruce B. Downs Blvd. Tampa

Dinner will be provided

Learner Objectives

- Discuss why early screening and surveillance are important.
- Define red flags of autism spectrum disorders.
- Review developmental screening tools.
- List barriers preventing change in practice.
- Describe model for improving screening practices.
- Create aim statement for changing practice.
- Develop next steps to initiate practice change.

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the University of South Florida College of Medicine and USF Florida Mental Health Insitute. The University of South Florida College of Medicine is accredited by the ACCME to provide continuing medical education for physicians. The University of South Florida College of Medicine designates this educational activity for a maximum of 1.0 category 1 credits towards the AMA physician's Recognition Award. Each physician should claim only those credits that he/she actually spent in the activity.

This activity for 1 contact hour is provided by the University of South Florida College of Nursing, which is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation. Each nurse should claim only those hours of credit that he/she actually spent in the educational activity.

RSVP by 4-27-05 to Craig Silverstein at 813-974-6464 or
csilverstein@fmhi.usf.edu

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College of Medicine and College of Nursing

FLORIDA DEVELOPMENTAL DISABILITIES COUNCIL, INC.

Statewide Autism System of Care

This publication was commissioned, funded by the Florida Developmental Disabilities Council, Inc., and produced through funding provided by the United States Department of Health and Human Services, Administration for Developmental Disabilities

Screening and Surveillance of Autism and Related Disabilities
How to Change One's Clinical Practice

Presenter

Flora Robinson, M.D.
Developmental Pediatrician
University of South Florida-All Children's Hospital

3:00 p.m. - 4:00 p.m., Wednesday, May 18, 2005
Duval County Health Department
515 W. 6th Street, Jacksonville
(2nd Floor, Conference Room A & B)

Learner Objectives

- Discuss why early screening and surveillance are important.
- Define red flags of autism spectrum disorders.
- Review developmental screening tools.
- List barriers preventing change in practice.
- Describe model for improving screening practices.
- Create aim statement for changing practice.
- Develop next steps to initiate practice change.

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the University of South Florida College of Medicine and USF Florida Mental Health Insitute. The University of South Florida College of Medicine is accredited by the ACCME to provide continuing medical education for physicians. The University of South Florida College of Medicine designates this educational activity for a maximum of 1.0 category 1 credits towards the AMA physician's Recognition Award. Each physician should claim only those credits that he/she actually spent in the activity.

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RSVP by 4-28-05 to Craig Silverstein at 813-974-6464 or
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Screening and Surveillance of Autism and Related Disabilities
How to Change One's Clinical Practice

Presenter

Quimby E. McCaskill, M.D., MPH, FAAP
Assistant Professor of Pediatrics
Associate Director of the Community Pediatrics Training Initiative
at the University of Florida

Noon to 1 p.m., Wednesday, June 1, 2005
Hendry Regional Medical Center - Conference Room
500 West Sugarland Highway (State Road 27)

Lunch will be provided

Learner Objectives

- Discuss why early screening and surveillance are important.
- Define red flags of autism spectrum disorders.
- Review developmental screening tools.
- List barriers preventing change in practice.
- Describe model for improving screening practices.
- Create aim statement for changing practice.
- Develop next steps to initiate practice change.

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the University of South Florida College of Medicine and USF Florida Mental Health Insitute. The University of South Florida College of Medicine is accredited by the ACCME to provide continuing medical education for physicians. The University of South Florida College of Medicine designates this educational activity for a maximum of 1.0 category 1 credits towards the AMA physician's Recognition Award. Each physician should claim only those credits that he/she actually spent in the activity**.** This activity for 1 contact hour is provided by the University of South Florida College of Nursing, which is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation. Each nurse should claim only those hours of credit that he/she actually spent in the educational activity.

Presented in cooperation with Hendry Regional Medical Center and Hendry County Health Department
RSVP on or before Friday, May 13 to Sue Reese (863) 674-4056, ext. 157 or Suzette_Reese@doh.state.fl.us

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College of Medicine and College of Nursing

Appendix B: Pediatric Healthcare Provider Self-Report Questionnaire

Pediatric Healthcare Provider Self-Report Questionnaire

Purpose: As part of a multidisciplinary collaborative through the University of South Florida, this instrument was designed to obtain information regarding screening and referral patterns of healthcare providers as well as potential barriers to early screening and referral for Autism Spectrum Disorders (ASD).
ASD includes: autistic disorder, Asperger syndrome, pervasive developmental disorder- not otherwise specified (PDD-NOS), Rett syndrome, and childhood disintegrative disorder.

