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The Screening and Diagnosis of Autistic Spectrum Disorders[1]

Pauline A. Filipek,[2,17] Pasquale J. Accardo,[3] Grace T. Baranek,[4] Edwin H. Cook, Jr.,[5] Geraldine Dawson,[6] Barry Gordon,[7] Judith S. Gravel,[8] Chris P. Johnson,[9] Ronald J. Kallen,[5] Susan E. Levy,[10] Nancy J. Minshew,[11] Barry M. Prizant,[12] Isabelle Rapin,[8] Sally J. Rogers,[13] Wendy L. Stone,[14] Stuart Teplin,[4] Roberto F. Tuchman,[15] and Fred R. Volkmar[16]

The Child Neurology Society and American Academy of Neurology recently proposed to formulate Practice Parameters for the Diagnosis and Evaluation of Autism for their memberships. This endeavor was expanded to include representatives from nine professional organizations and four parent organizations, with liaisons from the National Institutes of Health. This document was written by this multidisciplinary Consensus Panel after systematic analysis of over 2,500 relevant scientific articles in the literature. The Panel concluded that appropriate diagnosis of autism requires a dual-level approach: (a) routine developmental surveillance, and (b) diagnosis and evaluation of autism. Specific detailed recommendations for each level have been established in this document, which are intended to improve the rate of early suspicion and diagnosis of, and therefore early intervention for, autism.

KEY WORDS: Practice parameters diagnosis and evaluation of autism; dual-level approach.

INTRODUCTION

The synonymous terms *Autistic Spectrum Disorders* and *Pervasive Developmental Disorders* refer to a wide continuum of associated cognitive and neurobehavioral disorders, including, but not limited to, three core-defining features: impairments in socialization, impairments in verbal and nonverbal communication, and restricted and repetitive patterns of behaviors (American Psychiatric Association [APA], 1994). Many terms have been used over the years to refer to these disorders, (e.g., infantile autism, pervasive developmental disorder- residual type, childhood schizophrenia, and autistic psychoses). Although autism was

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[1] With the exception of the first author, all authors are listed in alphabetical order.

[2] University of California, Irvine, Irvine, California 92717.
[3] New York Medical College, Valhalla, New York 10595.
[4] University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27599.
[5] University of Chicago, Chicago, Illinois 60637-1513.
[6] University of Washington, Seattle, Washington 98195.
[7] Johns Hopkins University School of Medicine, Baltimore, Maryland 21218.
[8] Albert Einstein College of Medicine, Bronx, New York.
[9] University of Texas Health Science Center at San Antonio, San Antonio, Texas 78284-8200.
[10] University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania.
[11] University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.
[12] Brown University, Providence, Rhode Island 02912.
[13] University of Colorado Health Science Center, Denver, Colorado 80262.
[14] Vanderbilt University Medical Center, Nashville, Tennessee.
[15] University of Miami School of Medicine, Coral Gables, Florida.
[16] Yale University, New Haven, Connecticut 06520.
[17] Address all correspondence to Pauline A. Filipek, Departments of Pediatrics and Neurology, University of California, Irvine, College of Medicine, UCI Medical Center, Route 81-4482, 101 City Drive South, Orange, California 92868-3298; e-mail: filipek@uci.edu.

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first described over 50 years ago by Kanner (1943), our improved understanding of this complex disorder has emerged over the past two decades, and, despite the recent intense focus on autism, it continues to be an art and science in rapid evolution.

The terms *autism, autistic,* and *autistic spectrum disorders* are used interchangeably throughout this paper and refer to the broader umbrella of pervasive developmental disorders (PDD), whereas the specific term *Autistic Disorder* is used in reference to the more restricted criteria as defined by the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (DSM-IV; APA, 1994). The complexity and wide variability of symptoms within the autistic spectrum point to multiple etiologies which are currently grouped together under this diagnostic umbrella because of the similar core behavioral symptomatology.

The autistic spectrum disorders are not rare disorders, but instead are more prevalent in the pediatric population than cancer, diabetes, spina bifida, and Down syndrome. The earliest epidemiology studies noted a prevalence of Infantile Autism of 4–5 per 10,000 which is approximately 1 in every 2,000 people (Lotter, 1966). With the broader clinical phenotype and improved clinical recognition, the prevalence estimates have increased to 10–20 per 10,000, or one in every 500 to 1,000 people (Bryson, 1996; Bryson, Clark, & Smith, 1988a; Ehlers & Gillberg, 1993; Gillberg, Steffenburg, & Schaumann, 1991; Ishii & Takahasi, 1983; Sugiyama & Abe, 1989; Wing & Gould, 1979). Recent statistical analyses by the Commonwealth of Massachusetts Department of Public Health indicate a prevalence rate in the Zero-to-Three Early Intervention Program of 1 in 500 children (Tracey Osbahr, Massachusetts DPH, personal communication, March 1999). These higher prevalence rates imply that there are between 60,000 and 115,000 children under 15 years of age in the United States who meet diagnostic criteria for autism (Rapin, 1997). Most recently, Baird *et al.* (1999) found a prevalence rate of 30.8 cases per 10,000 of Autistic Disorder (1 in 333 children), with 27.1 additional cases per 10,000 for the autistic spectrum disorders. These prevalence rates are significantly higher than those noted in previous reports and require reconfimation in a future study. However, the notion of these markedly increasing prevalence rates further affirms the need for improved early screening and diagnosis.

The overall ratio of males to females with autism has traditionally been reported at approximately 3:1 to 4:1 (Lotter, 1966; Wing & Gould, 1979). However, the ratio seems to vary with IQ, ranging from 2:1 with severe dysfunction to more than 4:1 in those with average IQ (Bryson, 1997; Ehlers & Gillberg, 1993; Wing & Gould, 1979). Some feel that fewer females with normal IQ are diagnosed with autism because they may be more socially adept than males with similar IQ (McLennan, Lord, & Schopler, 1993; Volkmar, Szatmari, & Sparrow, 1993b).

Every health care or educational agency serving young children can expect to see children with autism. Although symptoms of autism may be present in the first year of life in children who are diagnosed later, and symptoms are virtually always present before the age of 3 years, autism is often not diagnosed until 2 to 3 years after symptoms appear. Individuals with autism also often remain undiagnosed or inaccurately diagnosed. Many clinicians hesitate to discuss the possibility of a diagnosis of autism with parents of young children even when some symptoms are present, due to concerns about family distress, the possible adverse effects of labeling a child, the possibility of being incorrect, or the hope that the symptoms will reverse over time. However, it is believed that the positive outcomes of *accurate* diagnosis far outweigh the negative effects, and families universally express the desire to be informed as early as possible (Marcus & Stone, 1993).

In actuality, the advantages of early diagnosis of autism are many and include earlier educational planning and treatment, provision for family supports and education, reduction of family stress and anguish, and delivery of appropriate medical care to the child (Cox *et al.,* 1999). Screening activities are crucial to early diagnosis. The purpose of screening is to identify children at risk for autism as soon as possible so that they can be rapidly referred for full diagnostic assessment and needed interventions. The press for early identification comes from evidence gathered over the past 10 years that intensive early intervention in optimal educational settings results in improved outcomes in most young children with autism, including speech in 75% or more and significant increases in rates of developmental progress and intellectual performance (Dawson & Osterling, 1997; Rogers, 1996, 1998). However, these kinds of outcomes have been documented only for children who receive 2 years or more of intensive intervention services *during the preschool years* (Anderson, Avery, Dipietro, Edwards, & Christian, 1987; Anderson, Campbell, & Cannon, 1994; Fenske, Zalenski, Krantz, & McClannahan, 1985; Hoyson, Jamieson, & Strain, 1984; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Ozonoff & Cathcart, 1998). Thus, early screening and early identification are crucial for improving outcomes of children with autism (Hoyson *et al.,* 1984; McEachin *et al.,* 1993; Rogers, 1996, 1998, in press; Rogers & Lewis, 1989; Sheinkopf & Siegel, 1998).

Howlin and Moore (1997) described the diagnostic experiences of almost 1,300 families with children with

autism from the United Kingdom. The average age at diagnosis in this study was not until 6 years (while in the U.S. the average is 3 to 4 years of age), despite the fact that most if not all parents of children with autism had a sense that something was wrong by 18 months of age on average and usually first sought medical assistance by 2 years of age. The U.K. parents reported that despite concerns in at least three different developmental areas, fewer than 10% were given a diagnosis at initial presentation. About 90% were referred to another professional (at a mean age of 40 months). Twenty-five percent were nonetheless told "not to worry." In the remaining 10%, over half were told to return if their worries persisted, and the rest were told that their child "would grow out of it." Of those families referred to a second professional, only 40% were given a formal diagnosis and 25% were referred to yet a third or fourth professional. Almost 25% of the families were either reassured by the second professional and told not to worry, or their concern was acknowledged but no further action was taken. Almost 20% reported that they either had to exert considerable pressure to obtain the referrals or pay privately. Over 30% of parents referred to subsequent professionals reported that no help was offered (e.g., with education, therapy, or referrals to parent support groups), and only about 10% reported that a professional explained their child's problems. Almost half of the families reported that the school system and other parents were the major source of assistance over time, rather than the medical health care community.

Howlin and Moore (1997) concluded that (a) early parental concerns about a child's development should be taken more seriously by both primary care and specialist professionals, with speedy referrals to appropriate facilities, (b) labels such as "autistic tendencies" or "features" should be avoided if one is unable to give a specific diagnosis of autism, and that (c) diagnosis in itself may be a critical step but will not improve prognosis unless combined with practical help and support to assist parents in obtaining treatment for the child, in order to develop skills and strategies applicable throughout the child's life.

DESCRIPTION OF THE ANALYTICAL PROCESS

Selection of Consensus Panel

Filipek was named by the American Academy of Neurology to chair a committee to determine practice parameters for screening and diagnosis of autism. Nominations were then sought from the American Academy of Audiology, American Academy of Child and Adolescent Psychiatry, American Academy of Family Physicians, American Academy of Neurology, American Academy of Pediatrics, American Occupational Therapy Association, American Psychological Association, American Psychological Society, American Speech-Language Hearing Association, Child Neurology Society, Society for Developmental and Behavioral Pediatrics, and the Society for Developmental Pediatrics for representative(s) from each organization with the requisite expertise in the screening and diagnosis of autism, whether by clinical research or clinical practice.

Final representatives include Judith S. Gravel (American Academy of Audiology); Edwin H. Cook Jr. and Fred R. Volkmar (American Academy of Child and Adolescent Psychiatry); Isabelle Rapin and Barry Gordon (American Academy of Neurology); Stuart Teplin, Ronald J. Kallen, and Chris Plauche Johnson (American Academy of Pediatrics); Grace T. Baranek (American Occupational Therapy Association); Sally J. Rogers and Wendy L. Stone (American Psychological Association); Geraldine Dawson (American Psychological Society); Barry M. Prizant (American Speech-Language Hearing Association); Nancy J. Minshew and Roberto F. Tuchman (Child Neurology Society); Susan E. Levy (Society for Developmental and Behavioral Pediatrics); and Pasquale J. Accardo (Society for Developmental Pediatrics). Representatives were named from the following associations: Barbara Cutler and Susan Goodman (Autism National Committee), Cheryl Trepagnier (Autism Society of America), Daniel H. Geschwind (Cure Autism Now), and Charles T. Gordon (National Alliance for Autism Research). The National Institutes of Health also named liaisons to serve on this committee, including Marie Bristol-Power (National Institute of Child Health and Human Development), Judith Cooper (National Institute of Deafness and Communication Disorders), Judith Rumsey (National Institute of Mental Health), and Giovanna Spinella (National Institute of Neurological Disorders and Stroke).

Consensus was reached by group discussion in all cases, either including the entire panel, or within subgroups by specialities.

Literature Review

Comprehensive computerized literature searches of *Medline* (National Library of Medicine) and *PsychINFO* (American Psychological Association) in all languages using the terms "(autistic OR autism OR pervasive) NOT treatment" produced over 4,000 documents. The focus was on literature published since 1990 that reported scientific research, but older sources and less stringent studies were included when relevant. A bibli-

ography of over 2,750 references was developed for this review; article abstracts were initially reviewed, followed by the relevant articles in entirety. The review process was expedited by the many review papers and meta-analyses developed for DSM-IV (APA, 1994), the research overview resulting from the *National Institutes of Health State of the Science Conference on Autism* in 1995 (see Bristol *et al.,* 1996, and accompanying articles) and current review articles, book chapters and books (Bailey, Phillips, & Rutter, 1996; Bauer, 1995a, 1995b; D. J. Cohen & Volkmar, 1997; Filipek, 1999; Minshew, 1996a; Minshew, Sweeney, & Bauman, 1997; Rapin, 1997; Rutter, 1996).

HISTORICAL PERSPECTIVE

Autism from 1943 to 1980

Kanner (1943) first described a syndrome of "autistic disturbances" with case histories of 11 children who presented between the ages of 2 and 8 years and who shared "unique" and previously unreported patterns of behavior including social remoteness, obsessiveness, stereotypy, and echolalia. After its initial description, autism was poorly ascertained during the middle decades of the 20th century. In DSM-I (APA, 1952) and DSM-II (APA, 1968), "psychotic reactions in children, manifesting primarily autism," were classified under the terms "schizophrenic reaction or schizophrenia, childhood type" (p. 28).

Despite this early but persisting view of autism as a psychosis, several prominent research groups formulated the first set of diagnostic criteria for this disorder by the 1970s (Ritvo & Freeman, 1978; Rutter & Hersov, 1977). With DSM-III (APA, 1980), the term *Pervasive Developmental Disorders* (PDD) was first used to describe disorders

> characterized by *distortions* in the development of multiple basic psychological functions that are involved in the development of social skills and language, such as attention, perception, reality testing, and motor movement . . . The term Pervasive Developmental Disorder was selected because it describes most accurately the core clinical disturbance: many basic areas of psychological development are affected at the same time and to a severe degree. (p. 86)

Under this new PDD umbrella, the possible diagnoses included, for the first time, the term *Infantile Autism* (with onset prior to age 30 months) as well as Childhood Onset Pervasive Developmental Disorder (with onset after age 30 months), each further subclassified into "Full Syndrome Present" or "Residual State," and Atypical Pervasive Developmental Disorder. In DSM-III, autism was also clearly differentiated from childhood schizophrenia and other psychoses for the first time, and the *absence* of psychotic symptoms, such as delusions and hallucinations, became one of the six diagnostic criteria. The revised DSM-III-R (APA, 1987) broadened the PDD spectrum and narrowed the possible diagnoses to two, Autistic Disorder and Pervasive Developmental DisorderNot Otherwise Specified (PDD-NOS).

Currently, DSM-IV (APA, 1994) includes five possible diagnoses under the PDD umbrella (Table I) which are concordant with the *International Classification of Disease,* 10th edition (ICD-10), used primarily abroad (World Health Organization [WHO], 1992).

The Broader Phenotype

Although Allen first coined the phrase "autistic spectrum disorder" (1988), the same year that Wing wrote about the "autistic continuum" (1988), controversy still surrounds this concept of a broader clinical phenotype. DSM-III (APA, 1980) acknowledged that such a continuum existed, and labeled it PDD; the term Autistic Disorder was reserved only for those with classical signs and symptoms presenting before 30 months of age. Over the past 10 years, however, there has been a slowly growing clinical consensus that the umbrella of "pervasive developmental disorders" does actually represent an "autistic spectrum" (Wing, 1997). For the first time, DSM-IV criteria included the term *qualitative* to describe the impairments within the major criteria, defining a *range of impairments* rather than the *absolute presence or absence* of a particular behavior as sufficient to meet a criterion for diagnosis.

Table I. The Pervasive Developmental (Autistic Spectrum) Disorders

DSM-IV Diagnoses (APA, 1994)	ICD-10 Diagnoses (WHO, 1992, 1993)
Autistic disorder	Childhood autism
Asperger disorder	Asperger syndrome
Childhood disintegrative disorder	Other childhood disintegrative disorder
Rett disorder	Rett syndrome
PDD-NOS[a]	Atypical autism
Atypical autism	Other PDD
	PDD, unspecified
(no corresponding DSM-IV diagnosis)	Overactive disorder with mental retardation with stereotyped movements

[a] PDD-NOS = Pervasive Developmental Disorder-Not Otherwise Specified.

The currently recognized clinical phenotype includes children with milder, but nonetheless unequivocal, social, communication, and behavioral deficits. Many high-functioning autistic children are diagnosed after presentation to clinics specializing in learning disabilities or Attention-Deficit/Hyperactivity Disorder (ADHD) (Porter, Goldstein, Galil, & Carel, 1992). Almost 15% of previously undiagnosed children receiving special education services met criteria for DSM-III-R Autistic Disorder in one series (Deb & Prasad, 1994). Autistic "traits" were also retrospectively found in almost one quarter of 2,201 adults previously diagnosed with various learning disabilities (Bhaumik, Branford, McGrother, & Thorp, 1997). Questionnaires devised to specifically diagnose ADHD will not identify autistic symptomatology, and 74% of children with high-functioning autism in another series had erroneously been previously diagnosed with ADHD despite clear differences in their social competence, cognitive development, and restricted range of activities (Jensen, Larrieu, & Mack, 1997).

PRESENTING SIGNS AND SYMPTOMS OF THE AUTISTIC SPECTRUM DISORDERS

All children on the autistic spectrum demonstrate the same core deficits, in (a) reciprocal social interactions and (b) verbal and nonverbal communication, with (c) restricted and repetitive behaviors or interests (APA, 1994). There is, nonetheless, marked variability in the severity of symptomatology across patients, and level of intellectual function can range from profound mental retardation through the superior range on conventional IQ tests. The DSM-IV criteria for Autistic Disorder are presented in Table II and are described below for each neurobehavioral domain. The symptoms and signs represent a summary of clinical features which are discussed in greater detail in the DSM-IV (APA, 1994), in the monograph edited by Rapin (1996c), in the *Wing Autistic Disorders Interview Checklist- Revised* (Wing, 1996), and in numerous additional publications describing the clinical presentation of the Autistic Spectrum Disorders (Allen, 1991; Bauman, Filipek, & Kemper, 1997; D. J. Cohen & Volkmar, 1997; Filipek, 1999; Lord & Paul, 1997; Minshew, 1996a; Rapin, 1997).

Autistic Disorder

(DSM-IV A1). Qualitative Impairment in Social Interactions

It is important to understand that these criteria refer to a *qualitative impairment* in reciprocal social interactions, and *not* to the absolute lack of social behaviors. The behaviors under this rubric range from total lack of awareness of another person, to eye contact which is present but not used to modulate social interactions. The outline for this section follows the DSM-IV outline for the criteria for Autistic Disorder (Table II) (APA, 1994).

