

Caring for Children With Autism Spectrum Disorder, Part I: Prevalence, Etiology, and Core Features

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Autism spectrum disorder (ASD) affects 1 in 150 children and has been gaining national attention over the past decade. Given the prevalence of this disorder, there is a high probability that pediatric nurses will care for a child with ASD, regardless of the setting in which they work. Children with ASD traverse the primary care outpatient setting, schools, subspecialty clinics, and inpatient units. A basic understanding of the current issues regarding prevalence and etiology, coupled with knowledge of the core features of ASD, will help pediatric nurses in all settings and at various practice levels better care for these children.
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IN 1943, an original paper by Leo Kanner described the presentation of children who would later be labeled as *autistic*. In his words, "There is from the start an extreme autistic aloneness that, whenever possible, disregards, ignores, shuts out anything that comes to the child from the outside" (Frith, 2003, p. 6). This aloneness emerges from a fundamental impairment in social interaction. It is this social impairment, along with impairments in communication, and the presence of restricted patterns of behaviors and interests that characterize a group of disorders known as autism spectrum disorders (ASDs; Charman & Baird, 2002; Dover & Le Couteur, 2007; National Institute of Mental Health [NIMH], 2007; Walker et al., 2004). ASDs are sometimes also referred to as pervasive developmental disorders (PDDs), and the PDDs include autistic disorder, Asperger's disorder (AD), childhood disintegrative disorder (CDD), Rett's disorder, and PDD-not otherwise specified (PDD-NOS; American Psychiatric Association [APA], 1994; Volkmar & Klin, 2005). In clinical practice, Rett's disorder and CDD are sometimes not included in the grouping of ASD and, therefore, some sources may describe ASD as including autism, AD, and PDD-NOS (Kutscher, 2006). For the purposes of this review, ASD will refer to autism, AD, and PDD-NOS, as most of the issues discussed pertain primarily to these populations.

These disorders are collectively described as a spectrum of disorders because the symptoms can occur in a variety of combinations and present with varying degrees of severity (Autism Society of America [ASA], 2006). The emergence of language describing a spectrum of disorders highlights the possible interrelatedness of these diagnoses and accommodates the nature of the variability in symptom severity often seen in children on the spectrum (Filipek et al., 1999). More recent attention to the category of PDD-NOS has contributed to the conceptualization of a "broader phenotype" of ASD, as this category includes children who display various patterns of skills and difficulties related to, but not adequately meeting the restrictive criteria for other pervasive developmental disorders such as AD or autism (Dawson et al., 2002; Filipek et al., 1999; Volkmar, Lord, Bailey, Schultz, & Klin, 2004). Despite the challenges encountered by clinicians

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regarding classification, all children with ASD have difficulties in the three previously described domains: social interaction, patterns of communication, and restricted or repetitive behaviors or interests.

ASDs have been gaining national attention, and it is common for families to either have a child or know someone with a child on the spectrum. Pediatric nurses at all practice levels, regardless of the setting in which they work, are frequently asked about issues related to the health of children. It is important to have an understanding of what ASDs are, how to identify children with an ASD, and how a diagnosis of ASD is formally obtained.

PREVALENCE

It was assumed for many years that autism was rare, occurring at a rate of about four to five cases per 10,000 children. Prevalence reports in the late 80s and early 90s, however, indicated that the rate might be somewhere around 30 to 60 per 10,000 children, with about one quarter of those (10–20 per 10,000) meeting criteria for true autism (Filipek et al., 1999; Fombonne, 2003, 2005; Volkmar, Chawarska, & Klin, 2005). This alarming rise in the reported prevalence compelled many to explore why the number of children with ASD seemed to be increasing and sparked debate about whether there is an autism “epidemic” (Barbaresi, Katusic, Colligan, Weaver, & Jacobsen, 2005; Barclay, 2005; Fombonne, 2001; Gernsbacher, Dawson, & Goldsmith, 2005; Newschaffer, Falb, & Gurney, 2005; Williams, Higgins, Brayne, 2006). In response to the circulating concerns regarding the true prevalence of autism and related disorders, the Centers for Disease Control and Prevention (CDC) conducted a study examining 8-year-old children living in 14 sites in the United States (CDC, 2007b). Their findings state that 1 in 150 children are living with an ASD. This statistic is the widely adopted prevalence rate currently reported throughout the United States by organizations and experts focused on autism.