General Information

Please rate your **overall knowledge of:**	Poor	Fair	Good	Excellent
1. Autism Spectrum Disorders (ASD)	1	2	3	4
2. Early warning signs of ASD	1	2	3	4
3. Developmental screening instruments* (e.g., ASQ, PEDS)	1	2	3	4
4. Autism-specific screening instruments* (e.g., CHAT, M-CHAT)	1	2	3	4

**Note. This refers to use of the entire instrument and does not include use of only a few items from the instrument.*

5. Please indicate the age at which you believe **it is possible to** accurately screen and refer a child suspected of having an Autism Spectrum Disorder:	_____ months
6. Please indicate the age at which you believe **you are able to** accurately screen and refer a child suspected of having an Autism Spectrum Disorder:	_____ months

II. Screening Patterns

A) How often do you use the following **developmental screening instruments:**	Never (0%)	Rarely (1-19%)	Sometimes (20-49%)	Usually (50-99%)	Always (100%)
1. Ages & Stages Questionnaires (Bricker & Squires)	1	2	3	4	5
2. Parents' Evaluations of Developmental Status (PEDS; Glascoe)	1	2	3	4	5
3. Communication and Symbolic Behavior Scales Developmental Profile Infant-Toddler Checklist (CSBS DP; Wetherby & Prizant)	1	2	3	4	5
B) How often do you use the following **autism-specific screening instruments:**	Never (0%)	Rarely (1-19%)	Sometimes (20-49%)	Usually (50-99%)	Always (100%)
1. Checklist for Autism in Toddlers (CHAT; Baron-Cohen, Allen, & Gillberg)	1	2	3	4	5
2. Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, & Barton)	1	2	3	4	5
3. Pervasive Developmental Disorder Screening Test (PDDST; Siegel)	1	2	3	4	5
C) How often do you use **developmental screening instruments** with patients in the following age ranges:	Never (0%)	Rarely (1-19%)	Sometimes (20-49%)	Usually (50-99%)	Always (100%)
0-6 months	1	2	3	4	5
7-12 months	1	2	3	4	5
13-18 months	1	2	3	4	5
19-24 months	1	2	3	4	5
25-36 months	1	2	3	4	5
37-48 months	1	2	3	4	5
Older than 48 months	1	2	3	4	5

III. Potential Barriers to Utilizing Screening Instruments

Please indicate the extent to which each item is likely or unlikely to **impede your use** of screening instruments (e.g., PEDS).	Unlikely	Somewhat Unlikely	Somewhat Likely	Very Likely
1. Insufficient time	1	2	3	4
2. Lack of staff to assist with screenings	1	2	3	4
3. Insufficient information regarding referral resources	1	2	3	4
4. Cost of screening instruments	1	2	3	4
5. Inadequate reimbursement	1	2	3	4
6. Concern regarding emotional impact on the family	1	2	3	4
7. Belief that clinical impression is sufficient	1	2	3	4

IV. Demographics

Age: <30 31-40 41-50 51-60 >60

Gender: Male Female

Race: White (Non-Hispanic) Black/African American Hispanic Asian/Pacific Islander
Native American Multi-Racial/Ethnic Other

Location of practice: Rural Suburban Urban Other

Profession: Pediatrician Family Practice Registered Nurse Nurse Practitioner Other
Subspecialty (if applicable): _____

Setting of practice: Hospital Clinic Private Practice University-Affiliated Center Other

Years in practice: _____

Number of trainings completed related to: Autism Spectrum Disorders: _____ Changing practice/service delivery: _____

Thank you for completing this questionnaire

Appendix C: Implementation Checklist

Autism System of Care Training- Implementation Checklist

Trainer: _____ Date: _____

Reviewer: _____

ASC Training Content:	**Yes**	**Partially**	**No**
Reminded participants about importance of completing questionnaire and turning it in			
Reviewed **7** Learning Objectives			
Discussed "triad of impairments" in autism			
Discussed all **8** "red flags" of autism			
Reviewed indicators for immediate evaluation			
Reviewed average age of diagnosis & recommended age			
Discussed importance of using screening instruments			
Discussed importance of early screening/intervention			
Reviewed **5** recommended general screening instruments			
Reviewed **3** autism-specific screening instruments			
Detailed review of PEDS			
Detailed review of Ages and Stages Questionnaire (ASQ)			
Reviewed AAP's screening recommendations			
Reviewed perceived and concrete barriers to screening			
Reviewed Model for Improvement (Aim, Measures, Ideas)			
Discussed the **5** criterion of effective aim statements			

Reviewed "Plan, Do, Study, Act" Cycles			
Discussed measurement and data collection			
Discussed **5** steps in approaching barriers			
Reviewed example of change in practice to increase early screening			
Participants completed Individual 10-minute activity			
Reviewed "Tips for Success"			
Reviewed resources (e.g., websites, articles, books)			
Addressed **7** Learning Objectives			
Reminded participants of follow-up questionnaire and importance of completing and returning			

Obtain presenter's comments *(e.g., How do you feel the training went? Is there any part of the training where you feel more time should be spent, Is there any material that should be added? Removed?)*

_____

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