Table II. Diagnostic Criteria for 299.00 Autistic Disorder (APA, 1994)[a]

A. A total of six (or more) items from (1), (2), and (3), with two from (1), and at least one each from (2) and (3):
   (1) qualitative impairment in social interaction, manifest by at least two of the following:
      a) marked impairment in the use of multiple nonverbal behaviors, such as eye-to-eye gaze, facial expression, body postures, and gestures, to regulate social interaction;
      b) failure to develop peer relationships appropriate to developmental level;
      c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by lack of showing, bringing or pointing out objects of interest);
      d) lack of social or emotional reciprocity
   (2) qualitative impairment in communication, as manifest by at least one of the following:
      a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime);
      b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others;
      c) stereotyped and repetitive use of language, or idiosyncratic language;
      d) lack of varied, spontaneous make-believe, or social imitative play appropriate to developmental level.
   (3) restrictive repetitive and stereotypic patterns of behavior, interests, and activities, as manifested by at least one of the following:
      a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus;
      b) apparently inflexible adherence to specific nonfunctional routines or rituals;
      c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements);
      d) persistent preoccupation with parts of objects.
B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.
C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

[a] Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders* (*4th ed.,* pp. 70–71 Washington, DC: American Psychiatric Association, 1994.

(A1a). Marked Impairment in the Use of Multiple Nonverbal Behaviors, Such As Eye-to-Eye Gaze, Facial Expression, Body Posture, and Gestures to Regulate Social Interaction. As infants, some children with autism do not lift up their arms or change posture in anticipation of being held. They may not or may cuddle or stiffen when held, and often do not look or smile when making a social approach. Some children do make eye contact, often only in brief glances, but the eye contact is usually not used to direct attention to objects or events of interest. Other children make inappropriate eye contact, by turning someone else's head to gaze into their eyes. Autistic children often ignore a familiar or unfamiliar person because of a lack of social interest. Some children do make social approaches, although their conversational turn-taking or modulation of eye contact is often grossly impaired. At the opposite extreme of social interactions, some children may make indiscriminate approaches to strangers (e.g., may climb into the examiner's lap before the parent has even entered the room, be unaware of psychological barriers, or be described as a child who continuously and inappropriately "gets into your face" in an intrusive manner).

(A1b). Failure to Develop Peer Relationships Appropriate to Developmental Level. Younger children may demonstrate lack of interest, or even apparent lack of awareness of peers or other children. Some children with autism have no age-appropriate friends, and often older children may be teased or bullied. A child may want "friends" but usually does not understand the concept of the reciprocity and sharing of interests and ideas inherent in friendship. For example, they might refer to all classmates as "friends." One telling example is the child who said without compunction, "Oh, I have many, many, twenty-nine friends, but none of them like me." Verbal children may have one "friend" but the relationship may be very limited or may focus only on a similar circumscribed interest, such as a particular computer game. Often, children gravitate to adults or to older peers, in which case they play the role of a follower, or to much younger peers, where they become the director. In either case, the demands on social reciprocity are much less compared to interactions with age-appropriate peers.

*(A1c). A Lack of Spontaneous Seeking to Share Enjoyment, Interests, or Achievements with Other People (*e.g.*, by a Lack of Showing, Bringing, or Pointing Out Objects of Interest).* As infants, some children with autism do not reciprocate in lap play, but rather either hold the parent's arms as the parent performs the game in a mechanical fashion, or insist that the parent watch the child perform the game. Regardless, the characteristic give-and-take in lap play that is seen in typically developing children by the end of the first year is often missing. They often do not point things out or use eye contact to share the pleasure of seeing something with another person, which is called *joint attention*.

(A1d). Lack of Social or Emotional Reciprocity. Some children with autism show no interest in other children or adults, and tend to play alone by themselves away from others. Others play with adults nearby, or sit on the outskirts of other children's play and either engage in parallel play or simply watch the other children. Some children involve other children in designated, often repetitive play, but often only as "assistants" without heeding any suggestions from the other children. Some tend to serve in the passive role in other children's play, for example as the baby in a game of "house," and simply follow others' directions. Other children may seek out one specific child with whom there is a limited solitary interest that dominates the entire relationship.

(A2). Qualitative Impairment in Communication

The communication impairments seen in the autistic spectrum are far more complex than presumed by simple speech delay and share some similarities with the deficits seen in children with developmental language disorders or specific language impairments (Allen & Rapin, 1992). Expressive language function across the autistic spectrum ranges from complete mutism to verbal fluency, although fluency is often accompanied by many semantic (word meaning) and verbal pragmatic (use of language to communicate) errors. Young autistic children, even if verbal, almost universally have comprehension deficits, in particular deficits in understanding higher order complex questions. Deficits in pragmatics, the use of language to communicate effectively, are also almost universally present. Some children with autism do not respond to their names when called by a parent or other favored caretaker, and often they are initially presumed to be severely hearing-impaired. This syndrome, *verbal auditory agnosia* (VAA), is similar to adult-onset *acquired word deafness,* with one very important exception: adults with *acquired word deafness* remain fluent because their language has been overlearned, whereas children with autism with either developmental VAA or acquired VAA with an epileptiform aphasia usually are mute (Rapin & Allen, 1987).

(A2a). Delay in, or Total Lack of, the Development of Spoken Language (Not Accompanied by an Attempt to Compensate Through Alternative Modes of Communication Such As Gesture or Mime). In early infancy, some children with autism do not babble or use any

other communicative vocalizations, and are described as very quiet babies. Some children have absolutely no spoken language when speech should be developing, and also fail to compensate with facial expressions or gestures. A typically developing infant or toddler may pull his mother over to a desired object, but then will clearly point to the object while looking at the mother's face. In contrast, a characteristic behavior of many children with autism is to mechanically use *another person's hand to indicate the desired object*, often called "hand over hand pointing." Some children even throw another's arm up towards the desired object that is out of reach, without any communicative pointing, gesturing, or vocalizations. Other "independent" children make no demands or requests of the parents, but rather learn to climb at a young age and acquire the desired object for themselves.

(A2b). In Individuals with Adequate Speech, Marked Impairment in the Ability to Initiate or Sustain a Conversation with Others. Some children with autism speak relatively fluently, but are unable to engage in a conversation, defined as two or more parties communicating in a give-and-take fashion on a mutually agreed upon topic. In a conversation, Partner A makes a statement in turn on the given topic that is directed at Partner B, who then makes another statement directed back at Partner A, which is continued over more than one cycle of turn-taking. Questions may be included, but they are obviously not the dominant sentence structure used in conversation. A hallmark of verbally fluent autistic children is their inability to initiate or sustain a conversation on a topic of mutual interest, although they may be able to respond relatively well to, or ask a myriad of questions, or talk "at" another person in a monologue or soliloquy about their favorite topic.

(A2c). Stereotyped and Repetitive Use of Language, or Idiosyncratic Language. A hallmark of autistic speech is *immediate* or *delayed echolalia*. Immediate echolalia refers to immediate repetition of words or phrases spoken by another—the children are simply repeating exactly what was heard without formulating their own language. It is important to realize that immediate echolalia is a very crucial aspect of normal language development in infants under the age of 2 years. It becomes pathologic when it is still present as the *sole and predominant expressive language* after the age of about 24 months, and can often be present throughout the preschool or school-age years in children with autism. It is imperative to differentiate speech that consists predominantly of immediate echolalia from the more classic picture of immediate echolalia progressing rapidly to spontaneous phrase speech in typically developing toddlers. *Delayed echolalia* or *scripts* refer to the use of ritualized phrases that have been memorized (e.g., from videos, television, commercials, or prior overheard conversations). The origin of this stereotypic language does not necessarily have to be clearly identifiable. Many older children with autism incorporate the scripts in appropriate conversational context, which can give much of their speech a "rehearsed" and often more fluent quality relative to the rest of their spoken language. Children also show difficulties with pronouns or other words that change in meaning with context, and often reverse pronouns or refer to themselves in the third person or by name. Others may use literal idiosyncratic phrases or neologisms. Verbal children with autism may speak in very detailed and grammatically correct phrases, which are nonetheless repetitive, concrete, and pedantic. If a child's answers to questions seem to "miss the point," further history and conversation should be elicited with the child, as this is also a hallmark of autistic language deficits. These children typically answer factual questions correctly and appropriately, but when asked a question that requires understanding concepts or concept formation, they give details that are often only tangentially related to the actual question.

(A2d). Lack of Varied, Spontaneous Make-Believe, or Social Imitative Play Appropriate to Developmental Level. Some children with autism do not use miniature objects, animals, or dolls appropriately in pretend play. Others use the miniatures in a repetitive mechanical fashion without evidence of flexible representational play. Some highly verbal children may invent a fantasy world which becomes the sole focus of repetitive play. A classic example of the lack of appropriate play is the verbal autistic preschooler who "plays" by repeatedly reciting a soliloquy of the old witch scene *verbatim* from *Beauty and the Beast* while manipulating dollhouse characters in sequence precisely according to *the script*. When given the same miniature figures and dollhouse, but instructed to play something other than *Beauty and the Beast*, this same child is incapable of creating any other play scenario.

(A3). Restricted, Repetitive, and Stereotypic Patterns of Behaviors, Interests, and Activities

Again, this category of stereotyped behaviors and interests, like the previous ones, encompasses qualitative deficits in several behaviors.

(A3a). Encompassing Preoccupation with One or More Stereotypic and Restricted Patterns of Interest That Is Abnormal in Intensity or Focus. Some verbal children with autism ask the same question repeatedly, regardless of what reply is given, or engage in highly

repetitive perseverative play. Others are preoccupied with unusual special interests. For example, many children are fascinated with dinosaurs, but children with autism may not only amass exhaustive facts about every conceivable type of dinosaur, but also about which museums house which particular fossils, and so forth; these children will often repeatedly "share" their knowledge with others regardless of the others' interest or suggestions to the contrary. Some autistic preschoolers are zealous fans of *Wheel of Fortune* or *Jeopardy*, even when still preverbal or minimally verbal; this unusual interest in a preschool child is considered by many to be a hallmark of autism (Allen, 1991).

(A3b). Apparently Inflexible Adherence to Specific Nonfunctional Routines or Rituals. Many children with autism are so preoccupied with "sameness" in their home and school environments or with routines, that little can be changed without prompting a tantrum or other emotional disturbance. Some may, for example, insist that all home furnishings remain in the same position, or that all clothing be of a particular color, or that only one specific set of favored sheets be on the bed. Others may eat only from a specific plate when sitting in a specific chair in a specific room, which may not necessarily be the kitchen or dining room. Some children may insist on being naked while in the home, but insist on wearing shoes to the dinner table. This inflexibility may also extend to familiar routines, for example, taking only a certain route to school, or entering the grocery store only by one specific door, or never stopping or turning around once the car starts moving. Many parents may either not be aware that they are following certain rituals to avoid an emotional upheaval, or may be aware but too embarrassed to volunteer such information. Within this context, some children have distinct behavioral repertoires that they self-impose to sustain sameness, even when not imposed externally. By adulthood, many of these rituals may evolve to more classic obsessive-compulsive symptoms, including hoarding unusable or broken objects, or repetitively whispering words or phrases to themselves.

*(A3c). Stereotyped and Repetitive Motor Mannerisms (*e.g.*, Hand or Finger Flapping or Twisting or Complex Whole-Body Movements). S*ome children will have obvious stereotypic motor movements, such as hand clapping or arm flapping whenever excited or upset, which is pathologic if it occurs after the age of about 2 years. Running aimlessly, rocking, spinning, bruxism, toe-walking, or other odd postures are commonly seen in children with autism. Others may simply repetitively tap the back of their hand in a less obtrusive manner. It has been noted that, in higher functioning youngsters, the stereotypic movements may become "miniaturized" as they get older into more socially acceptable behaviors, such as pill-rolling (Bauman, 1992a; Rapin, 1996c). It is also important to realize that not all children with autism have repetitive motor movements.

(A3d). Persistent Preoccupation with Parts of Objects. Many children demonstrate the classic behavior of lining up their toys, videotapes, or other favored objects, but others may simply collect "things" for no apparent purpose. Many engage in repetitive actions, such as opening and closing doors, drawers, or flip-top trash cans, or turning light switches off and on. Others are fascinated and repetitively flick strings, elastic bands, measuring tapes, or electric cords. Younger children with autism are often particularly fascinated with water, and they especially enjoy transferring water repetitively from one vessel into another. Some may taste or smell items. Others love spinning objects, and may either spend long periods spinning the wheels of a toy car or watching ceiling fans, or spinning themselves until they fall from dizziness. Some children will often look at objects out of the corner of their eyes.

Asperger Disorder

Unbeknownst to each other, the year after Kanner's (1943) first description of autism, a pediatrician named Asperger (1991/1944) also described four children with "autistic psychopathy," who had presumably milder autistic behaviors and normal IQ. This report written in German was not widely known until the 1980s (Wing, 1981b). The diagnostic term was included for the first time in DSM-IV (APA, 1994), and the criteria for the qualitative impairments in social interaction, and restrictive and repetitive patterns of behaviors and activities are identical to those for Autistic Disorder. This diagnostic category is clearly in evolution and, as discussed in Schopler, Mesibov, and Kunce (1998), it is unclear whether it will remain a valid syndrome separate from autism.

In contrast to the Autistic Disorder criteria which include deficits in verbal and nonverbal communication and play, Asperger criteria currently state that there is no evidence of "clinically significant" language delay, such that the child used single words by age 2 years, and communicative phrases by age 3 years (APA, 1994). (Note that these criteria for language delay are much laxer than those recommended for referral in the current guidelines.) Normal or near-normal IQ is also the rule, including self-help skills, "adaptive behavior (other than in social interaction), and curiosity about the environment in childhood." The lack of clear language deviance usually leads

to later clinical recognition than with other autistic spectrum disorders, which is presumably due to the normal or near-normal adaptive behavior early in life (Volkmar & Cohen, 1991). Yet, the language in Asperger's is clearly not typical or normal. Individuals with Asperger disorder usually have pedantic and poorly modulated speech, poor nonverbal pragmatic or communication skills, and intense preoccupations with circumscribed topics such as the weather or railway timetables (Ghaziuddin & Gerstein, 1996; Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995; Wing, 1981a). Their speech is often concrete and literal, and their answers often "miss the point." Some clinicians have mislabeled individuals with this speech pattern as having a *Semantic-Pragmatic Language Disorder* rather than Asperger's or autism (Bishop, Hartley, & Weir, 1994; Bishop, 1989; Gagnon, Mottron, & Joanette, 1997). However, this diagnosis of a language disorder is not an appropriate substitution for the diagnosis of autism, as it does not account for the social deficits and restrictive, repetitive interests.

Socially, individuals with Asperger disorder are usually unable to form friendships. Because of their naive, inappropriate one-sided social interactions, they are also often ridiculed by their peers. Often they cease their attempts because of the cruel ridicule, and remain extremely socially isolated. Yet, they honestly desire success in interpersonal relationships, and are often quite puzzled when they do not succeed (Bonnet & Gao, 1996). They often have both fine and gross motor deficits, including clumsy and uncoordinated movements and odd postures (Asperger, 1991/1944; Klin *et al.,* 1995; Wing, 1981a). However, motor apraxia is an inconsistent finding, as formal tests of motor abilities do not differentiate high-functioning autism from Asperger disorder (Ghaziuddin, Butler, Tsai, & Ghaziuddin, 1994; Manjiviona & Prior, 1995).

The validity of Asperger disorder as a discrete diagnostic entity distinct from high-functioning (verbal) autism remains controversial (Kurita, 1997; Schopler, 1996; Schopler *et al.,* 1998; Volkmar *et al.,* 1996). Clinically, the diagnosis of Asperger disorder is often given as an alternative, more acceptable, "A-word" to high-functioning children with autism (Bishop, 1989). There are multiple partially overlapping clinical criteria currently in use around the world for the diagnosis of Asperger disorder, which adds to the confusion (APA, 1994; Attwood, 1998; Gillberg & Gillberg, 1989; 1995; Szatmari, Bremner, & Nagy, 1989; Wing, 1981a; WHO, 1992, 1993). The similarity and overlap of signs and symptoms of Asperger's with the Syndrome of Nonverbal Learning Disabilities further expands the spectrum of these developmental disorders (Harnadek & Rourke, 1994; Klin *et al.,* 1995; Rourke, 1989a, 1989b; Voeller, 1986). However, again, a diagnosis of a learning disability is not an appropriate substitution for a diagnosis of autism, as all too often it does not account for the social deficits and restrictive, repetitive interests. To add to the confusion, a recent retrospective review of the original four Asperger cases (1991/1944) reported that these children actually meet current DSM-IV (APA 1994) criteria for Autistic Disorder (Miller & Ozonoff, 1997). As DSM-IV is now written, if criteria for Autistic Disorder are met, this precludes a diagnosis of Asperger disorder.

Childhood Disintegrative Disorder

Childhood Disintegrative Disorder (CDD) refers to the rare occurrence of normal early development until at least age 24 months, followed by a rapid neurodevelopmental regression that results most often in autistic symptomatology. CDD, previously called *Heller's syndrome, dementia infantilis* or *disintegrative psychosis,* usually occurs between 36 and 48 months of age but may occur up to 10 years of age. There have been only a hundred or so reports of CDD in the literature (Volkmar, Klin, Marans, & Cohen, 1997; Volkmar & Rutter, 1995). The hallmark signs include the loss of previously normal language, social, play, or motor skills, and frequently include the onset of restrictive repetitive behaviors, all typical of autism (APA, 1994). CDD is usually associated with more severe autistic symptoms than is early-onset autism, including profound loss of cognitive skills resulting in mental retardation (Catalano, 1998; Evans-Jones & Rosenbloom, 1978; Hoshino *et al.,* 1987; Short & Schopler, 1988; Tuchman & Rapin, 1997; Volkmar & Rutter, 1995). A recent review of CDD noted a 4 : 1 male predominance, mean age of onset of 29 ± 16 months, with over 95% showing symptoms of speech loss, social disturbances, stereotyped behaviors, resistance to change, anxiety and deterioration of self-help skills (Volkmar, 1992, 1994).