According to the CDC, using this current prevalence data, “we can estimate that if 4 million children are born in the United States every year, approximately 24,000 of these children will eventually be diagnosed with an ASD” (CDC, 2007b, ¶2). In addition, the CDC points out that using this prevalence rate, if it has been constant over the past two decades, we can estimate that up to 500,000 individuals between the ages of birth

and 21 have an ASD (CDC, 2007b). After intellectual impairment, ASDs are the most common developmental disability (CDC, 2007b). The prevalence of ASD is currently higher than that of spina bifida, cancer, or Down syndrome (Filipek et al., 1999; Muhle, Trentacoste, & Rapin, 2004; NIMH, 2007).

There is uncertainty regarding whether the increase in reported prevalence reflects a true increase in the incidence of ASD. Newschaffer et al. (2005) examined birth cohort curves from a national data source and concluded that the autism prevalence has been increasing with time and that the cohort curves of the most recent years continue to indicate an increase, but may mark a slowing in the increase. Other scientists point out the difficulties, however, in determining whether there has been a true rise in the incidence of ASD (Barbaresi et al., 2005; Barbaresi, Katusic, & Voigt, 2006). While prevalence reports indicate the number of children living with a particular disorder at a specific time, incidence reports provide information about the number of new cases of a disease in a given population at risk of developing the disease over time. In addressing the increased prevalence reports, experts frequently refer to the recent “broadening” phenotype of ASD and the resulting inclusion of children with disorders that do not necessarily meet the criteria for true autism as a potential influence on the increased numbers (Barbaresi et al., 2005; Barclay, 2005; Dover & Le Couteur, 2007; Gernsbacher et al., 2005; Fombonne, 2001, 2003; Rutter, 2005). Experts also highlight methodological differences in case definition and case-finding procedures and discuss the “adoption of a much broader concept of autism, a recognition of autism among normally intelligent subjects, changes in diagnostic criteria, and an improved identification of persons with autism attributable to better services” (Fombonne, 2001, p. 411; Volkmar & Klin, 2005). Even after noting the limitations of previous studies, however, it is not possible to completely rule out the possibility that there has been an increase in incidence over time.

Despite the uncertainty regarding whether there has been an increase in the number of children developing ASD, there is good epidemiological data to support the currently accepted prevalence of ASD as reported by the CDC. The CDC reports have validated national concerns and further raised scientific interest that will ultimately result in rigorous tracking of the incidence of autism over the next years. The CDC has created the Autism

and Developmental Disorders Monitoring Network in an effort to strategically address this issue (CDC, 2007a). In addition, the increased public awareness of the vast number of children living with ASD is propelling scientists from a variety of disciplines to examine possible causes of autism and will hopefully lead to a better understanding of the etiology of this disorder.

ETIOLOGY

Unlike other medical conditions where a precise causal mechanism can usually be delineated, the etiology of ASD continues to perplex many experts, clinicians, and researchers in the field. It is believed that autism is a neurobehavioral disorder and has no single cause (ASA, 2006; Happe, Ronald, & Plomin, 2006; Sunil, 2006). Growing evidence supports the idea that ASD may be caused by several factors, including genetic susceptibility and environmental influences. The precise nature of the interplay between genetic predisposition and environmental factors is the targeted question of many current research initiatives. The heterogeneity of the phenotype of ASD highlights the complexity that scientists encounter as they examine the etiology of ASD. There is emphasis on the importance of integrating findings from a variety of disciplines attempting to understand why children with ASD present with such varying degrees of difficulties in the three primary domains.

