

## Fragile X Syndrome, *DSM-III-R*, and Autism

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**Abstract.** Although reports of autistic behavior in fragile X males have been published for 8 years, there is little information about specific behaviors shown by fragile X males that are suggestive of the diagnosis of autism. The new diagnostic criteria for autistic disorder contained in the *DSM-III-R* provided the opportunity for more closely investigating the topography of autistic behavior in 17 fragile X males and the effects of age and IQ on its occurrence. The criteria most frequently met by these subjects were related to deficits in social interaction with peers, abnormalities in verbal and nonverbal communication, stereotypic motor behavior, and unusual responses to sensory stimuli. Fragile X subjects did not frequently show abnormalities in attachment behaviors and reciprocal interaction with caregivers. There were no discernable age or IQ effects. The importance and implications of these findings are discussed and the need for greater exploration of autism "subtypes" is emphasized. *J. Am. Acad. Child Adolesc. Psychiatry*, 1990, 29, 6:885-891. **Key Words:** fragile X syndrome, autism, *DSM-III-R*, social behavior.

Fragile X (fra X) syndrome is an X chromosome-linked genetic condition which gives rise to significant developmental and behavioral disability in the majority of affected males. With respect to the occurrence of autistic behavior in fra X males, several studies indicate that these males have a greater frequency of social, communication, sensory, and motor abnormalities than would be accounted for by cognitive disability alone (Levitas et al., 1983; Fryns et al., 1984; Hagerman et al., 1986; Hanson et al., 1986; Wolf-Schein et al., 1987; Borghraef et al., 1987; Cohen et al., 1988). Similarly, cytogenetic surveys of groups of autistic individuals result in a range of 0% to 16% of male subjects testing positive for the fra X chromosome (Smalley et al., 1988). Although these data suggest that at least some fra X males manifest a significant degree of autistic behavior, important questions remain about the relationship of such variables as age and IQ to autistic behavior, and the developmental progression of behavioral abnormalities in fra X males.

Although many modifications in diagnostic criteria were incorporated into the latest revision of the Diagnostic and Statistical Manual of Mental Disorders (*DSM-III-R*; American Psychiatric Association, 1987), the changes made to the criteria for autistic disorder (AD) were quite significant. Current criteria consist of a list of 16 behavioral descriptors that are empirically divided into three categories (Appendix 1). To fulfill diagnostic criteria for AD, an individual must

meet eight of the 16 criteria including two from category A, and one each from categories B and C (Appendix 1). Recent reviews have questioned the specificity of these revised criteria (Cantwell and Baker, 1988; Volkmar et al., 1988). However, compared to the *DSM-III*, the *DSM-III-R* multiitem format provides a greater opportunity for exploration of specific subtypes of pervasive developmental disorder occurring in particular populations such as individuals with fra X syndrome. Information obtained from studies investigating autistic subtypes may be of importance for the development of more precise psychiatric nosology, improved diagnostic recognition, and the definition of biologically distinct as well as treatment-specific subgroups (Siegel et al., 1986; Wing and Atwood, 1987; Volkmar et al., 1989).

In this report, initial results from an ongoing study investigating the occurrence of neuropsychiatric abnormalities in males with fra X syndrome are described. Data regarding *DSM-III-R* diagnostic criteria, relationship of age and IQ to the occurrence of autistic behavior, and the developmental progression of behavioral abnormalities are presented and discussed. Based on previous clinical work, with fra X patients, it was predicted that males with this genetic condition would demonstrate a specific subset of behaviors from the autistic spectrum. In particular, it was expected that fra X males would show abnormalities of peer interaction, verbal and nonverbal communication deficits, stereotypic motor behavior, and unusual reactions to particular sensory stimuli. With respect to variables affecting the frequency and severity of autistic behaviors, it was additionally predicted that younger subjects would be more likely to demonstrate autistic symptoms at the time of the evaluation. However, it was not expected that cognitive level would be associated with the degree of autistic behavior within the fra X group.

Although of a preliminary and descriptive nature, the information presented in this report is of potential clinical use to educators, mental health professionals, clinical genetics staff, and parents of fra X children with respect to educational, therapeutic, and genetic planning for males with fra X syndrome.

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## Method

Subjects consisted of the first 17 cytogenetically confirmed, noninstitutionalized males with fra X syndrome seen in an ongoing research study. In this study, children with both fra X syndrome and other (non-fra X) causes of developmental disability receive a comprehensive neuropsychiatric and neuropsychological evaluation. The average age for the 17 subjects was 11 years with a range from 3 to 24 years. Average composite IQ (*Stanford-Binet Intelligence Scale, 4th Edition*; Thorndike et al., 1986) was 50 with a range from 36 to 88.

Interviews were conducted by a trained research assistant or a child psychiatrist with several years of experience working with developmentally disabled children. Both examiners were present for 14 of 17 interviews. For the remaining three interviews, each examiner interviewed the parents at separate times. Evaluation appointments and verbal instructions to the parents on how to maintain examiner blindness were provided before the date of the evaluation by a person other than the individual conducting the interview. However, for several subjects, examiner blindness was compromised by inadvertent parental statements regarding the diagnostic status of their child or by the presence of characteristic physical phenotypic features of fra X syndrome in the child. Therefore, for at least one-half of the subjects, one of the interviewers remained blind to the genetic diagnosis. A semistructured interview (the Neuropsychiatric Developmental Interview [NDI]) created for this research study was administered to both parents of each fra X subject, except for one family in which the father was deceased. The NDI is an interview that elicits the occurrence of any past or present behaviors fulfilling each of the 16 *DSM-III-R* criteria for AD. In this interview, the age of onset of the behavior and, if applicable, age of behavior remission are elicited. The age of greatest severity is also recorded as is a severity rating at that time. The severity rating consists of a number on a continuous scale from 0 (behavior not present) to 5 (greatest frequency or severity).