In children with autism, it is also well recognized that clinical regression can and often does occur *as early as 15 months of age,* with a mean age of 21 months (Tuchman, 1996). The relationship between autism with an early regressive course (before 36 months), CDD (after 36 months), Landau-Kleffner syndrome (Landau & Kleffner, 1957; Landau & Kleffner, 1998), and electrical status epilepticus during slow wave sleep (ESES) is currently poorly understood, as is the underlying etiology and pathophysiology (Bristol *et al.,* 1996; Tuchman & Rapin, 1997). Estimates of the rates of regression in children with autism range from 10 to over 50% (Hoshino *et al.,* 1987; Tuchman & Rapin, 1997), with

total loss of expressive language occurring in between 20 and 40% (Kurita, 1985, 1996; Kurita, Kita, & Miyake, 1992; Rutter & Lord, 1987). Between 36 and 55% of parents of children with autism note problems in the first year of life, but likely only retrospectively (Short & Schopler, 1988; Volkmar, Stier, & Cohen, 1985). Some children had autistic symptoms quite early, but did not receive a medical referral or assessment until 2 or 3 years of age. Either parents failed to recognize the insidious problems or the physician or others discounted the parental concerns. Acute or subacute loss of language is more likely to motivate parents to seek medical help than is the onset of social abnormalities (Rogers & DiLalla, 1990). One of the most troubling problems hindering a better understanding of autistic regression and CDD involves the disentangling of "age at onset" from "age at recognition" (Volkmar *et al.,* 1985). Retrospective evaluation of home movies and videotapes is now a well-accepted research strategy for identifying autistic symptoms by as early as 12 months of age (Adrien *et al.,* 1992; Baranek, 1999; Osterling & Dawson, 1994).

Autism with regression and CDD have both been associated with seizures or epileptiform electroencephalograms (EEG) (Rapin, 1997; Tuchman, 1995; Tuchman & Rapin, 1997; Tuchman, Rapin, & Shinnar, 1991a, 1991b). In a recent study of children with autism with a history of regression (Tuchman & Rapin, 1997), there were almost twice as many children in the sample with epileptiform EEGs (21%) as there were with clinical epilepsy (11%), which indexes a significant portion of children with autism with subclinical epileptiform activity. These investigators suggested that regression has a significant association with an epileptiform EEG, even in the face of a lack of clinical seizure activity (19% in those with regression vs. 10% in those without). The majority of the epileptiform EEGs were localized to the centrotemporal regions. It is noteworthy that seizures or epileptiform EEGs were more prevalent in those children with regression who also demonstrated a significant cognitive deficit (Tuchman & Rapin, 1997).

Atypical Autism/ PDD Not Otherwise Specified (PDD-NOS)

These diagnoses are used when clinically significant autistic symptomatology is present, including deficits in reciprocal social interactions, verbal or nonverbal communication, or stereotyped behavior, interests, and activities, but full criteria are not met for an alternative specific diagnosis under the autistic spectrum or PDD umbrella; for example, in a child who does not meet the required total of 6 of the possible 12 criteria for the diagnosis of Autistic Disorder, or who had symptom onset after age 36 months. Also, children whose symptoms are atypical or not as severe would be coded under this diagnosis (APA, 1994).

Atypical autism/ PDDNOS is not a distinct clinical entity with a specific definition, although individuals given this diagnosis are traditionally thought to have milder symptoms. PDDNOS is a diagnosis by exclusion of the other autistic spectrum disorders (Towbin, 1997). It is often used as a "default" or "wastebasket" diagnosis when either insufficient or unreliable information is available, or when the practitioner is hesitant to use the term "autism." Indeed, when 176 children diagnosed by DSM-III-R criteria (APA, 1987) with Autistic Disorder were compared with 18 children diagnosed with PDDNOS, no significant differences were noted on any neuropsychological or behavioral measures when co-varied for nonverbal IQ (Rapin *et al.,* 1996). Screening and diagnostic procedures for atypical autism/PDDNOS is the same as for the other autistic spectrum disorders, as is management.

Rett Syndrome

Rett syndrome, a neurodegenerative disorder essentially limited to girls, becomes manifest after a period of normal function after birth. Although it was first described by Rett in 1966, clinical awareness of the syndrome did not occur until Hagberg *et al.* (1983) reported 35 additional cases. The girl with Rett syndrome initially presents as early as age 6 to 8 months, after a normal birth, a normal newborn head circumference, and normal early developmental milestones, with a decelerating head circumference growth rate. This is eventually followed by microcephaly (i.e., head circumference less than the second percentile) and by the loss of purposeful hand skills. Subsequently, stereotypic hand movements such as wringing, washing, licking, or clapping, and poor truncal or gait coordination develop, with loss of social engagement and severely impaired receptive and expressive language development and cognitive skills (Armstrong, 1997; Hagberg *et al.,* 1983; Naidu, 1997; Percy, Gillberg, Hagberg, & Witt-Engerstrom, 1990). Almost all the children have abnormal EEGs with slow background activity and spikes, but clinical seizures occur in only about one third of cases (Armstrong, 1997; Naidu, 1997; Percy *et al.,* 1990). There is general agreement that Rett syndrome is a developmental disorder, although its classification in DSM-IV and ICD-10 as a PDD remains controversial (Burd, Fisher, & Kerbeshian, 1989; Gillberg, 1994; Tsai, 1992). However, it was classified under the PDD umbrella so that a misdiagnosis of

autism would not be given in lieu of the correct diagnosis of Rett syndrome.

SCREENING AND DIAGNOSIS OF AUTISM: "SCREEN, PROBE, EVALUATE"

Screening for autism calls for two different levels of investigation, each answering a different question (Siegel, 1998). *Level 1* screening should be performed on all children and involves identifying children at risk for any type of atypical development. *Level 2* involves a more in-depth investigation of children already identified to be at risk for a developmental disorder, differentiates autism from other kinds of developmental difficulties, and includes evaluations by autism specialists aimed at determining the best means of intervention based on the child's profile of strengths and weaknesses. Please refer to the Algorithm (Fig. 1) for an overview of this process. Although the process itself has been separated into two levels of evaluation, this does not necessarily indicate separate independent levels of professional involvement, as a given single professional may well perform both sequential stages.

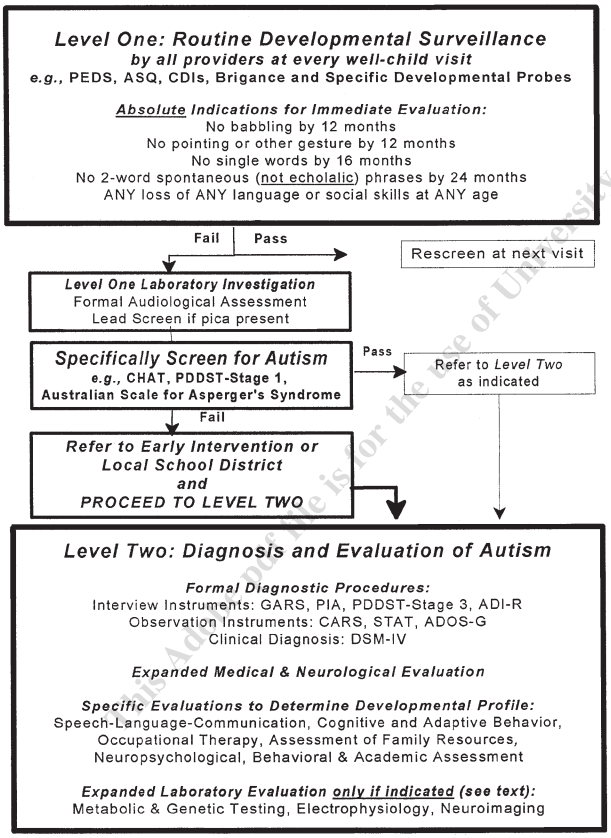

Fig. 1. Algorithm.

Since we currently have no biological marker for autism, screening must focus on behavior. Furthermore, in most cases, autism appears to have a gradual onset, often without clear evidence of sensorimotor impairment. Children with autism typically sit, crawl, and walk at the expected age. Many even produce a few words at developmentally appropriate times, although these words seldom develop into useful early language. Symptoms that may be present during infancy (a serious expression, increased irritability, sleep and eating difficulties, and placidity) are behaviors commonly seen in otherwise typically developing children.

At the present time, specific behaviors that distinguish infants with autism from others at 12 months of age have been identified in studies using observations based on home videotapes (Osterling & Dawson, 1994). Using home videotapes of first birthday parties in infants with autism versus typical development, these investigators found that four behaviors correctly identified over 90% of the autistic and typical infants. These behaviors, which were replicated in a subsequent study (Mars, Mauk, & Dowrick, 1998), were eye contact, orienting to name being called, pointing, and showing. A more recent study of home videotapes of first birthdays (Osterling & Dawson, 1999) found that these 1-year-olds with autism could also be distinguished from 1-year-olds with idiopathic mental retardation. One-year-old infants with autism used less eye contact and oriented to their names less frequently than those with mental retardation and those with typical development. Furthermore, these same behaviors distinguished these same infants with autism at 8 to 10 months from those with typical development (Brown, Dawson, Osterling, & Dinno, 1998). Baranek (1999) similarly used retrospective video analysis with 9- to 12-month-old infants and found that a pattern of nine behaviors differentiated between autism, developmental disabilities and typical development with 94% accuracy. The autistic pattern included greater problems with responsiveness to social stimuli (e.g., delayed responding to name; social touch aversion) as well as other nonsocial aspects of sensory responsiveness. Although the long-range stability and predictive utility of these findings remains to be determined, these results suggest that autism will eventually be reliably detected as early as 1 year of age, or even younger (Baranek, 1999; Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998).

Autism can be diagnosed reliably in children by or before the age of 3 years. Recent studies have demonstrated that symptoms of autism are measurable by 18 months of age, and that these symptoms are stable

from toddler age through the preschool age (Charman *et al.,* 1997; Cox *et al.,* 1999; Lord, 1995; Stone *et al.,* 1999). Furthermore, these studies have identified the main characteristics that differentiate autism from other developmental disorders in the 20-month to 36-month age range, characteristics that early screening tools need to target. These involve negative symptoms, or behavioral deficits, in the following areas: eye contact, orienting to one's name, joint attention behaviors (e.g., pointing, showing), pretend play, imitation, nonverbal communication, and language development. There is some indication that socially directed emotional behavior may also differentiate the groups; neither sensory-perceptual nor positive symptoms such as repetitive behaviors or behavioral outbursts appear to consistently differentiate between autistic and nonautistic groups early on.

Screening for autism may not identify children with milder variants of the disorder (without mental retardation or obvious language delay). These children's difficulties often go undiagnosed for years, causing them increasing difficulty as they try to meet the demands of elementary education without needed supports. Their difficulties cause great stress for their families, who recognize the child's challenges but have difficulty convincing others that their child has a disability. These children and their families will benefit greatly from improved screening efforts and the increased opportunity for effective intervention that screening activities can yield. However, this screening also needs to target the symptoms of verbal individuals with high-functioning autism and Asperger disorder, and must focus on older children, adolescents, and young adults (Garnett & Attwood, 1998). Such screens are also relevant for educational settings, where these older children may also be recognized.

Level 1: Routine Developmental Surveillance and Screening Specifically for Autism

It is the consensus of this Panel that primary care providers must change their approach to well-child care, so as to perform proactive screening for developmental disorders. It has been estimated that almost 25% of children in any practice demonstrate developmental issues at some point. Therefore, developmental screening must become an absolutely essential routine of each and every well-child visit throughout infancy, toddler, and preschool years, and even beyond early school-age if concerns are raised. The additional use of Specific Developmental Probes will increase the sensitivity and specificity of the screening process for autism.

Unfortunately, fewer than 30% of primary care providers conduct standardized screening tests (in the rigid manner for which they were intended) at well-child appointments (Dworkin, 1989, 1992; Majnemer & Rosenblatt, 1994; Rapin, 1995). Additionally, the American Academy of Pediatrics (AAP) is stressing the importance of developmental *surveillance* at every well-child visit: a flexible, continuous process that is broader than screening and includes eliciting and valuing parental concerns, specific probing regarding age-appropriate skills in each developmental domain, and skilled observations (American Academy of Pediatrics Committee on Children with Disabilities, 1994; Johnson & Blasco, 1997). Implementation of the developmental surveillance process at every well-child visit and the acquisition of the necessary skills to make it happen will only be accomplished with training at the preservice and in-service levels. Additionally, current managed-care policy, which allows only a few minutes for well-child appointments, must change if clinicians are to implement the training they receive (Glascoe, Foster, & Wolraich, 1997). A high degree of advocacy on the part of parents, health care professionals, and managed care administrators is essential if the recommendations of this Practice Parameter are to be appropriately implemented.

It is important to realize that parents *usually are correct* in their concerns about their child's development (Glascoe, 1994, 1997, 1998; Glascoe & Dworkin, 1995). They may not be as accurate regarding the qualitative and quantitative parameters surrounding the developmental abnormality, but almost always, if there is a concern, there is indeed a problem in some aspect of the child's development. Any developmental concern on Chief Complaint must be valued and lead to further investigation.

Although a positive parental concern strongly suggests an underlying developmental problem, the lack of concern does not imply normal development. Lack of parenting experience, cultural influences, denial, time constraints in the presence of more pressing medical issues, all contribute to parental reluctance to bring up developmental issues. Even when the parents express no concerns, a child's development should be monitored closely by using one of the available parental questionnaire instruments. Some clinics utilize well-child clinic forms with preprinted developmental milestones that are appropriate for each routine visit. The information on these forms should be taken from valid milestone charts and cover each developmental domain.

General Developmental Screening: Parental Questionnaires

Traditional Instruments. The *Denver-II* (DDST-II, formerly the *Denver Developmental Screening Test-*

Revised; Frankenburg, Dodds, Archer, Shapiro, & Bresnick, 1992) has been the traditional tool used for developmental screening in primary care practices. It is designed for children from birth to 6 years of age, and samples receptive and expressive language, articulation, fine motor-adaptive, personal-social, and gross motor skills. It yields a single score (abnormal, questionable, untestable, normal, or advanced). Easy to administer and score, the test can be completed in 25 minutes or less. However, the validity of the test has not been studied. In addition, subsequent research found that the measure was significantly insensitive (meaning that the instrument missed a significant number of delayed children—many missed true positives) and lacked specificity (meaning that a significant number of normal children—true negatives—were misclassified as delayed) (Glascoe *et al.,* 1992). The *Revised Denver Pre-Screening Developmental Questionnaire* (R-DPDQ; Frankenburg, 1986), in contrast, is designed to identify a subset of children who need further screening. It uses parental report and presents 10 to 15 items, sampling the various domains, in the age range of birth to 6 years. R-DPDQ items were drawn from the Denver Developmental Screening Test (the very popular predecessor of the Denver-II) which detected only 30% of children with language impairments and 50% of children with mental retardation (Borowitz & Glascoe, 1986; Glascoe *et al.,* 1992; Greer, Bauchner, & Zuckerman, 1989). Many other comprehensive studies also document the lack of sensitivity and specificity of this instrument (Cadman *et al.,* 1984; Camp, van Doorninck, Frankenburg, & Lampe, 1977; Diamond, 1987; Grant & Gittelsohn, 1972; Harper & Wacker, 1983; Lindquist, 1982; Sciarillo, Brown, Robinson, Bennett, & Sells, 1986; Sturner, Green, & Funk, 1985). Because of the lack of sensitivity and specificity of both the DDST-II and R-DPDQ, an alternative instrument must be used for appropriate *Level 1* primary-care screening at every well-child visit.

Standardized Developmental Screening Instruments. Examples of Level 1 parent questionnaires with acceptable psychometric properties include: (a) *The Ages and Stages Questionnaire, Second Edition* (ASQ; Bricker & Squires, 1994; Bricker & Squires, 1999; Squires, Bricker, & Potter, 1997) uses parental report for children from birth to 3 years, and provides clear drawings and directions for eliciting thoughtful responses. Separate forms of 10 to 15 items for each age range are tied to the well-child visit schedule. Modifications are available for screening children at other particular ages. Well-standardized and validated, the ASQ has good sensitivity and excellent specificity and provides pass–fail scores. Because it is difficult to use the single outcome score to make referrals and because of the ASQ's brevity, it appears especially useful as a prescreening tool. (b) *The BRIGANCE® Screens* (Brigance, 1986; Glascoe, 1996) consist of seven separate forms, one for each 12-month age range from 21 to 90 months of age. It taps key developmental and early academic skills, including speech-language, fine and gross motor, graphomotor development, and general knowledge at younger ages and also reading and math at older ages. It uses direct elicitation and observation, and takes in approximately 10 minutes to administer. It is available in English or Spanish. It is well standardized and validated, and has been in use for over 10 years. The Screens produce cutoff and age-equivalent scores for motor, language, and readiness, and an overall cutoff score. The Screens also have good sensitivity and specificity to giftedness. (c) *The Child Development Inventories* (CDIs; Ireton, 1992; Ireton & Glascoe, 1995) include three separate measures with 60 items each (the Infant Development Inventory, birth to 21 months of age; Early Child Development Inventory, 15 to 36 months of age; and the Preschool Development Inventory, 36 to 72 months of age). All are completed by parental report in about 5 to 10 minutes. The CDIs can be self-administered in waiting or exam rooms or mailed to families. For parents with limited English, items can be directly administered to children. The CDIs screen for language, motor, cognitive, preacademic, social, self-help, behavior, and health problems. Forms for the older two age groups produce a single cutoff score equivalent to 1.5 standard deviations below the population mean. Clinicians must then analyze errors to determine the domains in which children are having the most difficulty in order to make appropriate referrals (e.g., fine motor deficits might dictate an occupational therapy referral whereas global deficits dictate the need for comprehensive assessment). Although the CDIs were standardized exclusively in St. Paul, MN, a number of validity studies support the instruments' effectiveness in other geographic locations, with minorities and with groups with lower socioeconomic status (Chaffee, Cunningham, Secord-Gilbat, Elbard, & Richards, 1990; Guerin & Gottfried, 1987; Ireton & Glascoe, 1995; Sturner, Funk, Thomas, & Green, 1982). These also showed the measures to have excellent sensitivity and good specificity. The parent instrument to the CDIs, the *Child Development Inventory*, is more of an assessment than a screening tool for children 15 to 72 months of age. (d) *The Parents' Evaluation of Developmental Status* (PEDS, Glascoe, 1998) helps providers carefully elicit and interpret parents' concerns. PEDS assigns probabilities of delays and disabilities to the various types of concerns, thus enabling clinicians to make evidence-based

decisions, provide in-office counseling, encourage suggestions, and give reassurance. To use PEDS, parents must answer 10 questions. These are written at the fifth-grade level in English and in Spanish, and more than 90% of parents can complete the questionnaire in writing while they wait for their appointment. Clinicians or office staff can score and interpret the results in about 2 minutes. PEDS was validated and standardized on 971 children around the country in four separate validation studies (Glascoe, 1991, 1994; Glascoe, Altemeier, & MacLean, 1989; Glascoe, MacLean, & Stone, 1991). Its accuracy in the detection of disabilities meets conventional standards for screening tests (sensitivity to developmental problems and specificity to normal development of 70 to 80%). Research on PEDS shows that parents are likely to be accurate, regardless of their level of education or parenting experience.