Autism etiology is being examined by a variety of disciplines and, therefore, a tremendous amount of literature is available to parents and clinicians attempting to explain why children develop ASD. It is important to have a basic understanding of this literature to help parents navigate the information available to them regarding the cause and potential treatment options for children with ASD. The following sections will review current research initiatives exploring possible infectious, gastrointestinal/nutritional, environmental toxin, inflammatory, metabolic, neuroendocrine factors and ASD. In addition, a few psychological perspectives are briefly presented.

Genetic Predisposition

Family studies have reported that there is a 60% concordance for classic autism in monozygotic twins versus 0% in dizygotic twins (Muhle et al., 2004; Sunil, 2006). When a broader phenotype for autism was used, the monozygotic concordance increased to 92%. These findings point to a strong

genetic base for autism, but also highlight the fact that there are likely to be environmental or nongenetic factors influencing the expression and, thus, the severity, of autism traits (Freitag, 2007; Muhle et al., 2004; Sunil, 2006; Szpir, 2006; Zafeiriou, Ververi, & Vargiami, 2007).

Additional genetic research is currently exploring the complex interactions between multiple genes in an attempt to understand the variability seen in children along the entire spectrum of autistic disorders. Recent publications propose that perhaps separate genes contribute to the social impairment, communicative impairment, and the rigid or repetitive behaviors, thus explaining the variation found along the spectrum (Happe et al., 2006). Neuroscientists have also recently noted that instead of looking for genes expressed in the brain, it might be more appropriate to look at genes modulating other biological functions. The discovery that a variant of a gene called MET doubles the risk of autism and that this gene modulates the nervous system, gut, and immune system allows for an even more creative conceptualization of what is occurring in children with ASD, particularly the subset with digestive and immune problems (Campbell et al., 2006; Neimark, 2007).

Although most experts agree that there is a strong genetic component to ASD, the more controversial discussions revolve around the nongenetic and/or environmental factors that may influence the phenotypic expression of ASD. No particular environmental factors have been scientifically validated; however, current ongoing studies are examining the possible gene–environment interactions that may lead to the development of ASD and will hopefully provide more concrete evidence for particular culprits (Szpir, 2006).

Environmental Influences

Several studies examining parental beliefs about the causes of autism demonstrate that there are a number of environmental factors considered to influence the development of ASD. Most commonly cited factors include immunizations (child and maternal immunization during pregnancy), environmental exposure (to infection, medications, or toxins), intolerance to food (primarily those containing casein and gluten), and specific perinatal events (e.g., fetal distress or anoxia, prematurity, low birth weight, uterine bleeding, or induced labor; Harrington, Patrick, Edwards, & Brand, 2006; Mercer, Creighton, Holden, & Lewis, 2006). In addition to those factors commonly mentioned by

parents, other prenatal, perinatal, and postnatal factors are under investigation (Kolevzon, Gross, & Reichenberg, 2007). It is not clear how, or whether, heavy metal exposure (mercury, cadmium, or lead) might contribute to ASD. It has been hypothesized that children with ASD have a diminished ability to detoxify and, therefore, exposure to metals results in increased circulating levels throughout the body and brain (Zafeiriou et al., 2007). Studies now under way are also investigating the relationship between factors such as atypical placental growth, abnormal gut tissue, inflamed tissue in the brain, maternal/paternal age, and food allergies (Kolevzon et al., 2007; Neimark, 2007). What was once considered a primary disorder of the brain is now being conceptualized by some experts as a disorder, whereby the interaction between the genetic predisposition and environmental factors leads to a change in cellular function. This, then, manifests itself throughout the body and presents as an array of biological, neurological, and psychological abnormalities which have come to represent the autism spectrum disorders (Herbert, 2005; Neimark, 2007).

Several large, longitudinal, prospective studies aim to shed light on the gene–environment interaction. The Childhood Autism Risks from Genetics and the Environment (CHARGE) project is a case-control study initiated in 2002 at the University of California Davis Medical Investigation of Neurodevelopmental Disorders Institute in Sacramento, California. It is collecting vast amounts of genetic, medical, family, and exposure data on nearly 700 already-enrolled children. The hope is to add 900 children to that sample number in the future (Szpir, 2006). Preliminary findings indicate that the immune system seems to function at a lower level in autism. The challenge, however, lies in determining whether the low-functioning immune system is a result of the autism or whether the low-functioning immune system causes autism (Szpir, 2006). Results are inconclusive at this time, but will likely be a topic of interest following the conclusion of the CHARGE project. In addition, the Autism Birth Cohort Study in Norway and the CDC-established Centers for Autism and Developmental Disabilities Research and Epidemiology promise to rigorously examine the multitude of suspected factors that might be involved in ASD development.