Chief Complaints and Specific Probes Regarding Developmental Concerns

There are at least three general concerns with which young children and their parents present to the primary care provider at a well-child visit: speech or language delay; problems with social development with or without similar concerns in speech or language; and the development of a younger sibling of a child with known or suspected autism. Any child whose parents are concerned in these areas should be further evaluated through *Levels 1 and 2,* as appropriate. Any concern that implies "regression" or loss of skills in language or social skills should be a serious red flag.

The Child Whose Parents Are Concerned about Speech or Language Delay. Chief complaints about "isolated" speech deficits are the most common concerns raised by parents in children between the ages of 1 and 5 years. Most of the time these concerns relate to delayed expressive language, because parents are not usually as knowledgeable about their child's receptive language skills. There are several classic parental concerns, as well as absolute language milestone misses, either of which should immediately prompt further investigation (Table III). When these or other language concerns are voiced, the *Level 1* provider should probe with questions to the parent regarding social skills and behavior, as well as communication, in an effort to determine whether there are any problems in addition to language (Table IV).

The Child with a Suspected Problem in Social Development or Behavior (with or without Similar Concerns in Speech or Language). Any concerns regarding problems with social development should always be taken seriously, as seriously as an older child's complaint of back or chest pain. Unlike "stomachaches" and "headaches" which are common, self-limiting, and can often be treated symptomatically without a diagnostic workup, a complaint of back or chest pain is rare and deserves investigation. Similarly, parents rarely complain of social delays or problems, so any and all such concerns should be immediately investigated. In addition, complaints about behavioral concerns that coexist with any other concerns of social or communication development should be immediately investigated (see Tables III and IV). It is even more significant when parents voice additional concerns in the communication and behavior areas as well as in socialization.

The Younger Sibling of an Older Child with Known or Suspected Autism. The younger sibling(s) of an autistic child deserves special attention whether or

Table III. Parental Concerns that are RED FLAGS for Autism

Communication Concerns
Does not respond to his/her name
Cannot tell me what (s)he wants
Language is delayed
Doesn't follow directions
Appears deaf at times
Seems to hear sometimes but not others
Doesn't point or wave bye-bye
Used to say a few words, but now he doesn't
Social Concerns
Doesn't smile socially
Seems to prefer to play alone
Gets things for himself
Is very independent
Does things "early"
Has poor eye contact
Is in his own world
Tunes us out
Is not interested in other children
Behavioral Concerns
Tantrums
Is hyperactive/uncooperative or oppositional
Doesn't know how to play with toys
Gets stuck on things over and over
Toe walks
Has unusual attachments to toys (e.g., always is holding a certain object)
Lines things up
Is oversensitive to certain textures or sounds
Has odd movement patterns
Absolute indications for immediate further evaluation
No babbling by 12 months
No gesturing (pointing, waving bye-bye, etc) by 12 months
No single words by 16 months
No 2-word spontaneous (*not just echolalic*) phrases by 24 months
ANY Loss of ANY Language or Social Skills at ANY Age

Table IV. Ask Specific Development Probes: "Does (s)he . . ." or "Is there . . ."

Socialization
. . . cuddle like other children?
. . . look at you when you are talking or playing?
. . . smile in response to a smile from others?
. . . engage in reciprocal, back-and-forth play?
. . . play simple imitation games, such as pat-a-cake or peek-a-boo?
. . . show interest in other children?
Communication
. . . point with his finger?
. . . gesture? nod yes and no?
. . . direct your attention by holding up objects for you to see?
. . . anything odd about his/her speech?
. . . show things to people?
. . . lead an adult by the hand?
. . . give inconsistent responses to name? . . . to commands?
. . . use rote, repetitive, or echolalic speech?
. . . memorize strings of words or scripts?
Behavior
. . . have repetitive, stereotyped, or odd motor behavior?
. . . have preoccupations or a narrow range of interests?
. . . attend more to parts of objects (e.g., wheels)?
. . . have limited or absent pretend play?
. . . imitate other people's actions?
. . . play with toys in the same exact way each time?
. . . strongly attached to a specific unusual objects(s)?

not the parents have concerns about this child's development. Siblings constitute an important autism-risk group; their development needs to be monitored very carefully not only for autism-related symptoms but also for language delays and early anxiety symptoms. While some parents may be overly vigilant regarding the presence of "autistic features" and overreact, other parents may not realize that their younger child demonstrates milder autistic symptoms, because the severity of the older child overshadows the subtle abnormalities in the younger. The main advantage of identifying young children with autism as soon as possible is to provide them with early treatment in high quality autism intervention programs. Additionally, it is important to note that a younger sibling may mimic their older autistic sibling even when s/he has no innate autistic characteristics of her/his own. When the parents do have a concern, *Level 1* screening should proceed directly to the autism-specific questionnaires. When the parents have no concerns, screening should both probe for autistic behaviors and monitor all developmental domains at each and every well-child visit. Because there are no pathognomonic signs or diagnostic tests for autism, the history is one of the most important tools used to determine whether or not the child is at risk for a diagnosis of autism. *Level 1* professionals must learn what questions to ask and how to interpret the answers in the context of normal child development (see Tables III and IV).

Level 1 Laboratory Investigations

Formal Audiologic Evaluation

All children with developmental delays, especially those with delays in social and language development, should undergo a formal audiologic hearing evaluation. This may become a moot point as the standard of pediatric care moves toward universal screening. Until such time, any child with delayed language or at risk for autism should be provided with a referral for audiologic testing on the same day that a concern is identified.

Parent or practitioner concern regarding a speech, language, or hearing problem (loss of sensitivity, inconsistent responses, no response, or unusual responses to sounds or sound sources) should result in an immediate referral for audiologic assessment. Comprehensive hearing tests should be provided by an audiologist with experience in the assessment of very young children and difficult-to-test populations. This referral should occur regardless of the child having "passed" a neonatal hearing screen. Integrity of hearing cannot be determined by informal observations of behavioral responses to environmental sounds or by parent-caregiver report. Hearing loss (conductive, sensorineural, or mixed) can co-occur with autism; children with autism may be incorrectly thought to have peripheral hearing loss (Adkins & Ainsa, 1979; Jure, Rapin, & Tuchman, 1991; Klin, 1993; Smith, Miller, Stewart, Walter, & McConnell, 1988). Audiologic assessment should occur early in the differential diagnostic process and include a battery of tests including behavioral audiometric measures, assessment of middle-ear function and electrophysiologic procedures (American Speech-Language-Hearing Association, 1991).

The goal of audiologic assessment is to delineate the type, degree, configuration, and symmetry of any existing hearing loss or to confirm the presence of normal peripheral hearing sensitivity. Two broad categories of hearing assessment methods are available: behavioral and electrophysiologic. Behavioral audiologic assessment should include measures of hearing that are appropriate for the child's developmental level. Unconditioned behavioral response procedures (behavioral observation audiometry or BOA) are of limited use in characterizing hearing sensitivity as a function of frequency. Conditioned response procedures (such as

Visual Reinforcement Audiometry or Conditioned Play Audiometry) are useful in audiologic assessment of children beginning at the developmental age of 6 months. Reliable, accurate, frequency-specific threshold information may be obtained using this simple, pleasant, and cost-effective method. The audiologic assessment of children with autism may present challenges for the audiologist requiring modifications of traditional test techniques and test environments. Limited reports and clinical experience suggest that many children with autism may be assessed using operant test procedures (Gravel, Kurtzberg, Stapells, Vaughan, & Wallace, 1989; Verpoorten & Emmen, 1995).

Electrophysiologic procedures are useful for estimating hearing sensitivity and for examining middle ear, cochlear, and VIIIth nerve or auditory brainstem pathway integrity (Gorga, Kaminski, Beauchaine, Jesteadt, & Neely, 1989; Stapells, Gravel, & Martin, 1995). These methods require no behavioral response from the child, although a child must be quiet (usually, in natural or sedated sleep) for varying amounts of time depending upon the procedure. Acoustic immittance procedures, specifically tympanometry, are useful for quantifying middle-ear function, and acoustic reflex threshold assessment can be used as a cross-check of auditory function. Evoked otoacoustic emissions are useful for examining cochlear (sensory) function. This measure is frequency-specific, and time- and cost-efficient. Evoked otoacoustic emissions are absent with hearing losses greater than 30 to 40 dB (Prieve, 1992; Robinette, 1992) and the technique has been used in children with autism (Grewe, Danhauer, Danhauer, & Thornton, 1994). The frequency-specific Auditory Brainstem Response (ABR) is the single most useful electrophysiologic procedure for use in estimating hearing thresholds and has been demonstrated to be highly correlated with behavioral hearing thresholds in children who hear normally and in children who have sensorineural hearing loss (Stapells *et al.,* 1995).

Audiologic assessment should not be delayed in the differential diagnosis of autism. It is recommended that audiologic assessment be completed at centers that have qualified and experienced professional personnel (pediatric audiologists) who have current test methods and technologies readily available. It is recommended that facilities without these components enter consortial arrangements with centers that are able to provide this type of comprehensive assessment of children with autism.

When hearing loss (conductive or sensorineural) is detected, the child should be referred to an otolaryngologist, but concerns raised at the *Level 1* screen regarding other developmental indicators (‘red flags”) for autism (e.g., lack of social relationships, unusual behaviors) must not be ignored. The audiologist, speech-language pathologist, and medical practitioner’s follow-up of the child should include surveillance for indicators of autism. When appropriate, in-depth assessment (psychological, sensorimotor) should be recommended in order to address the potential co-occurrence of autism and hearing loss.

Transient, fluctuant conductive hearing loss associated with otitis media with effusion can co-occur in children with autism. Audiologic and medical follow-up for conductive hearing loss associated with recurrent otitis media is important in the long-term management of children with autism.

Lead Screening

Children with developmental delays who spend an extended period in the oral–motor stage of play (where everything “goes into their mouths”) are at increased risk for lead toxicity especially in certain environments. The prevalence of pica in this group can result in high rates of substantial and often recurrent exposure to lead and, quite possibly, other metals (Shannon & Graef, 1997). Several studies report the neurobehavioral effects and behavioral toxicity of lead and its potential clinical relevance in patients with autism. Mean blood lead concentration was notably higher in 18 children with autism than in 16 nonautistic children or in 10 normal siblings; 44% of the autistic and psychotic children had blood lead levels greater than 2 standard deviations above the mean for normal controls (Cohen, Johnson, & Caparulo, 1976). In three of six reported cases of lead poisoning in children with autism, developmental deviance seemed to have been present before the possible impact of lead toxicity, while in two, the lead poisoning may have contributed to the onset or acceleration of developmental symptomatology (Accardo, Whitman, Caul, & Rolfe, 1988). A more recent chart review found that 17 children with autism were treated for plumbism over a 6-year period from 1987 to 1992. When compared to a randomly selected group of 30 children without autism who were treated during the same interval, the children with autism were significantly older at diagnosis, had a longer period of elevated blood lead levels during treatment, and 75% were subsequently reexposed despite close monitoring, environmental inspection, and either lead hazard reduction or alternative housing (Shannon & Graef, 1997). Therefore, all children with delays or who are at risk for autism should have a periodic lead screen until the pica disappears (Centers for Disease Control and Prevention, 1997; Shannon & Graef, 1997).

Specific Screening for Autism

All professionals involved in early child care (pediatricians, neurologists, psychiatrists, psychologists, audiologists, language pathologists, occupational therapists, and physical therapists) should be sufficiently familiar with the signs and symptoms of autism to recognize possible indicators (social, communicative, and behavioral) of the need for further diagnostic evaluation. It is important to be aware that children with autism often are referred for a variety of concerns, such as language delays, regulatory behavior problems in infancy, motor or sensory problems, social and behavioral problems, emotional disturbance, and learning problems.

There are new screening instruments in the field that focus on children with autism: the *Checklist for Autism in Toddlers* (CHAT; Baron-Cohen, Allen, & Gillberg, 1992; Baron-Cohen *et al.,* 1996), the *Pervasive Developmental Disorders Screening Test* (PDDST., Siegel, 1998), and for undiagnosed older verbal children, the *Australian Scale for Asperger's Syndrome* (Garnett & Attwood, 1998).

Checklist for Autism in Toddlers (CHAT; Baron-Cohen *et al.,* 1992; 1996) is designed to screen for autism at 18 months of age, and is also aimed at the primary care setting. The first section consists of a series of nine questions to be asked of the parent, such as whether the child ever demonstrates any pretend play. The second section consists of a series of five items to be observed or administered to the child by the provider during the visit, such as seeing whether the child looks where you point (joint attention), has any interest in pretend play, or is able to follow a command. Strengths of the CHAT include its ease of administration and its demonstrated specificity to symptoms of autism in 18-month-old infants. From both the initial study of siblings of children with Autistic Disorder and from the larger epidemiological study involving a population study of 16,000 18-month-old infants, virtually all the children failing the five-item criterion on the CHAT administered twice (1 month apart) were found to have Autistic Disorder when diagnosed at 20 and 42 months (Baron-Cohen *et al.,* 1992, 1996; Charman *et al.,* 1998; Cox *et al.,* 1999). However, the epidemiological study has indicated that the CHAT was less sensitive to milder symptoms of autism, as children later diagnosed with PDDNOS, Asperger, or atypical autism did not routinely fail the CHAT at 18 months. As a tool for identifying 18-month-olds at risk of autism from a normal population, the CHAT appears to be a useful tool, but not an entirely sufficient tool, for identifying the majority of children who will fall within the autistic spectrum.

An unpublished variation on the CHAT is *The Developmental Checklist,* currently under development, which expands the CHAT into a 30-item checklist that a parent alone can fill out in about 10 minutes (Robins, Fein, Barton, & Liss, 1999).

Pervasive Developmental Disorders Screening Test-Stage 1 (PDDST; Siegel, 1998) is a clinically derived parent questionnaire, divided into three Stages, each of which is targeted at a different level of screening. PDDST-Stage 1 is aimed for use in the primary care setting, with items aimed incrementally from birth to 36 months of age. Unlike the CHAT, this instrument rates positive as well as negative symptoms, and includes a number of questions concerning regression. In addition to sampling similar areas as other scales, the PDDST also samples temperament, sensory responses, motor stereotypies, attention, attachment, and peer interest. Parental report of stereotypic behaviors is probably more accurate than observation, due to the greater length of observation and varied environments. The tool was developed in several steps, beginning with a review of clinical records of a large number of children with autism. Test–retest and interrater (between parents) reliabilities were then used to identify problematic items. Follow-up clinical diagnosis at age 5 was used to determine the accuracy of screening. Finally, the instrument was administered to a large number of children with mixed diagnoses to set cutoff scores and algorithms; this work is ongoing. A significant cutoff of three affirmative answers in PDDST-Stage 1 has been established for further diagnostic consideration of an Autistic Spectrum Disorder. This instrument has not yet been published but is available (see Appendix).

Australian Scale for Asperger's Syndrome (Garnett & Attwood, 1998) is a parent or teacher rating scale for high-functioning older children on the autistic spectrum who remain undetected at school age. It consists of 24 questions rated with a score from 1 to 6, plus a checklist of 10 additional yes or no behavioral characteristics. If the answer is yes to the majority of questions in the scale and most of the ratings are between 2 and 6, a referral for a diagnostic assessment of autism should be made.

Referral to Early Intervention or Local School District

As mandated by Public Law 99-457, and reauthorized as Public Law 105-17: Individuals with Disabilities Education Act- IDEA (1997), referral for early intervention must be initiated by the *Level 1* professional. Children less than 36 months of age should be referred

to the zero-to-three service system in their community; children ages 36 months and older should be referred to the local school district.

Level 2: Diagnosis and Evaluation of Autism

Once a child screens positive, he/she then should be referred for an appropriate assessment by an experienced clinician, one with expertise in the diagnosis of developmental disorders. Although numerous studies show that autism can be reliably diagnosed in preschool children, experienced clinicians are usually necessary for accurate and appropriate diagnosis (Gillberg, 1990; Lord, Storoschuk, Rutter, & Pickles, 1993; Volkmar *et al.,* 1994). Many children who screen positive and enter into more comprehensive assessments may NOT, in the end, necessarily be considered to have autism but may have a range of other disorders—any of which may merit intervention in their own right. Accordingly, it is important that evaluators have a range of experience in the diagnosis and assessment of developmental disabilities. In some cases children may not come to diagnosis in the preschool years and it is important that screening encompass children in the older school-age group as well.

It is therefore the consensus of this Panel that *Level 2* evaluations should be performed only by professionals who have specific expertise in the evaluation and treatment of autism.

At the present time no biological marker or simple laboratory test or procedure exists for the diagnosis of autism and related conditions. Clinicians must, accordingly, rely on their clinical judgment, aided by guides to diagnosis such as DSM-IV and ICD-10, as well as by the results of various assessment instruments, rating scales, or checklists. The latter instruments do NOT substitute for the diagnosis by an experienced clinician.

Interdisciplinary collaboration and consultation are indicated in the diagnosis and assessment of children with autism and related difficulties. The needs for service from the various providers will vary depending on the needs of the child, family, symptomatic presentation, clinical context, and so forth (Volkmar, Cook, Pomeroy, Realmuto, & Tanguay, in press). The efforts may involve numerous specialists, including psychologists, neurologists, speech pathologists and audiologists, pediatricians, child psychiatrists, occupational therapists, and physical therapists as well as educators or special educators. When assessments are interdisciplinary in nature, it is critical that the service providers coordinate their work to avoid duplication of effort and maximize efficient use of time. It also is essential that one provider assume a major role as the "Coordinator of the Assessment."

Research from many studies suggests that the autistic spectrum disorders are not qualitatively different from Autistic Disorder, but differ primarily in terms of severity or the presence of repetitive or sensory behaviors. This distinction is often confounded by higher verbal skills in individuals with autistic spectrum disorders other than Autistic Disorder. It is important to insure that any individual with an autistic spectrum disorder receive adequate assessments and appropriate diagnoses. Factors that are not specific to autism, including degree of language impairment, mental handicap, and presence of nonspecific behavior disorders such as overactivity and aggression, significantly affect outcome and treatment of individuals with autism. Diagnostic evaluations must address these issues and provide continued monitoring of nonspecific as well as autism-related impairments across development.

In addition to its important role in diagnosis, a comprehensive assessment has an essential role in treatment planning. Although the focus of this paper is on screening and diagnosis, the other important functions of assessment and treatment are essential. As a practical matter, the assessment should be concerned not only with diagnosis as such but with obtaining information on patterns of strengths and weaknesses important to intervention. Indeed the results of the formal assessments are often not as important as the less formal, but clinically informative, observations of the child during the assessment. Parents should be intimately involved in this process. The assessment should also be careful to note areas of strength as well as weakness.

Expanded Medical and Neurological Evaluation

Birth, Medical, Developmental, and Family Histories

This evaluation would expand on that already performed at *Level 1.* Besides delineating social, communication, and behavior characteristics, the focus should be on the search for acquired brain injury, comorbid conditions, or other medical or neurologic difficulties common to autism.

Birth History. An increase of only *mild* obstetrical complications was noted in the deliveries of autistic individuals, which was independent of maternal age or parity, making a causal relationship unlikely (Bolton *et al.*, 1997). Specifically, no association was found between autism and gestational age or occurrence of vaginal bleeding, infection, diabetes, toxemia, maternal age, or prior abortions (Bolton *et al.*, 1997; Cryan, Byrne, O'Donovan, & O'Callaghan, 1996; Ghaziuddin, Shakal, & Tsai, 1995; Piven *et al.*, 1993; Rapin, 1996a). There

was also no association between autism and birth weight, induction of labor, breech presentation, forceps or cesarian delivery, prolonged labor, neonatal depression, need for intensive care or mechanical ventilation, neonatal seizures, or prolonged neonatal hospitalization (Bolton *et al*., 1997; Fein et al., 1997; Piven *et al*., 1993; Rapin, 1996a). Although several prior studies indicated a possible association between autism and increased obstetrical risk factors, although mild, these have not been borne out (Bryson, Smith, & Eastwood, 1988b; Deykin & MacMahon, 1980; Finegan & Quarrington, 1979; Folstein & Rutter, 1977a; Folstein & Rutter, 1977b; Gillberg & Gillberg, 1983; Levy, Zoltak, & Saelens, 1988; Lord, Mulloy, Wendelboe, & Schopler, 1991; Mason-Brothers *et al*., 1987, 1990; Nelson, 1991; Tsai, 1987). Many of these studies did not correct for the strong influence of maternal parity (e.g., reproductive stoppage effect), which accounted for the differences in at least two studies (Lord *et al*., 1991; Piven *et al*., 1993).

Medical and Developmental History. Detailed history should be aimed at determining developmental milestones, developmental regression at any age, identifying any encephalopathic events, history of attention deficit disorder, seizure disorder, depression, mania, troublesome behaviors such as irritability, self-injury, sleep or eating disturbances, and pica for possible lead exposure.

Family History. Autism, mental retardation, fragile X syndrome, and tuberous sclerosis should specifically be inquired about in nuclear and extended family because of their implications regarding the need for chromosomal or genetic evaluation. In addition, the presence of affective disorder and anxiety disorder should be investigated, as these disorders have been shown to be increased in families of autistic individuals and increase the burden to the family (Bolton *et al*., 1994; DeLong, 1994; DeLong & Nohria, 1994; Fombonne, Bolton, Prior, Jordan, & Rutter, 1997; Piven *et al*., *1990, 1994).*

Autism: Family studies have shown that there is a 50- to 100-fold increase in the rate of autism in first-degree relatives (Rutter, Bailey, Simonoff, & Pickles, 1997; Simonoff, 1998). Recent family studies have shown that first-degree relatives of autistic probands have elevated rates of social difficulties, characterized by social withdrawal or awkwardness, and have a higher incidence of cognitive and executive function deficits, anxiety, and affective disorders (Bailey, Palferman, Heavey, & Le Couteur, 1998b; DeLong, 1994; DeLong &, Nohria, 1994; Hughes, Leboyer, & Bouvard, 1997; Piven *et al.,* 1990, 1991a, 1994, 1997). Extended relatives in both simplex and multiplex families (i.e., those with more than one autistic child) had a higher rate of social and communication deficits and stereotyped behaviors than did relatives of children with Down syndrome (Bolton *et al.,* 1994; Piven, Palmer, Jacobi, Childress, & Arndt, 1997a). These impairments were milder but qualitatively very similar to autism, with relatively normal intellectual function (IQ). In addition, first-degree relatives demonstrated higher verbal than nonverbal IQ scores, with significant discrepancies noted between the scores (Fombonne *et al.,* 1997). The first twin study of 11 monozygotic (MZ) pairs reported a concordance rate of over 36% for Infantile Autism, with no concordance in 10 dizygotic (DZ) twin pairs (Folstein & Rutter, 1977a, 1977b). However, a total of 82% of these MZ and 10% of the DZ twin pairs were concordant for some form of cognitive, social, or language deficits. A recent study of 28 MZ twin pairs (including the original 11 pairs) showed a concordance rate of 60% for DSM-IV Autistic Disorder, 71% for the broader spectrum of PDD or Atypical Autism, and 92% for an even broader phenotype of social and communication deficits with stereotyped behaviors that nonetheless were clearly differentiated from normal (Bailey *et al.,* 1995; Le Couteur *et al.,* 1996).

Fragile X: Numerous early reports noted a highly significant association between fragile X (FraX) and autism, in up to 25% of autistic individuals (Blomquist *et al.,* 1985; Brown *et al.,* 1986; Gillberg & Wahlstrom, 1985; Wahlstrom, Gillberg, Gustavson, & Holmgren, 1986), although this association was and remains controversial (I. L. Cohen *et al.,* 1991). While other studies report a much lower incidence of FraX (3–7%) in patients with autism (Bailey *et al.,* 1993a; Bolton & Rutter, 1990; Piven, Gayle, Landa, Wzorek, & Folstein, 1991b), another study found no evidence of FraX using cytogenetic (not DNA analysis) techniques (Hashimoto, Shimizu, & Kawasaki, 1993). Molecular genetic analyses of a large cohort of autistic individuals found FraX in only three siblings: one girl with Autistic Disorder, her brother with Atypical Autism, and a second brother without autistic features but with a learning disability (Klauck *et al.,* 1997). Because the presence of FraX genotype did not correlate with the autism phenotype, they concluded that the association between autism and fragile X does not exist. Therefore, although few children with autism have fragile X syndrome, children with fragile X syndrome often have autistic symptomatology (Feinstein & Reiss, 1998).

Tuberous Sclerosis Complex: Tuberous sclerosis complex (TSC) is a neurocutaneous disorder that also affects other organ systems, including the heart and kidneys. TSC has been linked to two distinct gene loci: TSC1 to chromosome 9 (9q34) and TSC2 to chromosome 16 (16p13.3) (OMIM™, 1997). The phenotypes of TSC1 and TSC2 have been considered identical; how-

ever, a recent study noted that mental handicap and sporadic rather than familial occurrence may be more frequently associated with the TSC2 genotype (Jones *et al.,* 1997; OMIM™, 1997), although this finding may also represent an ascertainment bias. Depigmented macules (shaped like an ash-leaf (Fitzpatrick, 1991)) are usually the first visible sign of the disease. They are often visualized only with the use of an ultraviolet light (Wood's lamp). Facial angiofibroma, formerly called adenoma sebaceum, and shagreen patches over the lower back are also characteristic, but often do not appear until late childhood or early adolescence (Webb, Clarke, Fryer, & Osborne, 1996). The major intracerebral lesions are the tubers which consist of histiogenic malformations of both neuronal and glial elements with giant heterotopic cells. They are characteristically located in the subependymal regions and in the cortex, predominantly in the frontal lobes (Braffman & Naidich, 1994; Harrison & Bolton, 1997; Truhan & Filipek, 1993). TSC has been strongly associated with autism. Estimates suggest that 17% to over 60% of mentally retarded individuals with TSC are also autistic, most commonly co-occurring with epilepsy (Curatolo *et al.,* 1991; Dykens & Volkmar, 1997; Gillberg, Gillberg, & Ahlsen, 1994; Harrison & Bolton, 1997; Hunt & Shepherd, 1993; Riikonen & Simell, 1990; Smalley, Smith, & Tanguay, 1991; Smalley, Tanguay, Smith, & Gutierrez, 1992). In contrast, the number of autistic individuals with TSC has been estimated to be between 0.4 and 3% in epidemiological studies (Dykens & Volkmar, 1997; Gillberg *et al.,* 1991; Lotter, 1967; Olsson, Steffenburg, & Gillberg, 1988; Ritvo *et al.,* 1990; Smalley *et al.,* 1992). This rate increased to 8 to 14% in autistic subjects with epilepsy (Gillberg, 1991; Riikonen & Amnell, 1981). A recent report noted an inverse correlation between IQ and the number of tubers identified on MRI in a small cohort of individuals with TSC; those individuals with both TSC and autism not only had the most tubers, but also had tubers located in the temporal lobes, a finding not seen in nonautistic subjects with TSC (Bolton & Griffiths, 1997).

Pertinent Positives on the Physical and Neurological Examination

Examination of persons with autism may require more time because of the likelihood of poor cooperation by a patient with impaired communication and behavioral problems. Severe unexplained behavioral changes may be due to an undiagnosed intercurrent illness (e.g., dental abscess, gastric ulcer, or ear infection) or an unrecognized injury. In some individuals, an adequate medical or dental examination may require sedation.

Head Circumference. The head circumference in children with autism is larger on average than in typically developing children (Bailey *et al*., 1995; Bolton *et al*., 1994; Davidovitch, Patterson, & Gartside, 1996; Lainhart *et al*., 1997; Woodhouse *et al*., 1996). The same has been noted with postmortem brain weights (Bailey *et al*., 1993b, 1998a; Bauman, 1992b, 1996; Bauman & Kemper, 1994, 1997; Courchesne, Muller, & Saitoh, 1999). Only a small proportion of children with autism have frank macrocephaly with head circumferences above the 98th percentile, but the distribution of the measures is clearly shifted upward with the mean in autism falling at about the 75th percentile (Bailey *et. al*., 1995; Bolton *et al*., 1994; Davidovitch *et al*., 1996; Filipek *et al*., 1992b; Lainhart *et al*., 1997; Rapin, 1996b; Woodhouse et al., 1996). It also appears that a large head size may not necessarily be present at birth, but may appear in early to mid-childhood due to an increased rate of brain growth (Lainhart *et al*., 1997; Mason-Brothers *et al*., 1987, 1990). The phenomenon of a larger head size without frank neuropathology in children with autism is widely acknowledged (Bailey *et al*., 1995; Bolton *et al*., 1994; Davidovitch *et al*., 1996; Lainhart *et al*., 1997; Rapin, 1996b; Woodhouse *et al*., 1996). Barring lateralizing signs on the remainder of the examination, routine neuroimaging for the sole finding of a head circumference greater than the 98th percentile in an autistic individual is not warranted (Filipek, 1996, 1999; Filipek, Kennedy, & Caviness, 1992a; Minshew, 1996b; Minshew & Dombrowski, 1994).

*General Examination. G*iven the high prevalence of autism in TSC, an examination using a hand-held ultraviolet light (Wood's lamp) should be performed on every child presenting with possible autism as an initial screen for tuberous sclerosis (Reich, Lenoir, Malvy, Perrot, & Sauvage, 1997; Smalley *et al*., 1992). Also, unusual or dysmorphic features (of facies, limb, stature, etc) should be noted, for, if present, they suggest the need for consultation with a geneticist.

Mental Status Examination. The mental status examination should include the evaluation of social interactions, play, language, and communicative function. Social interactions should be queried if observation in the office proves inconclusive. Probes should be included for age-appropriate friendships, who initiates contact with the friends (child or parent), interest in other children, and the role within the friendship (e.g., leader of much younger peers or follower of much older peers with little or no same-aged peers). Deficient play skills are a hallmark of autism, independent of IQ (Rapin, 1996b). An adequate period of observation of the child's use of age-appropriate miniature toys in the examination room

is essential to discriminate between simple manipulative (banging or mouthing) or stereotypic (lining up) use of toys, and actual functional or symbolic (using one item to represent another) pretend play (Sigman & Ungerer, 1984; Stone, Lemanek, Fishel, Fernandez, & Altemeier, 1990). For example, classifying or sorting miniature figures, which may be subtle, is a typical stereotypic behavior of higher functioning children with autism which may be mistaken for appropriate play if only given a brief glance.

Cranial Nerve Examination. Clinical cranial nerve abnormalities were only infrequently noted in a large sample of children with autism (Bauman, 1992a; Rapin, 1996b).

Motor Examination. Impairments of gross and fine motor function have been reported in autistic individuals, and are more severe in those with lower IQ (Rapin, 1996b). Hypotonia was found in about 25% of 176 children with autism and in 33% of 110 nonautistic mentally retarded children, whereas spasticity was found in less than 5% of either group (exclusionary criteria for this sample included the presence of lateralizing gross motor findings). Limb apraxia was noted in almost 30% of autistic children with normal IQ, in 75% of retarded autistic children, and in 56% of the nonautistic retarded control group. A third significant finding was the presence of observed motor stereotypies in over 40% of children with autism (in contrast to a much higher prevalence by parental report), and in over 60% of those with low IQ, but in only 13% of the nonautistic control group.

Autism Diagnostic Tools

The diagnosis of autism as distinct from other developmental disabilities requires a comprehensive multidisciplinary approach. The evaluation should include measures of parental report, child observation and interactions, and clinical judgment. Assessments should include cognitive, adaptive behavior, and diagnostic measures.

Diagnostic Parental Interviews/Questionnaires

The Gilliam Autism Rating Scale (GARS; Gilliam, 1995) is a checklist designed to be used by parents, teachers, and professionals to help both identify and estimate the severity of symptoms of autism in individuals age 3 to 22 years. Items are based on DSM-IV (APA, 1994) and are grouped into four subtests (a) stereotyped behaviors (b) communication, (c) social interaction, and (d) an optional subtest which describes development in the first 3 years of life. This tool provides a global rating of autistic symptomatology.

The Parent Interview for Autism (PIA; Stone & Hogan, 1993) is a structured interview designed to gather diagnostically relevant information from parents of young children suspected of having autism. The PIA consists of 118 items, organized into 11 dimensions assessing various aspects of social behavior, communicative functioning, repetitive activities, and sensory behaviors. Items are phrased as questions about specific observable behaviors, and ratings of the frequency of occurrence are obtained. Internal consistency and test–retest reliability were adequate, and concurrent validity with the DSM (APA, 1994) and the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Rochen-Renner, 1988) was demonstrated. Significant group differences between young children with autism and young children with developmental delays or mental retardation were obtained for the total score as well as the dimensions of Relating, Imitation, Peer Interactions, Imaginative Play, Language Understanding, and Nonverbal Communication. The PIA takes about 45 minutes to administer.

The Pervasive Developmental Disorders Screening Test- Stage 2 (PDDST; Siegel, 1998). The PDDST is a clinically derived parent questionnaire divided into three Stages, each of which is targeted at a different level of screening. Further details on this instrument were included earlier under Level 1 Screening. PDDST-Stage 2 was developed for Developmental Disorders Clinics, and PDDST-Stage 3 for Autism or PDD Clinics. Significant cutoffs have been established for further diagnostic consideration of an Autistic Spectrum Disorder: four affirmative answers in PDDST-Stage 2, and six affirmative answers in PDDST-Stage 3. This instrument has not yet been published but is available (see Appendix).

The Autism Diagnostic Interview-Revised (ADI-R); Le Couteur *et al*., 1989; Lord *et al*., 1993, 1997; Lord, Rutter, & Le Couteur, 1994) is a comprehensive structured parent interview that probes for autistic symptoms in the spheres of social relatedness, communication, and ritualistic or perseverative behaviors. It permits DSM-IV (APA, 1994) and ICD-10 (WHO, 1992, 1993) diagnoses within the autistic spectrum, with definitive threshold scores for the diagnosis of Autistic Disorder. The ADI-R (and ADOS-G) are currently the "gold standard" diagnostic instruments in all appropriate autism research protocols. Because administration of the ADI-R takes approximately 1 hour and requires specific training and validation procedures, its utility to primary care or clinical specialty professionals is probably less than its import in the research community.

Diagnostic Observation Instruments

The Childhood Autism Rating Scale (CARS; Schopler et al., 1988) is a 15-item structured interview and observation instrument which is suitable for use with any child over 24 months of age. Each of the 15 items uses a 7-point rating scale to indicate the degree to which the child's behavior deviates from an age-appropriate norm; in addition, it distinguishes mild-to-moderate from severe autism. The CARS is widely recognized and used as a reliable instrument for the diagnosis of autism, and takes approximately 30 to 45 minutes to administer (Schopler, Reichler, DeVellis, & Daly, 1980).

The Screening Tool for Autism in Two-Year-Olds (STAT; Stone, 1998a, 1998b) is a theoretically and empirically derived, interactive measure to be administered to children ages 24 to 35 months by various early childhood professionals. The STAT, still in development, is designed to differentiate autism from other developmental disorders, thus it is a Level 2 screening instrument. In a 20-minute play interaction involving 12 activities, the tool samples three areas: play (both pretend and reciprocal social play), motor imitation, and nonverbal communicative development. The tasks used on the STAT were those that best differentiated between children with autism and those with other developmental disorders in studies of matched groups of two-year-olds on a wide range of measures. There is a manual with clear instructions for administration and scoring. In a pilot study involving 40 children, the tool correctly classified 100% of children with autism (n = 8) and 97% of children with other developmental delays (n = 32) using a criterion of failure on two of the three areas. Thus, demonstrating very strong sensitivity and specificity. Current work on the tool is focused on the empirical determination of best cutoffs and algorithm scoring.

The Autism Diagnostic Observation Schedule-Generic (ADOS-G; DiLavore, Lord, & Rutter, 1995; Lord, 1998; Lord *et al*., 1989) is a semi-structured observational assessment in four modules that includes investigator-directed activities to evaluate communication, reciprocal social interaction, play, stereotypic behavior, restricted interests, and other abnormal behaviors, in autistic individuals ranging from nonverbal preschool children to verbal autistic adults. It takes approximately 30 to 45 minutes to administer. It also permits DSM-IV (APA, 1994) and ICD-10 (WHO, 1992, 1993) diagnoses within the autistic spectrum, with definitive threshold scores for the diagnosis of Autistic Disorder. As with the ADI-R, administration of the ADOS-G requires specific training and validation procedures. As mentioned earlier, the ADOS-G and ADI-R are the two "gold standard" diagnostic instruments in all appropriate autism research protocols. Because administration of the ADOS-G takes less time than the ADI-R, many autism specialty professionals are using this instrument in their clinical practices; albeit predominantly abroad where clinical time is not as limited as with managed care in the US.