Vaccines

Issues involving vaccination continue to be a controversial topic. There are two separate but

related concerns regarding immunizations. The first involves the measles, mumps, and rubella (MMR) vaccine and the belief that administration of this vaccine causes ASD in some genetically predisposed children. A report by Wakefield et al. (1998) described 12 children who displayed ASD and bowel symptoms. He contended that children with regressive autism and bowel symptoms reflected a unique process linked to the MMR vaccine (Brown, Berkovic, & Scheffer, 2007; Francois et al., 2005; Silverman & Brosco, 2007; Taylor, 2006). This proposition drew enormous attention from parents and clinicians. Despite criticism regarding the study design, the retraction of this interpretation by almost every coauthor of the article, rigorous follow-up studies, and the recent reports from the Institute of Medicine (IOM) and the CDC stating that there is no causal relationship between the MMR vaccine and ASD, this issue remains at the forefront of many discussions and continues to be on the autism research agenda (CDC, 1999, 2000; IOM, 2001; Murch et al., 2004; Silverman & Brosco, 2007; Taylor, 2006).

The second hotly debated concern related to vaccination involves the sheer number of vaccines children receive and the possible relation of increased immunization to the perceived increase in autism prevalence (Silverman & Brosco, 2007). Attention to the preservative thimerosal (which contains ethylmercury) used in vaccines has been postulated to cause neurotoxicity and, thus, ASD. Removal of thimerosal and subsequent research (IOM, 2004) do not reveal any link between immunization and developmental disabilities; however, parent advocacy groups maintain that additional research into this issue is imperative.

Parental concern regarding immunization is prevalent. Pediatric nurses and clinicians need to be prepared to talk with parents about their concerns and provide accurate information regarding the current research on vaccines as a potential cause for autism. Too often, parents report that their concerns are simply “dismissed” and, unfortunately, the sense of trust and partnership with health care providers can be broken (Harrington et al., 2006). Ensuring an open, thoughtful partnership with parents will allow pediatric providers to manage the care of children with ASD and their families collaboratively.

Psychological Perspectives

During the first decades following Kanner’s description of infantile autism, there was tremen-

dous focus on the parental role in the psychogenesis of autism. It was wrongly believed that autism was a psychiatric disorder resulting when parents did not provide adequate love or create a supportive environment for their children (Volkmar & Klin, 2005). Early treatment, therefore, involved working with children and their parents (Silverman & Brosco, 2007). This theoretical framework was challenged in the 1960s by Bernard Rimland (1964), who more accurately alluded to the genetic component and the neurological nature of the disorder (Rimland, 1964; Silverman & Brosco, 2007). Investigation into the etiology of ASD has now crossed a myriad of disciplines including those aimed at taking a more biomedical and physiological approach. The historical roots in psychology and psychiatry, however, have resulted in a long tradition of successful research on ASD. Much of what is currently realized about the cognitive nature of ASD derives from psychological literature and many effective treatment protocols are rooted in cognitive and behavioral therapy (i.e., Applied Behavioral Analysis).

Clinicians, parents, and experts in autism have reason to be encouraged by the vast number of research initiatives aimed at understanding the cause(s) of ASD. The next decade will likely see numerous reports delineating specific mechanisms and will hopefully result in the development of effective and tailored treatment options. Experts universally agree that early detection and intervention ensures the best possible outcome for children with ASD (National Research Council, 2001). Understanding the core features of ASD and knowing the clinicians role in screening, diagnosis, and subsequent management of children with ASD are imperative.

Core Features

All ASDs are characterized by three defining features: impairments in socialization, limitations in verbal and nonverbal communication, and the presence of restricted and repetitive behaviors and/or interests (APA, 1994; NIMH, 2007). Currently, general practitioners in clinical practice utilize the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; APA, 1994)* and the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10; World Health Organization, 1992)* diagnostic criteria as formal guidelines for diagnosis of autism, AD, and other spectrum disorders not meeting full criteria for autism. The ambiguity of

the definition for PDD-NOS has been noted, and many clinicians point out the difficulties in differentiating among ASDs using current diagnostic criteria (Barbaresi et al., 2006). The current criteria in the *DSM-IV* and the ICD-10 classification systems allow for extreme latitude in interpretation on the part of the clinician (Volkmar & Klin, 2005). Despite diagnostic limitations, it is important to discuss different manifestations of the core features and deficits that are associated with each of the ASDs.

Children meeting criteria for true autism, as defined by the *DSM-IV* and ICD-10, demonstrate a variety of deficits, which manifest themselves in different behaviors. To diagnose true autism, a child must meet six criteria as outlined by the *DSM-IV*, at least two criteria relating to the qualitative social impairment, at least one criteria relating to impaired communication, and one relating to range of interests and activities (APA, 1994). The condition must be present before the age of 3 years. Although the *DSM-IV* is utilized in some clinical settings, formal evaluation today will likely involve other diagnostic instruments for ASD. In addition, screening measures are now available for practitioners to utilize in the primary care setting when ASD is suspected. It is, therefore, not as important for pediatric nurses to know by heart the specific diagnostic criteria as put forth by the APA, but to glean a global picture of the way a child with ASD would present and understand the nature of the disorder. See "Caring for Children With Autism Spectrum Disorder, Part II: Screening, Diagnosis, and Management" for a complete discussion on the various screening tools now available for use in the primary care setting. In addition, this related article discusses formal diagnosis and issues important for nurses to understand when helping care for children with ASD.

Autism

Typically developing infants are social beings (NIMH, 2007). Gazing at others, attuning to voices, holding fingers, and smiling are natural behaviors in infancy. Social impairments in ASD, therefore, often manifest themselves in poor eye contact and the inability to utilize nonverbal gestures to manipulate the social environment, such as pointing or sharing gaze with others (APA, 1994; Dover & Le Couteur, 2007; NIMH, 2007; Volkmar & Klin, 2005). Younger children and infants do not imitate or play the same way as typically developing children. They often lack pretend play and might show little interest in things. As they grow, children

with autism often do not develop peer relationships appropriately and do not appear to respond emotionally to others. Howlin (1998) summarizes in detail the deficits seen in autism and discusses how older children lack social awareness and thus may seem isolated from the world. They appear to not have feelings and do not always seem sensitive to others. They may also act socially inappropriate at times. For example, children with verbal abilities may ask an obese woman why she is “fat.”

Communication impairments in autism manifest as either a delay in or complete lack of the development of spoken language. In individuals with verbal abilities, conversation skills are limited, and they may demonstrate repetitive use of language or idiosyncratic language use (APA, 1994; Volkmar & Klin, 2005). Children with autism often repeat things or ask the same question over and over again. Parents of younger children may initially report a lack of babbling, odd speech patterns including echolalia (repeating or echoing others), and unusual tone or pitch. Many children with autism, if they do acquire some basic language abilities, have difficulty telling others what they want or need, and this can lead to frustration, anxiety, and even tantrum-like behavior.

Restricted patterns of behavior, interests, and activities comprise the third category of impairment in children with ASD. Children with autism might be preoccupied with a particular interest that is of abnormal intensity or focus. They often demonstrate repetitive play, such as in lining up cars. Many children with autism have motor mannerisms, such as hand flapping, which are repetitive in nature. Change is often a stressful occurrence for them. They may have routines or patterns from which they cannot deviate.

Deficits associated with true autism permeate all aspects of the child’s and, thus, the family’s, life. Special consideration needs to be taken when working with these children, especially in the health care settings, to be sensitive to the way children with ASD experience the world. Although the specifications for the diagnosis of autism have been delineated and widely accepted, there is controversy about how to accommodate all the children who have a spectrum disorder but do not meet the criteria for true autism. These children include those with AD and PDD-NOS.