Differential Diagnosis of Autistic Spectrum Disorders

The differentiation of autism from other developmental disorders is accomplished during *Level 2.* Using the data collected from the various evaluations, professionals must also determine the possible existence of comorbid disorders. The differential diagnosis of autism includes consideration of mental retardation not associated with autism, specific developmental disorders (e.g., of language), and other psychiatric conditions (Volkmar *et al.,* in press).

Mental retardation or *borderline intelligence* often coexists with autism. Individuals with severe and profound mental retardation may exhibit various characteristics that are often associated with autism, particularly stereotyped movements.

Specific developmental disorders, particularly developmental language disorders, may mimic autism and related conditions. Usually in children with language disorders, the primary deficits are in the area of language or communication, and social skills are typically well-preserved.

Schizophrenia occasionally has its onset in early childhood. Usually there is a history of previously relatively normal development with the onset of characteristic hallucinations and delusions typical of schizophrenia. However, a lack of typical social development is often part of the premorbid history.

Selective mutism sometimes is confused with autism and related conditions. In selective mutism the child's ability to speak in some situations is preserved, but the child is mute in other situations. The history and presentation are quite different from that of autism. Although it is the case that children with autism are often mute, their mutism is never "selective" nature.

Stereotyped movement disorder is characterized by motor mannerisms (stereotypies) and the presence of mental retardation. A diagnosis of stereotyped movement disorder is not made if the child meets criteria for one of the pervasive developmental disorders.

Dementia occasionally has its onset in childhood. In some cases the child will fulfill criteria for childhood disintegrative disorder, in which case that diagnosis as

well as the specific medical diagnosis causing the dementia can be made. The typical pattern of dementia of childhood onset is one of progressive deterioration in mental and motor functioning.

Obsessive compulsive disorder (OCD) presents in some children with unusual interests and behaviors. However, social skills are preserved, as are language and communication skills. When social skill deficits or communication deficits are present in OCD, they are qualitatively different from those found in autism.

Schizoid personality disorder is characterized by relative isolation, with the ability to relate normally in some contexts. However, personality disorders are not diagnosed before the age of 18 years by current DSM-IV standards (APA, 1994).

Avoidant personality disorder is characterized by anxiety in dealing with social situations.

Reactive attachment disorder usually presents with a history of very severe neglect or abuse; the social deficits of reactive attachment disorder tend to remit dramatically in response to a more appropriate environment.

Specific Evaluations to Determine the Developmental Profile

Speech–Language–Communication Evaluation

Language pathologists are independent health care providers who have responsibilities at the levels of screening *(Level 1),* diagnosis and evaluation *(Level 2)* of autism. Evaluation at both levels may be accomplished in a single session rather than in discrete segments. Standardized speech, language, and communication assessments conducted in formal testing situations may provide important information about specific parameters of speech and language functioning. However, such assessments may provide only limited information about social-pragmatic abilities (i.e., use of language and communicative abilities in social contexts), which are characteristically limited in the autistic spectrum disorders (Allen, 1989; Allen & Rapin, 1992; Lord & Paul, 1997; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Wetherby, Prizant, & Hutchinson, 1998; Wetherby, Schuler, & Prizant, 1997; Wetherby, Yonclas, & Bryan, 1989). Therefore, a variety of strategies should be used, including direct assessment, naturalistic observation, and interviewing significant others, including parents and educators, who can be invaluable sources of information (Prizant & Wetherby, 1993; Stone & Caro-Martinez, 1990). Each of these strategies has the potential to provide qualitatively different information about a child's speech, language, and communicative abilities that may ultimately be integrated to develop a profile for differential diagnosis and intervention planning. Observations should include a child's interactions with a variety of persons including family members and peers, as well as professionals, because variability in communicative functioning across persons and settings is to be expected (Wetherby *et al.,* 1997). Specific domains should be addressed in a comprehensive assessment for both preverbal and verbal individuals, taking into account their age, cognitive level, and socioemotional abilities (Wetherby *et al.,* 1998).

*Receptive Language and Communication. C*linical experience suggests that caregivers or professionals often assume that a child understands others' communicative signals and may interpret a lack of response to gestures or speech as noncompliant or uncooperative behavior. Children's ability to respond to and use communicative gestures and vocalizations should be documented, with and without the support of situational cues. True linguistic comprehension is evidenced when children can comprehend words without situational or nonverbal cues, especially when words refer to persons, objects, and events outside of the immediate environment. At higher levels of ability, assessment should address comprehension of different simple and complex sentence types (e.g., negatives, questions, causal, conditional), of ongoing discourse (e.g., ability to understand a story or sequence of events), and of nonliteral language (i.e., idioms, sarcasm). Guidelines and procedures for more in-depth assessment of comprehension for preverbal and verbal individuals are available (Lund & Duchan, 1993; Miller & Paul, 1995).

Expressive Language and Communication. The primary focus in this domain is documentation of (a) communicative means, the behaviors by which a child expresses intentions, emotions, and physiological states, and (b) communicative functions, the purposes for which a child communicates (Prizant & Wetherby, 1993).

Communicative means in preintentional children may include a variety of nonverbal and vocal behaviors such as body posture and movement, facial expression, directed gaze and gaze aversion, and vocalizations. In developmentally more advanced children, intentional use of idiosyncratic (e.g., physically leading others) and conventional (e.g., pointing, nodding, waving) gestures, as well as vocalizations and emerging word forms should be documented (Schuler, Prizant, & Wetherby, 1997). Children with autism have been found to have a limited repertoire of conventional gestures and vocalizations (Stone *et al.,* 1997; Wetherby *et al.,* 1998), even when compared to children with other developmental language disorders.

Communicative functions expressed preverbally or verbally may include communicating for relatively nonsocial purposes to have immediate needs met (e.g., requesting objects or actions, protesting), or for more social purposes such as to bring attention to oneself (e.g., requesting social routines, greeting, calling) and communicating to bring others' attention to interesting objects or events (e.g., pointing to or commenting on interesting events). Young children with autism communicate primarily for relatively nonsocial purposes when compared to children with developmental language disorders (Mundy, Sigman, & Kasari, 1990; Wetherby *et al.,* 1989, 1998). In addition, the rate of communicative acts and a child's ability to persist in repairing communication breakdowns should also be documented. Assessment should also document forms and functions of unconventional nonverbal (e.g., disruptive behaviors) and verbal (e.g., immediate and delayed echolalia, perseverative speech, incessant questioning) communicative behavior (Carr & Durand, 1985; Prizant & Rydell, 1993).

For verbal children able to engage in conversation, collection and analysis of spontaneous language samples supplement scores on formal language tests (see below). It provides information about a child's narrative and conversational discourse, including ability to initiate, maintain, and terminate conversational interactions following acceptable conventions of discourse, the ability to maintain topic and follow topics introduced by others, and to take the perspective of others by providing sufficient, but not excessive, amounts of background or known information (Prizant, Wetherby, Schuler, & Rydell, 1997).

*Voice and Speech Production. S*ome young children with autism may not be able to acquire and use speech as a primary mode of communication, due to severity of cognitive impairment, severe to profound hearing loss, or severe language comprehension disorders. Less frequently, specific neuromotor speech disorders are involved, including developmental verbal dyspraxia, a dysfunction in the ability to plan the coordinated movements to produce intelligible sequences of speech sounds, or dysarthria, a weakness or lack of control of the oral musculature. For nonspeaking individuals, or for those with speech of limited intelligibility, assessment should address quality and variety of communicative vocalizations and oral–motor abilities (e.g., chewing, swallowing). Other aspects of speech to evaluate in more verbal individuals include prosody, volume, and fluency of speech production, especially when disturbance in these parameters negatively impact on communicative competence.

It is recommended that tests be used for speech–language–communication assessments (Crais, 1995; Wetherby & Prizant, 1992) that (1) focus on functions of communication; (2) analyze preverbal communication (gestures, gaze, vocalizations); (3) assess social-affective signaling; (4) profile social, communicative and symbolic abilities; (5) directly assess the child, not only rely on parental report; (6) permit observation of initiated and spontaneous communication, and (7) directly involve caregivers during the assessment (Wetherby & Prizant, 1992). The most widely used tests for children with language and communication disorders are listed in Table V, which was adapted from Wetherby and Prizant (1992) and Crais (1995). The numbers in Table V referring to the relative strengths and weaknesses reflect the seven points outlined above.

Cognitive Evaluation

Although the *Level 1* professional may have obtained a rough estimate of the child's cognitive status (mental age) by using screening tools or problem-solving milestone charts from preprinted well-child forms and textbooks, knowing the child's cognitive status is important in determining his overall level of functioning. This is, in turn, important when trying to establish a discrepancy between the child's level of social function and the overall cognitive and adaptive function, a key criterion in the diagnosis of autism.

As is true of language pathologists, clinical psychologists and developmental pediatricians are independent health care providers who have responsibilities at both levels of screening and diagnosis, which may or may not be accomplished in a single session rather than as discrete segments. Additional visits may be necessary for the child to adapt to change as well as to the newness of the procedures in order to optimize the chances that the results accurately represent the child's abilities. While the diagnosis of autism is based ultimately on clinical symptoms and early history, the results of cognitive assessment may assist in differential diagnosis, as well as provide important information for planning intervention and evaluating its effects. Research has demonstrated specific profiles on cognitive batteries, with spared performance on tasks that rely on rote, mechanical, or perceptual processes, and deficient performance on tasks requiring higher-order conceptual processes, reasoning, interpretation, integration or abstraction (Minshew & Goldstein, 1998). This pattern is present across multiple cognitive domains, with dissociations between simple and complex processing demonstrated in areas of language, memory, executive function, motor function, reading, mathematics, and

Table V. Strengths and Weaknesses of Specific Language Instruments[a]

Instrument	Strengths	Weaknesses
Evaluation of only receptive language		
Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981)	5	1–4, 6–7
Receptive One-Word Picture Vocabulary Test-Revised (ROWPVT-R; Gardner, 1990b)	5	1–4, 6–7
Evaluation of only expressive language		
Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT-R; Gardner, 1990a)	5	1–4, 6–7
Evaluation of both receptive and expressive language		
Birth to Three Developmental Scales (Bangs & Dodson, 1986)	2, 4 1, 3, 5 limited	6, 7
Clinical Evaluation of Language Fundamentals-3 (CELF-3; Semel, Wiig, & Secord, 1995)	5	1–4, 6–7
Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 1993)	1–6	7 limited
MacArthur Communcative Development Inventories (MCDI; Fenson *et al.,* 1993)	1–3, 5–7	4
Preschool Language Scale-3 (PLS; Zimmerman, Steiner, & Pond, 1992)	1, 5	2–4, 6–7
Receptive-Expressive-Emergent-Language Scale-Revised (REEL-R; Bzoch & League, 1991)	1, 2 limited 5	3, 4, 6, 7
Rosetti Infant-Toddler Language Scale (1990)	1–6	7 limited
Sequenced Inventory of Communication Development (SICD; Hedrick, Prather, & Tobin, 1984)	1, 2 & 6 limited 5	3, 4, 7

[a] The numbers referring to the strengths and weaknesses are based on the seven points outlined in the text. This table was adapted from Wetherby and Prizant (1992) and Crais (1995).

perspective-taking (Klinger & Dawson, 1995; Minshew, Goldstein, Taylor, & Siegel, 1994; Ozonoff, personal communication; Reed & Peterson, 1990; Rumsey & Hamburger, 1988). However, few direct comparison studies between autism and other disorders have been conducted and it is possible that other disorders may share some aspects of this information-processing profile, which accounts for the differences in behavioral profile.

In terms of intellectual assessment, the Wechsler Intelligence Scale for Children/WISC-III (1991), and the Wechsler Adult Intelligence Scale/WAIS-III (1997) are the tests of choice for higher functioning and older individuals with relatively good verbal language. Numerous studies have demonstrated a particular pattern characteristic of autism: performance IQ (PIQ) higher than verbal IQ (VIQ) and specific inter-subtest scatter, with Block Design typically the highest subtest and Comprehension usually the lowest (see Lincoln, Allen, & Kilmasian, 1995; cited in Lincoln, Allen, & Kilman, 1995a. However, the PIQ–VIQ split is severity dependent. When Full-scale (FSIQ) and VIQ are both above 70, 80% of autistic individuals will have no significant VIQ–PIQ disparity, and the remainder are evenly divided between those with PIQ>VIQ and those with PIQ<VIQ (Siegel, Minshew, & Goldstein, 1996). Thus, there is substantial variability in the intellectual profiles of people with autism. However, although these patterns may be typical, they are by no means universal and cannot be used for diagnostic or differential diagnostic purposes. No cognitive pattern confirms or excludes a diagnosis of autism.

Intellectual testing is essential for educational planning and, for some children, assists in projecting the long-term level of disability. It is usually beneficial to conduct these evaluations prior to entry into kindergarten, and to collaborate with educational professionals, including school psychologists, in order to address issues related to curriculum planning and school performance issues often addressed by school psychologists. In autism, however, it should be recognized that the predictive validity of such testing is not necessarily high.

There are particular concerns about the validity of testing younger, lower functioning, and nonverbal children. It is critical that care be taken in choosing which

intellectual test to administer to lower functioning or nonverbal individual with autism (Groden & Mann, 1988; Johnson-Martin, 1988; Klin *et al.,* 1997; Watson & Marcus, 1988). It is recommended that tests be used which (1) are appropriate for both mental age and chronological age; (2) provide a full range (in the lower direction) of standard scores; (3) sample both verbal and nonverbal intellectual skills; (4) measure and score separately verbal and nonverbal skills; (5) provide an overall index of ability; and (6) have norms which are current and relatively independent of social function. With these principles in mind, the most appropriate and widely used intellectual tests for younger, low- or nonverbal individuals with autism are listed in Table VI.

Clinical judgment is required to properly interpret the findings of these measures for the purpose of differential diagnosis. Additional information regarding assessment and interpretation of psychological measures is provided in other resources (Jacobson & Mulick, 1996; Marcus, Lansing, & Schopler, 1993; Marcus & Stone, 1993).

Adaptive Behavior Evaluation

It is essential that a measure of adaptive function (the capability for self-sufficiency in acticities of daily living) be collected by the psychologist for any child evaluated for an associated mental handicap. Diagnosis of mental retardation relies upon both subaverage intellectual functioning (IQ < 70) and concurrent deficits in adaptive functioning (APA, 1994).

The Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984b) are considered to be the most widely used instrument to assess adaptive behavior (Klin *et al.,* 1997). The scales offer an estimate of adaptive development in the domains of Socialization (interpersonal relationships, play and leisure time, and coping skills); Daily Living Skills (personal, domestic, and community skills); Motor Skills (gross and fine motor); and Communication (receptive, expressive, and written communication), with developmentally ordered skills for each area. There are three available versions of the Vineland: (a) a survey form used as a diagnostic and classification tool for children and adults (Sparrow *et al.,* 1984b); (b) an expanded form for use in developing educational or rehabilitation plans (Sparrow, Balla, & Cicchetti, 1984a); and (c) a classroom edition to be used by teachers (Sparrow, Balla, & Cicchetti, 1985). Standard scores, percentile ranks, adaptive levels, and age equivalents are available. The expanded edition is the most useful for autistic children, whose adaptive function is usually lower than their cognitive level (Volkmar, Carter, Sparrow, & Cicchetti, 1993a). Recent supplementary norms have been published for individuals with autism (Carter *et al.,* 1998).

The Scales of Independent Behavior-Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996) is a comprehensive norm-referenced assessment of adap-

Table VI. Strengths and Weaknesses of Specific Cognitive Instruments[a]

Instrument	Strengths	Weaknesses
Bayley Scales of Infant Development II (1993)	1: ≤42 months 3,5,6	1: not normed for >42 months 2: standard score (SS) ≥ 50 4: also mixes in social cannot always establish basal score
Mullen Scales of Early Learning (1997)	1: ≤60 months 3,4,5,6	
Leiter-Revised (Roid & Miller, 1997)	6 highlights visual strengths of autistic individuals	1: basal score = 24 months 3: nonverbal only 4,5
Merrill-Palmer (Stutsman, 1948)	3: verbal section is limited 5	1: basal score = 18 months 4 6: outdated
Differential Abilities Scales (DAS; Elliott, 1990)	1: extends from preschool through schoolage	2: SS to 45 only 3,4,5,6
Stanford-Binet IV (Thorndike, Hagen, & Sattler, 1986)	3,4,5,6	1: basal score = 24 months 2: SS to 70 only—highly verbal, long administration

[a] The numbers referring to the strengths and weaknesses are based on the six points outlined in the text.

tive and maladaptive behavior, for ages ranging from infancy through elderly adulthood. Fourteen Adaptive Behavior Clusters are offered in three forms: Early Development Form (15–20 minutes), Short Form (15–20 minutes), Full-scale Form (45–60 minutes). These cover motor skills, social interaction and communication skills, personal living, self-care, and community living skills. Age-equivalent scoring tables are included in the response booklets for each subscale, allowing examiners to get immediate developmental information.

Sensorimotor Assessment and Occupational Therapy Evaluation

Sensorimotor Assessment: Diagnostic practice has conventionally placed little emphasis on the assessment of sensorimotor behaviors in autism, with the exception that stereotypies are part of a "restricted behavioral repertoire" (APA, 1994; Lord, 1995). The reasons for this include the facts that there is a dearth of systematic empirical research in this domain and that the existing literature is controversial with respect to the usefulness of these variables for the differential diagnosis of autism. Thus, it seems particularly important to document qualitative dimensions of early sensory processing and motor behaviors (through both observation and parent report) rather than simply assess motor milestones during infant screenings.

Evaluation of sensorimotor functions should focus on the detection and localization of underlying neurologic deficits, whereas occupational therapists have specific expertise in the evaluation of their impact on the individual's functional skills or daily activities. Evaluation of motor skills is particularly important in situations where there is a question of delay, dysfunction, or regression in such skills, to document areas of strength as well as weakness for prognostic and intervention planning. Assessment of gross and fine motor skills may be completed by qualified professionals (e.g., occupational therapists or physical therapists) with a variety of standardized tools appropriate to the developmental level of the individual with autism; however, adaptations may be needed if the person with autism has difficulty understanding the tasks or is uncooperative. More important, qualitative observations of praxis (e.g., planning or sequencing of novel complex movement patterns; imitation of movements or pantomime; organization of goal-directed actions with materials in the environment) are a critical part of the sensorimotor evaluation for individuals with autism because these abilities are often deficient (Rogers, Bennetto, McEvoy, & Pennington, 1996; Stone & Lemanek, 1990), and require specific interventions. Repetitive motor stereotypies, unusual posturing, object stereotypies, and self-injurious behaviors (SIBs) should be routinely documented through parental report or observation. Hand or finger mannerisms, body rocking, and other motor disturbances such as unusual posturing, are commonly reported in 37–95% of subjects studied (Adrien, Ornitz, Barthelemy, Sauvage, & Lelord, 1987; Elliott, 1990; Le Couteur *et al.,* 1989; Ornitz, Guthrie, & Farley, 1977), and often manifest during the preschool years (Lord, 1995). The development of stereotypies, particularly in severe forms (e.g., SIB), may profoundly influence individual outcomes and prognosis for treatment in children with autism.