Asperger's Disorder

The characterization of AD continues to create confusion and controversy among the autism

community. Although related to autism and PDD-NOS diagnostically (it is included in the *DSM-IV* and its diagnostic criteria are identical to autism, with the exclusion of the communication criteria), the “definition” of AD is argued to be unique (Filipek et al., 1999). Some have referred to AD as “autism without mental retardation,” “high functioning autism (HFA),” or “milder forms of autism marked by higher cognitive and linguistic abilities” (Klin, McPartland, & Volkmar, 2005, p. 88). Despite the *DSM-IV* diagnostic implications that there are no language impairments in AD, it is clear that language in children with AD is not typical or normal. Examples of current research include attempts to define whether there are distinctions between AD and HFA and the consideration that perhaps a broader phenotype of AD might include relatively successful individuals who are not necessarily disabled (Klin et al., 2005). Children with AD share many of the same features as children with autism, but do not have a history of language delay and usually have average or above-average intellectual abilities (Klin et al., 2005; Pratt & Buckmann, 2006; Sunil, 2006).

Socially, children with AD may not appear as withdrawn as children with autism, but they tend to approach others in inappropriate or eccentric ways (Klin et al., 2005). Children with AD do befriend others, but inherent in their friendships are difficulties related to awkwardness and perceived insensitivity on the part of others. They participate in conversation, but have a tendency to only discuss topics they are interested in and fail to “banter” back and forth as in typical two-way conversation. Their inability to understand the “rules” of interaction and poor comprehension of jokes and metaphor can lead to feelings of isolation and embarrassment. Children with AD may have flat and emotionless speech. They are often obsessed with particular topics, may ask repetitive questions, and display concrete and literal thinking. Their circumscribed interests lead them to learn volumes of information about a particular topic in a very intense nature. For example, a child might know or want to learn absolutely everything about vacuums—from how they are built, the history of when they were invented, down to the make and model of every vacuum in existence. Some children with AD display eccentric behaviors (Belschner, 2007). Children with AD usually have a history of poor motor coordination. Parents often describe them as “clumsy.”

The intentional focus on AD and its relation to the other spectrum disorders has led to a revitalization of research examining this particular population. The heightened attention has led to discussion about definition, causality, detailing its relationship to other spectrum disorders, and targeting interventions specifically designed to work with these children.

PDD-NOS

PDD-NOS, also referred to as “atypical autism,” is referenced when there are clinically significant autistic symptoms, but not quite enough to meet the full criteria for true autism. It is not a separate disorder with different manifestations and, therefore, many of the previously described manifestations are applicable to this population. Children with PDD-NOS are sometimes considered to demonstrate a “milder” symptomatology. Diagnosing PDD-NOS is a diagnosis by exclusion, when a child cannot be categorized into one of the other ASDs. One report describes children with PDD-NOS as being “midway between the autism and AD groups on IQ, measures of adaptive behavior, and language milestones” (Walker et al., 2004, p. 178). They are on the spectrum, are higher functioning than autism, have fewer repetitive behaviors than autism and AD, and have more delayed language

than children with AD (Walker et al., 2004). A similar approach is taken regarding treatment and management, and children with PDD-NOS usually benefit from the same therapies and interventions as other children with ASD.

CONCLUSION

Pediatric nurses at all practice levels and in a variety of settings need to have a basic understanding of ASDs. Children with ASD visit primary care offices, subspecialty clinics, and hospitals. Many children with ASD also go to school and participate in community activities. Nurses should be able to identify abnormalities in development related to ASD and understand how children on the autism spectrum experience the world. This article aimed to provide a basic overview of the prevalence, etiology, and core features of ASD. The related article “Caring for Children With Autism Spectrum Disorder, Part II: Screening, Diagnosis, and Management” continues this discussion and provides detailed information regarding the primary care screening, formal diagnosis, treatment, and management of children with ASD. Realizing the variety of issues relevant to children and families with ASD will ensure that this population is positively taken care of.

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