Sensory processing abilities are also prominently aberrant in autism. Preoccupations with sensory features of objects, sensory modulation difficulties reflected in over- and underresponsiveness to environmental stimuli, and paradoxical responses to sensory stimuli, among others, have been reported in 42–88% of persons with autism studied (Elliott, 1990; Kientz & Dunn, 1997; Le Couteur *et al.,* 1989). Sensory processing requires assessment by expert clinical observations in tandem with parent reports or questionnaires because these disruptions may impact strongly on performance in daily activities.

The Sensory Integration and Praxis Tests (Ayres, 1989) are not routinely warranted as part of diagnostic evaluations of children with autism. However, this battery of tests may be prescribed on an individual basis to detect specific patterns of sensory integrative dysfunction in children between the ages of 4 and 9 years with average cognitive functioning.

Occupational Therapy Evaluation. The occupational therapist, as part of the evaluation team, should make a determination about the necessity to screen and fully evaluate an individual with autism about whom there are concerns regarding functional skills or occupational performance (i.e., goal-directed everyday routines). It is important that the occupational therapist have a comprehensive understanding of autism and be experienced in assessing persons in the age range of the clients being seen (e.g., child vs. adult). The occupational therapist first and foremost evaluates performance specifically in the areas of play or leisure, self-maintenance through activities of daily living, and productive school or work activities. Play is often disrupted in young children with autism (Restall & Magill-Evans, 1994; Stone & Lemanek, 1990) and particularly warrants assessment in a naturalistic context. Second, the occupational therapist should consider any specific performance components or contexts that may be impacting on the individual's daily functioning because this information is critical to the team diagnostic process as well as to an appropri-

ate individualized intervention plan. Among specific components noted to be problematic, but not necessarily specific, to persons with autism, are complex motor planning abilities (Mailloux, Parham, & Roley, 1998; Minshew *et al*., 1997), sensory processing abilities (Adrien *et al*., 1993; Baranek, 1999; Dahlgren & Gillberg, 1989; Kientz & Dunn, 1997; Ornitz *et al*., 1977), imitation skills (Rogers *et al*., 1996; Stone & Lemanek, 1990), social and interpersonal skills (Gillberg *et al*., 1990; Stone & Hogan, 1993; Volkmar *et al.,* 1993a), and coping with behavioral rigidities or restricted interests (Baranek, Foster, & Berkson, 1997). Supplemental interviews and parental reports should be used to corroborate observational findings or standardized assessments, particularly if those assessments were performed outside of the individual's typical routines and environments.

Neuropsychological, Behavioral, and Academic Assessment

Psychologists trained in evaluating autistic individuals can play a critical role in intervention planning, outcome assessment, and the diagnosis and treatment of comorbid psychological conditions. Standardized measures are used to establish baseline function in many domains of learning, performance, and socialization. Behavioral assessment by direct observation is used to address specific learning and behavior problems, to establish the functional or controlling relations of inappropriate behavior, to track behavioral progress, and to document the effectiveness of intervention. These are specialized psychological services, requiring appropriate training and experience. Specific assessments may address a child's psychological profile, motivation or reinforcement preferences, learning style, sensory and motor characteristics (and associated abnormalities), specific social skills deficits, academic skills, ritualistic or stereotyped patterns of behavior, and life-style and family relationships.

Recent research suggests that specific neuropsychological impairments can be identified in children in early childhood and that such impairments are correlated with the severity of autistic symptoms (Dawson, 1996; Dawson, Meltzoff, Osterling, & Rinaldi, 1998). Among the diverse types of neuropsychological impairments that may be exhibited by children with autism are deficits in explicit memory, in establishing rules governing reward contingencies, and in working memory, planning, and response inhibition (Dawson, 1996). Thus, it can be useful to assess a range of neuropsychological functions, including attention, memory, praxis, language and visual-spatial processing, so that educational strategies can address each child's specific strengths and weaknesses.

Assessment of Family Functioning and Resources

The family is a child's best resource. Parental intervention and behavior management strategies provided by a psychologist have a strong impact on the child's developmental status and autistic symptoms. Parental stress and exhaustion can adversely affect the child's well-being. Thus evaluation of the child must take place within the context of his or her family. One must determine the parents' level of understanding of their child's condition and offer appropriate counseling and education. One must determine if the family has informal supports, such as extended family, neighbors, or friends to assist them in their child-rearing responsibilities. The family's readiness to meet other families of children with similar conditions must also be assessed. Often families learn more and communicate more with other families than they do with professionals. Finally, based on the family's socioeconomic status and the status of the child, one must evaluate the need for and availability of various social services to provide respite and other supports.

Social workers, psychologists, or other professionals who specialize in families of autistic individuals may be best able to assess the family dynamics in relation to parenting and behavior management strategies as they specifically relate to the autistic child. These professionals may also know additional resources specifically tailored to families of autistic individuals. Finally, they themselves may facilitate parent support groups and plan parent seminars. This assessment will focus on the specific issues relating to the type of developmental profile identified during the *Level 2* evaluation. It cannot be overemphasized that *the family is the child's best resource.* Although there may be several confounding variables affecting a child's overall adult outcome, most autism specialists would agree that the family does play a very important role. This expanded assessment can also help determine the quality and quantity of community resources, educational programs and networking that a particular family needs. Each family is unique in its search for support and knowledge.

Level 2 Laboratory Investigation

Metabolic Testing

A wide range of biochemical determinations have been performed in urine, blood, and cerebrospinal fluid in an attempt to identify a specific metabolic abnormality in individuals with autism. Included are studies of inborn errors in amino acid, carbohydrate, purine, peptide, and mitochondrial metabolism, as well as toxicological

studies. The reported co-occurrence of autistic-like symptoms in individuals with inborn errors of metabolism has led to consideration of screening tests as part of the routine assessment of patients with severe developmental impairment (Steffenburg, 1991). However, the percentage of children with autism who prove to have an identifiable metabolic disorder is probably less than 5% (Dykens & Volkmar, 1997; Rutter, Bailey, Bolton, & Le Couteur, 1994; Rutter *et al.,* 1997). Most of the biochemical analyses are useful at present *only as research tools* in the ongoing effort to understand the biology of autism.

Metabolic testing or consultation is indicated by a history of lethargy, cyclic vomiting, early seizures, dysmorphic or coarse features, mental retardation or if mental retardation cannot be excluded, questionable newborn screening, or birth out of the US because of the potential absence of newborn screening and maternal public health measures. As recommended by the American College of Medical Genetics, selective metabolic testing should be initiated only in the presence of suggestive clinical and physical findings (Curry *et al.,* 1997).

Genetic Testing

Of the chromosomal disorders found in association with autism, the most common abnormality described in recent studies is that involving the proximal long arm of chromosome 15 (15q11–q13), occurring in 1 to 4% of consecutive cases meeting criteria for Autistic Disorder (Cook *et al.,* 1998; Gillberg, 1998). These are usually maternally inherited duplications, either pseudodicentric 15 (inverted duplication 15) or other atypical marker chromosomes, with one or two extra copies of the area roughly corresponding to the typical Angelman syndrome (AS)/Prader Willi syndrome (PWS) deletion region of approximately 4 million base pairs. The 15q patients typically have moderate to profound mental retardation. In samples of patients with autistic disorder whose IQ was greater than 35, interstitial duplications of 15q11–13 have been found in more than 1% of patients and at a greater frequency than fragile X or other currently identifiable chromosomal disorders (Cook *et al.,* 1998; Gillberg, 1998; Pericak-Vance *et al.,* 1997; Schroer *et al.,* 1998; Weidmer-Mikhail, Sheldon, & Ghaziuddin, 1998).

Angelman syndrome, usually due to an absence (deletion) of maternally inherited 15q11–q13 material, has been found in patients with autism and profound mental retardation (Gillberg, 1998; Schroer *et al.,* 1998; Steffenburg, Gillberg, Steffenburg, & Kyllerman, 1996). Autism has also been found in patients with PWS (Demb & Papola, 1995), although at a decreased rate relative to the frequency of autism in Angelman syndrome or duplications of 15q11–13. Confirmation by FISH probes for the PWS/AS region is necessary to confirm cytogenetic evidence of 15q11–13 abnormalities.

DNA analysis for fragile X and high resolution chromosome studies (karyotype) are indicated for a diagnosis of autism, mental retardation (or if mental retardation cannot be ruled out), if there is a family history of fragile X or undiagnosed mental retardation, or if dysmorphic features are present (American College of Medical Genetics: Policy Statement, 1994). It should be understood, however, that there is little likelihood of positive karyotype or fragile X testing in the presence of high-functioning autism. The absence of a positive genetic test does not exclude a genetic basis for autism. If the indications for DNA analysis for fragile X and high resolution chromosome studies are present but the family declines genetic testing, the family should be counseled to inform extended family members of the potential genetic risks of this disorder so they may seek appropriate genetic counseling.

In addition, the recurrence risk of autism is estimated to be between 3 and 7% across several studies (Bolton *et al.,* 1994; Jorde *et al.,* 1990; Piven *et al.,* 1990; Szatmari *et al.,* 1993).Therefore, although there is no current method to detect autism prenatally, parents should be counseled about the almost 50-fold increased risk of having a second child on the autistic spectrum (1 in 20 to 1 in 10, as compared with 1 in 1,000 to 1 in 500 for the general population).

Electrophysiologic Testing

The prevalence of epilepsy in a large cohort of preschool children with autism has been estimated as 7% (Rapin, 1996a), in another cohort, 14% (Tuchman *et al.,* 1991b), and the cumulative prevalence by adulthood is estimated at 20 to 35% (Minshew *et al.,* 1997). The peaks of seizure onset occurred in early childhood and again in adolescence (Gillberg & Steffenburg, 1987; Lockyer & Rutter, 1970; Minshew *et al.,* 1997; Rossi, Parmeggiani, Bach, Santucci, & Visconti, 1995; Volkmar & Nelson, 1990; Wong, 1993). Mental retardation, with or without motor abnormalities and family history of epilepsy, was a significant risk factor for the development of seizures in autistic individuals. The relationship between autism with an early regressive course (before 36 months), CDD (after 36 months), Landau-Kleffner syndrome (Landau & Kleffner, 1957, 1998), and electrical status epilepticus during slow wave sleep (ESES) is currently poorly understood, as are their underlying etiologies and patho-

physiologies (Bristol *et al.,* 1996; Tuchman & Rapin, 1997). Regression in adolescence associated with seizure onset has also been reported, with further loss of language and cognitive skills (Lockyer & Rutter, 1970), but little is known about its cause or prevalence (Minshew *et al.,* 1997).

Seizures may be of all types, but partial complex seizures seem to be more prevalent, with EEG abnormalities occurring most often over the temporal lobes (Olsson *et al.,* 1988). The recognition of complex partial seizures in autistic individuals is complicated by the tendency to blame unusual behaviors on autism, and by the lack of direct correlation between clinical seizures and EEG paroxysmal activity (Minshew *et al.,* 1997). In addition, a recent study suggests that there may be a casual relationship between a subgroup of children with autistic regression and EEG-defined "benign focal epilepsies" (Nass, Gross, & Devinsky, 1998). Any behaviors such as staring, cessation of activity, or aggressive escalations associated with confusion should trigger a high index of suspicion of complex partial seizures in autistic individuals.

Indications for a prolonged sleep-deprived EEG with adequate sampling of slow wave sleep include evidence of clinical seizures, history of regression (clinically significant loss of social and communicative function) at any age but especially in toddlers and preschoolers, and in situations where there is a high index of clinical suspicion that epilepsy, clinical or subclinical, may be present. There is inadequate evidence at the present time to recommend EEG studies in all individuals with autism (Rapin, 1995, 1997; Rossi *et al.,* 1995; Tuchman, Jayakar, Yaylali, & Villalobos, 1997; Tuchman, 1994, 1995; Tuchman & Rapin, 1997; Tuchman *et al.,* 1991b.)

Except for the specific tests noted earlier, event-related potentials (Ciesielski, Knight, Prince, Harris, & Handmaker, 1995; Kemner, Verbaten, Cuperus, Camfferman, & Van Engeland, 1994; Kemner, Verbaten, Cuperus, Camfferman, & van Engeland, 1995; Lincoln, Courchesne, Harms, & Allen, 1995b; Rapin & Dunn, 1997; Verbaten, Roelofs, van Engeland, Kenemans, & Slangen, 1991) and magnetoencephalography (Chuang, Otsubo, Hwang, Orrison, & Lewine, 1995; Morrell *et al.,* 1995; Salmelin, Service, Kiesila, Uutela, & Salonen, 1996) are considered to be research tools in the evaluation of autism, without evidence of routine clinical utility at present.

Neuroimaging

Computed tomographic (CT) studies during the 1970s and 1980s reported a wide range of brain imaging abnormalities, which contributed to the then prevalent view that most cases of autism would ultimately be found to be attributable to an underlying structural disorder. This perspective of autism, together with the general clinical practice in child neurology of including CT scanning in the search for etiologies of unexplained developmental delay in young children, led to the standardization of CT as part of the assessment of children diagnosed with autism during the 1970s and 1980s. This perspective changed substantially as a result of the landmark study of Damasio *et al.* (1980) demonstrating that CT abnormalities of the brain in autistic individuals were associated only with the presence of coexisting disorders rather than with autism itself. In a review of over 400 imaging studies in autistic subjects, a very low prevalence of focal lesions or other abnormalities was reported, and their inconsistent localization marked them as coincidental (Filipek *et al.,* 1992a). In a subsequent study, the prevalence of lesions on MRI in the children with autism was equal to that in the normal control volunteers (Filipek *et al.,* 1992b). A series of CT and magnetic resonance imaging (MRI) studies of autistic subjects screened to exclude those with identifiable disorders other than autism (see reviews by Minshew *et al.,* 1994, 1996b, Filipek *et al.,* 1992a, 1996, 1999) have confirmed the absence of significant detectable brain abnormalities characteristic of autism. The clinical perception that structural brain imaging should be routinely included in the assessment to identify gross brain abnormalities causing autism is, therefore, no longer viewed as valid (Filipek, 1999).

Functional imaging studies are a research endeavor in autism and do not have a role in clinical diagnosis at the present time. With the advent of functional imaging methods, such as functional MRI (fMRI), single photon emission tomography (SPECT), and positron emission tomography (PET), such studies are expected to play a major role in defining the brain basis for the behavioral impairments in autism, but as research tools only. The value of such studies will depend heavily on the design of activation paradigms, the documentation of the task demands of the paradigms for the individual, and the interpretation of the findings within the broader context of what is known about neurobehavioral function in autism. One construct of growing value in this regard is the cognitive model of autism as a selective disorder of complex information-processing abilities and as a disorder of multiple primary deficits (Minshew & Goldstein, 1998).

The presence of neurologic features not explained simply by the diagnosis of autism (e.g., asymmetric motor examination, cranial nerve dysfunction, severe headache) may be an indication for imaging, in which case the usual standards of practice apply (Filipek, 1999).

Autism *per se* is not considered an indication for neuroimaging, even in the presence of megalencephaly.

Tests of Unproven Value

There is inadequate evidence to support routine clinical testing of individuals with autism for hair analysis for trace elements (Gentile, Trentalange, Zamichek, & Coleman, 1983; Shearer, Larson, Neuschwander, & Gedney, 1982; Wecker, Miller, Cochran, Dugger, & Johnson, 1985), celiac antibodies (Pavone, Fiumara, Bottaro, Mazzone, & Coleman, 1997), allergy testing (in particular food allergies for gluten, casein, candida and other molds) (Lucarelli *et al.,* 1995), immunological or neurochemical abnormalities (Cook, Perry, Dawson, Wainwright, & Leventhal, 1993; Singh, Warren, Averett, & Ghaziuddin, 1997; Yuwiler *et al.,* 1992), micronutrients such as vitamin levels (Findling *et al.,* 1997; LaPerchia, 1987; Tolbert, Haigler, Waits, & Dennis, 1993), intestinal permeability studies (D'Eufemia *et al.,* 1996), stool analysis, urinary peptides (Le Couteur, Trygstad, Evered, Gillberg, & Rutter, 1998), mitochondrial disorders (including lactate and pyruvate) (Lombard, 1998), thyroid function tests (D. J. Cohen, Young, Lowe, & Harcherik, 1980; Hashimoto *et al.,* 1991), or erythrocyte glutathione peroxidase studies (Michelson, 1998).

Referral to Early Intervention

Again, the Level 2 clinicians should refer to an appropriate early intervention or school team if the Level 1 clinicians did not do so. If the child is, indeed, enrolled in a program, the results of Level 2 evaluations by the psychologist, speech and occupational therapists should be communicated to the staff in an effort to better tailor their intervention strategies to the particular needs of the child.

RECOMMENDATIONS

Level 1: Routine Developmental Screening

1. All professionals involved in early child care (pediatricians, neurologists, psychiatrists, psychologists, audiologists, language pathologists, physical therapists, and occupational therapists) should be sufficiently familiar with the signs and symptoms of autism to recognize possible social, communicative, and behavioral indicators of the need for further diagnostic evaluation.

2. Developmental screening should be performed at each and every well-child visit throughout infancy, toddlerhood, the preschool years, and at any age thereafter if concerns are raised about social acceptance, learning and behavior. Recommended screening tools include *The Ages and Stages Questionnaire (ASQ), The BRIGANCE® Screens, The Child Development Inventories (CDIs),* and the *Parents' Evaluation of Developmental Status (PEDS).* Also recommended is the use of Specific Developmental Probes, as outlined in the text, to specifically identify any parental concerns about development. The *Denver-II* (formerly the *Denver Developmental Screening Test-Revised*) is *not* recommended as an appropriate developmental screen in this capacity.

3. The following developmental milestones are nearly universally present by the age indicated. Failure to meet any of these milestones is an absolute indication to proceed with further evaluations. Delay in referral for such testing may delay early diagnosis and treatment and affect the long-term outcome.

No babbling by 12 months.

No gesturing (pointing, waving bye-bye, etc) by 12 months.

No single words by 16 months.

No 2-word spontaneous (*not just echolalic*) phrases by 24 months.

Any loss of *any* language or social skills *at any age*.

4. Level 1 Laboratory Investigations. Concern regarding a speech, language, or hearing problem by parent or practitioner should prompt an immediate referral for a formal audiologic assessment, regardless of whether the child "passed" a neonatal hearing screen.

Audiological assessment should be performed at centers with qualified and experienced pediatric audiologists, with current audiological testing methods and technologies. Facilities without these qualifications should enter consortial arrangements with centers that are able to provide this type of comprehensive assessment of children with autism.

Periodic lead screens should be performed in any autistic child with pica.

5. Professionals involved in early child care should also become familiar with and use one of the screening instruments for children with autism (e.g., the *Checklist for Autism in Toddlers* (CHAT), the *Pervasive Developmental Disorders Screening Test* (PDDST), or, for older verbal children, the *Australian Scale for Asperger's Syndrome*).

6. The social, communication and play development and behavior of siblings of children with autism needs to be monitored very carefully not only for autism-related symptoms but also for language delays, learning difficulties, and anxiety or depressive symptoms.

7. As mandated by Public Law 99-457, and reauthorized as Public Law 105-17: Individuals with Disabilities Education Act- IDEA (1997), a referral for

early intervention should be initiated by the primary care practitioner. Children less than 36 months of age should be referred to the zero-to-three service system in their community; children ages 36 months and older should be referred to the local school district.

8. Health care providers and others need to increase their comfort level in talking with families about autism, which is a treatable disorder with a wide range of outcomes. Thus, information about the benefits of early intervention for children with autism needs to be widely disseminated to health care professionals and others working with young children and families.

9. Screening tools for older children with milder symptoms of autism need to be made widely available in educational and recreational settings, where these children's difficulties are often most visible, as well as in health and allied health settings. Pediatricians can and should play an important role in raising a suspicion of autism, paving the way to appropriate referral to professionals knowledgeable about autism in verbal individuals.

Level 2: Diagnosis and Evaluation of Autism

1. It is the consensus of this Panel that Level 2 Diagnosis and Evaluation should be performed by professionals who specialize in the treatment of children with autism.

2. The diagnosis of autism should be accurately made based on clinical and DSM-IV criteria, and should include the use of a diagnostic instrument with at least moderate sensitivity and good specificity for autism.

Sufficient time must be planned for both a standardized parent interview regarding current concerns and behavioral history related to autism, and direct, structured observation of social and communicative behavior and play.

Such interview instruments include the *Gilliam Autism Rating Scale* (GARS), *The Parent Interview for Autism* (PIA), *The Pervasive Developmental Disorders Screening Test- Stage 2* (PDDST), or the *Autism Diagnostic Interview-Revised* (ADI-R).

Direct, structured observation instruments include the *Screening Tool for Autism in Two-Year-Olds* (STAT), the *Childhood Autism Rating Scale (CARS),* and the *Autism Diagnostic Observation Schedule-Generic* (ADOS-G).

3. Individuals with even mild autism must also receive adequate assessments and appropriate diagnoses, using practice standards similar to those outlined above.

4. Diagnostic evaluations must also address those factors that are not specific to autism, including degree of language impairment, mental handicap, and presence of nonspecific behavioral disorders such as overactivity, aggression, anxiety, depression, or specific learning disabilities, which can significantly affect outcome and treatment of autistic individuals.

5. An expanded medical and neurological evaluation whose focus is on the search for acquired brain injury, comorbid condition, or difficulties common in autism: pregnancy, delivery, perinatal history, developmental history including milestones, regression in early childhood or later in life, encephalopathic events, attention deficit disorder, seizure disorder (absence or generalized), depression or mania, troublesome behaviors such as irritability, self-injury, sleep and eating disturbances, and pica for possible lead exposure.

Family History should specifically probe in nuclear and extended family for autism, mental retardation, fragile X syndrome, and tuberous sclerosis complex, because of their implications regarding the need for chromosomal or genetic evaluation. In addition, family members with affective or anxiety disorder should be identified, as these impact on the care of the child and family burden. The focus of the physical and neurological examination should include: longitudinal measurements of head circumference, unusual features (facial, limb, stature, etc.) suggesting the need for genetic evaluation, neurocutaneous abnormalities (requiring an ultraviolet Wood's-lamp examination), gait, tone, reflexes, cranial nerves, and mental status including verbal and nonverbal language and play.

6. A speech–language–communication evaluation should be performed on all children who fail language developmental screening procedures, by a language pathologist with training and expertise in evaluating children with autism.

A variety of strategies should be used in this assessment, including but not limited to direct standardized instruments, naturalistic observation, parental interviews, and procedures focusing on social-pragmatic abilities.

Results of a speech–language–communication assessment should always be interpreted relative to a child's cognitive, motor and socioemotional abilities.

7. A cognitive evaluation should be performed in all children with autism by a psychologist or developmental pediatrician experienced in autism testing, and should include assessment of family (parent and sibling) strengths, talents, stressors, and adaptation, as well as resources and supports. Psychologists working with children with autism should be familiar with a range of theories and approaches specific to this population.

Psychological instruments should be appropriate for the mental and chronological age, should provide a full range (in the lower direction) of standard scores, including independently scored measures of verbal and nonverbal abilities, should provide an overall index of ability, and should have current norms which are independent of social ability.

8. A measure of adaptive functioning should be collected by the psychologist for any child evaluated for an associated mental handicap. Recommended instruments include the *Vineland Adaptive Behavior Scales* and the *Scales of Independent Behavior-Revised* (SIB-R).

9. Screening and full evaluation for sensorimotor skills by qualified professionals (occupational therapists or physical therapists) with expertise in testing persons with autism should be considered, including an assessment of gross and fine motor skills, praxis, sensory processing abilities, unusual or stereotyped mannerisms, and the impact of these components on the autistic person's life.

10. An occupational therapy evaluation is indicated when an autistic individual is experiencing disruptions in functional skills or occupational performance in the areas of play or leisure, self-maintenance through activities of daily living, or productive school and work tasks. The occupational therapist may evaluate these performance areas in the context of different environments, and through activity analysis, the contributions of performance component abilities (e.g., sensory processing, fine motor skills, social skills) in goal-directed everyday routines.

11. A neuropsychological, behavioral, and academic assessment should be performed, in addition to the cognitive assessment, to include communication skills, social skills and relationships, educational functioning, problematic behaviors, learning style, motivation and reinforcement, sensory functioning, and self-regulation.

12. Assessment of family functioning should be performed to determine the parents' level of understanding of their child's condition and offer appropriate counseling and education. Based on the family's socioeconomic status and the status of the child, one must evaluate the need for and availability of various social services to provide respite and other supports.

13. Assessment of family resources should be performed by social workers, psychologists, or other professionals who specialize in families of autistic individuals, who may be better able to assess the family dynamics in relation to parenting and behavior management strategies as they specifically relate to the autistic child.

14. Level 2 Laboratory Evaluation may include the following, as indicated:

(a). Metabolic testing or consultation is indicated by a history of lethargy, cyclic vomiting, early seizures; dysmorphic or coarse features; mental retardation or if mental retardation cannot be excluded; if there is any question concerning the occurrence or adequacy of newborn screening for a birth within the US; or birth out of the U.S. indicating the potential absence of newborn screening and maternal public health measures.

As recommended by the American College of Medical Genetics, selective metabolic testing should be initiated by the presence of suggestive clinical and physical findings.

(b). Genetic testing, specifically DNA analysis for fragile X and high resolution chromosome studies (karyotype), are indicated for a diagnosis of autism, mental retardation (or if mental retardation cannot be excluded), if there is a family history of fragile X or undiagnosed mental retardation, or if dysmorphic features are present. It should be understood, however, that there is little likelihood of positive karyotype or fragile X testing is the presence of high-functioning autism.

If a family declines genetic testing, they should be counseled to inform extended family members of the potential genetic risks of this disorder so they may seek appropriate genetic counseling.

Although there is no current method to detect autism prenatally, parents of children with autism should be counseled to inform them of the 50-fold increased risk of having another autistic child (1 in 10 to 1 in 20, as compared with 1 in 500 in the general population).

(c). Indications for a prolonged sleep-deprived EEG with adequate sampling of slow wave sleep include evidence of clinical seizures, history of regression (clinically significant loss of social and communicative function) at any age but especially in toddlers and preschoolers, and in situations where there is a high index of clinical suspicion that epilepsy, clinical or subclinical, may be present. There is inadequate evidence at the present time to recommend EEG studies in all individuals with autism.

Other event-related potentials and magnetoencephalography are considered research tools in the evaluation of autism at the present time, without evidence of routine clinical utility.

(d). Neuroimaging may be indicated by the presence of neurologic features *not explained by the diagnosis of autism* (e.g., asymmetric motor examination, cranial nerve dysfunction, severe headache), in which case the usual standards of practice apply. Routine clinical neuroimaging does not have any role in the

diagnostic evaluation of autism at the present time, even in the presence of autistic megalencephaly.

Functional imaging modalities (fMRI, SPECT, and PET) at present are considered solely as research tools in the evaluation of autism.

(e). Tests of unproven value: There is inadequate evidence to support routine clinical testing of individuals with autism for hair analysis for trace elements, celiac antibodies, allergy testing (in particular food allergies for gluten, casein, candida and other molds), immunological or neurochemical abnormalities, micronutrients such as vitamin levels, intestinal permeability studies, stool analysis, urinary peptides, mitochondrial disorders (including lactate and pyruvate), thyroid function tests, or erythrocyte glutathione peroxidase studies.

15. Reevaluation at least within a year of initial diagnosis and continued monitoring is an expected aspect of clinical practice, because relatively small changes in developmental level affect the impact of autism in the preschool years.

16. It is the consensus of this Panel that the role of medical professionals can no longer be limited to simply the diagnosis of autism. Professionals must expand their knowledge and involvement to be better able to counsel families concerning available and appropriate treatment modalities, whether educational, empirical, or "just off the web." In addition, professionals must be familiar with federal law which mandates a free and appropriate education for all children from the age of 36 months, and in some states, from zero to three as well.

Other Recommendations

1. Existing managed-care policy must change as follows:

Extremely brief well-child visits must increase in duration, with appropriate compensation, to permit the implementation of routine developmental screening as recommended above.

Short specialty visits must also increase in duration, with appropriate compensation, to permit the use of appropriate diagnostic instruments, as recommended above.

Autism must be recognized as a medical disorder, and managed care policy must cease to deny appropriate medical or other therapeutic care under the rubric of "developmental delay" or "mental health condition."

2. Existing governmental agencies that provide services for individuals with developmental disabilities must also change their eligibility criteria to include all individuals on the autistic spectrum, whether or not the relatively narrow criteria for Autistic Disorder are met, who nonetheless must also receive the same adequate assessments, appropriate diagnoses, and treatment options as do those with the formal diagnosis of Autistic Disorder.

3. Public awareness and dissemination activities regarding the signs and symptoms of autism must occur throughout communities, to provide information to parents, child-care workers, health-care settings, and community centers. Small, attractive fliers targeting symptoms, needs, and outcomes of very young children and also older children should be developed and disseminated widely, in collaboration with the national autism societies and associations, schools, health, and allied health agencies which need to join in this concerted effort.

4. Increased education of health-related and education-related professionals about autism must occur at the preservice level. Professionals must learn to provide more than a diagnosis and a telephone number for governmental services to parents. Trainees in general and developmental pediatrics, psychiatry, neurology, early childhood education, speech and language pathology, occupational therapy, physical therapy, psychology, nursing, child-care providers, public health, education, and other disciplines need markedly increased knowledge about the range of symptoms of autism both early and later in life, about the educational and community needs of autistic individuals, and the potential outcomes of autism. They must also learn how to discuss potential risks of autism with families.

AN ANALYSIS OF DIFFERENCES RELATIVE TO OTHER PRACTICE PARAMETERS

This consensus recommendation parallels and expands upon many of the major points of the Cure Autism Now (CAN) Consensus Statement (CCS; Geschwind, Cummings, & the CAN Consensus Group, 1998), especially its recognition of the effectiveness of appropriate early intervention programs, the urgency of early identification and diagnosis of autistic spectrum disorders that follows, and the necessity for a careful neurologic and medical examination in all children with autism. Specific recommendations regarding imaging, electrophysiology, metabolic and genetic testing in this document are similar to those from the CCS (Geschwind *et al.,* 1998). The purpose of the CCS was to provide guidelines for first tier autism screening and diagnostic referral for primary care practitioners (primarily pediatricians). The major difference between the current recommendations and the CCS is that the CCS recommended only the CHAT (Baron-Cohen *et al.,* 1992) as a rapid and effective screening tool to screen all 18-month-old children for autism, whereas in this current consensus, the CHAT is

grouped along with other screening instruments, and is felt not to be entirely sufficient for primary care screening purposes. Given the importance of early identification, and the currently unacceptable delays that occur between initial parental suspicion and diagnosis, the importance of widespread developmental screening beginning at 18 months cannot be overemphasized.

The American Academy of Child and Adolescent Psychiatry (AACAP) Practice Parameters (Volkmar *et al.,* in press) were consulted in the development of this document. The documents are similar with two main differences due to the difference in scope of the two documents. The AACAP practice parameters are concerned with aspects of diagnosis and treatment of particular relevance to psychiatrists in their care for children, adolescents, and adults with autism and related conditions. The present document is concerned primarily with aspects of assessment, including diagnostic screening, and does not address aspects of treatment. The AACAP looks forward to continued participation in the effort to provide consensus practice parameters for autism.

The American Academy of Pediatrics (AAP) Committee on Children with Disabilities was consulted regarding its own development of a Policy Statement regarding the role of the primary care pediatrician in the diagnosis and management of children with autism, which is in progress (American Academy of Pediatrics Committee on Children with Disabilities, 1994). The documents are also similar with main differences due to differences in scope of the target audience. The AAP document is concerned chiefly with the role of the primary care pediatrician and addresses management strategies as well as early diagnosis.

RECOMMENDATION FOR PARAMETER REVIEW

The Panel recommends review of these parameters in 2 to 3 years.

RECOMMENDATIONS FOR FUTURE RESEARCH

1. Develop and validate appropriate screening tools with adequate sensitivity and specificity for autism in children prior to age 1 year, which could be feasibly used by a wide range of practitioners. Current evidence suggests that it is likely that many children with autism can be identified by 12 to 18 months of age. It is the consensus of this Panel that early recognition can lead to early access to intervention, which would promote more positive long range outcomes for individuals with autism.

2. Continue to study the usefulness of electrophysiological techniques to clarify the role of epilepsy in autism, especially in children with a history of regression.

3. Continue efforts to identify contributing genes to determine whether the behavioral syndromes which constitute the basis of DSM-IV and ICD-10 have actual biologic validity.

4. Continue efforts to identify the harbingers, causes, and outcome of autistic regression.

5. Attempt to identify environmental factors, such as nonspecific infections or other immunologically mediated events, that might contribute to triggering the expression of autistic symptoms or regression.

6. Further research must focus on the development and validation of appropriate tools to accurately assess the cognitive and neuropsychological profile of individuals with autism, as it is clear that any of the current available tools has, despite the benefits listed in Table VI, significant limitations for use with autistic individuals.

7. A well-designed study of the prevalence of EEG abnormalities and seizures, of MRI abnormalities, and of genetic and metabolic abnormalities directly associated with autism.

8. Studies of the audiological characteristics of autistic individuals and development of appropriate clinical electrophysiological and behavioral procedures to assess peripheral hearing sensitivity and suprathreshold responses.

9. Further basic research on the development of complex auditory processing in children, to provide insight into the emergence of early auditory behaviors considered atypical.

10. Field trials on the results of implementing these guidelines to determine who is identified diagnostically by screening and the efficacy of the various screening instruments in detecting autism at different ages.

APPENDIX

Contact Information for Recommended Instruments

Ages and Stages Questionnaire (ASQ), Second Edition	Paul H. Brookes Publishing Company PO Box 10624, Baltimore, Maryland 21285 Telephone: 800-638-3775; Fax: 410-337-8539
Australian Scale for Asperger's Syndrome	Garnett, M. S., & Attwood, A. J. (1998). The Australian Scale for Asperger's Syndrome (pp. 17–19). In Attwood, T. (Ed.),

	Asperger's Syndrome. A Guide for Parents and Professionals. London; Jessica Kingsley Publisher, ISBN 1853025771.
Autism Diagnostic Interview-Revised *Autism Diagnostic Observation Schedule-Generic*	Catherine Lord Department of Psychiatry, MC3077, University of Chicago 5841 S. Maryland Ave, Chicago, IL 60637 Telephone: 773-702-9707; Fax: 773-834-2742
BRIGANCE® Screens	Curriculum Associates, Inc. P.O. Box 2001, North Billerica, MA 01862-0901 Telephone: 800-225-0248; Fax: 800-366-1158 E-mail: cainfo@curricassoc.com
Checklist for Autism in Toddlers (CHAT)	Baron-Cohen, S. *et al.* (1992). Can autism be detected at 18 months? The needle, the haystack, and the CHAT. *British Jóurnal of Psychiatry,* 161, 839–843. Baron-Cohen, S. *et al.* (1996). Psychological markers in the detection of autism in infancy in a large population. *British Journal of Psychiatry, 168,* 158–163.
Child Development Inventories (CDIs)	Behavior Science Systems Box 580274, Minneapolis, MN 55458 Telephone: 612-929-6220
Childhood Autism Rating Scale (CARS)	Western Psychological Services 12031 Wilshire Boulevard Los Angeles, CA 90025-1251 Telephone: 800-648-8857; Fax: 310-478-7838
Parents' Evaluation of Developmental Status (PEDS)	Ellsworth and Vandermeer Press, Ltd. 4405 Scenic Drive, Nashville, TN 37204 Telephone: 615-386-0061; Fax: 615-386-0346
The Parent Interview for Autism (PIA) *The Screening Tool for Autism in Two-Year-Olds (STAT)*	Wendy Stone Vanderbilt Child Development Center Medical Center South, Room 426 2100 Pierce Avenue, Nashville, TN 37232-3573 Telephone: 615-936-0249 E-mail: wendy.stone@mcmail.vanderbilt.edu
Pervasive Developmental Disorders Screening Test (PDDST)	Bryna Siegel Langley Porter Psychiatric Institute, Box CAS University of California, San Francisco, CA 94143-0984 Telephone: 415-476-7385; Fax: 415-476-7160.

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