For the diagnosis of AD, *DSM-III-R* criteria and instructions were followed including the notation that a criterion was met "only if the behavior is abnormal for the person's developmental level" (American Psychiatric Association, 1987; p. 38). For example, if a child was at a 3- to 4-year-old cognitive level and neither played with nor showed any interest in peers, he was coded as meeting criteria A4 and A5 for AD (Appendix 1). In addition, for the more difficult criteria such as those pertaining to social play, information about the child's behavior compared to classroom or other peers who had a comparable level of developmental delay was elicited from the parents and teacher (see below). The severity ratings from the NDI were used to determine whether a specific *DSM-III-R* criterion was met by a subject. Specifically, if the NDI question or questions related to a specific criterion had a severity rating of 4 or 5 on a continuous scale from 0 (behavior not present) to 5 (greatest frequency or severity), the subject was considered as meeting that criterion. Other components of the research evaluation used in determining whether a subject met individual *DSM-*

*III-R* criteria included a standardized (videotaped) behavioral assessment of the child with the mother and a stranger and behavioral information collected from the school or vocational setting (Aberrant Behavior Checklist; Aman and Singh, 1986).

In contrast to the criteria stated for AD, the *DSM-III-R* does not describe diagnostic criteria for pervasive developmental disorder, not otherwise specified (PDDNOS) beyond some unspecified level of impairment in the development of social interactional and communication skills. Therefore, in addition to the primary clinical impression that the subject had significant skills deficits in these areas, a specific operational definition for the diagnosis of PDD NOS was formulated and used for this study. This definition consisted of the subject meeting at least four of the 16 criteria presented in Appendix 1, including at least one criterion from categories A, B, and C.

Interrater reliabilities for the diagnoses of AD and PDD NOS were calculated from 12 joint interviews of pilot ( $N = 2$ ) and research ( $N = 10$ ) subjects with fra X syndrome and other causes of developmental disability participating in the ongoing study. The  $\kappa$  value for AD was 1.0, for PDD NOS was 0.64, and for the general category of PDD (AD and PDDNOS) was 0.83. In the calculation of  $\kappa$  values for this study, diagnostic agreement for either AD or PDDNOS was considered valid only if the raters agreed on the temporal characteristics (i.e., current or past) of the diagnosis as well as the diagnosis itself.

Statistical procedures used in the analysis of the association of autistic behavior with age and IQ consisted of the Student's *t*-test, the Fisher exact probability test (for categorical comparisons) and the Spearman rank correlation coefficient. In all cases, a two-tailed significance value of  $p < 0.05$  was used.

## Results

**Diagnoses.** Three of the 17 subjects (17.6%) met criteria for autistic disorder at the time of evaluation. Another three subjects had met criteria for autistic disorder in the past but no longer did so at the time of the evaluation. However, two of these subjects did meet present criteria for PDDNOS. Five other subjects met criteria for PDDNOS making a total of 10 subjects (58.8%) meeting criteria for some form of pervasive developmental disorder at the time of the evaluation. Six of the subjects diagnosed as having PDD NOS at the time of the evaluation met seven of the 16 *DSM-III-R* criteria for AD, while the other subject met six criteria. One subject met criteria for PDD NOS in the past indicating that only six of the subjects had never met diagnostic criteria for a pervasive developmental disorder at any time in their lives.

**Diagnostic criteria.** A distinct pattern of behavioral abnormalities emerged in the fra X group as a whole. Table 1 shows the specific *DSM-III-R* criteria met by the 17 fra X males in this study. Category A of the *DSM-III-R* diagnostic criteria (Appendix) contains items describing deficits in reciprocal social interaction. Items 1 to 3 from this category describe abnormal behaviors that are more likely to occur with caregivers (e.g., lack of awareness of other's

TABLE 1. Percent Fragility (Fx), Age, Composite IQ, (IQ-C), Verbal Reasoning IQ (IQ-V), DSM-III-R Criteria for Autistic Disorder and Diagnoses in 17 Males with Fragile X Syndrome

#	Fx	Age	IQ-C	IQ-V	DSM-III-R Criteria																
					A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	Dx
1	31	5	66	82	no	no	no	no	no	no	no	c	no	no	no	c	no	no	no	no	no
2	34	8	88	84	p	no	no	c	c	no	c	c	c	c	c	c	c	c	c	c	AD
3	23	6	52	66	no	no	no	c	c	no	no	p	no	c	no	c	c	no	c	c	PDD
4	44	8	36	41	p	p	no	p	p	no	c	p	c	c	no	c	c	p	p	no	*
5	14	7	50	62	no	no	no	c	c	no	c	c	c	no	no	c	c	no	no	no	PDD
6	18	14	43	62	no	no	c	p	c	no	c	no	c	c	no	c	c	no	no	c	AD
7	15	10	36	45	no	c	no	no	no	no	c	c	c	c	no	no	c	no	no	c	PDD
8	12	17	36	56	no	p	p	c	c	no	c	p	c	c	no	no	c	no	no	no	PDD*
9	22	20	60	68	no	no	c	c	c	no	c	c	no	no	c	c	no	no	c	no	PDD
10	24	24	36	45	no	no	no	no	no	no	p	no	no	no	no	c	p	no	no	no	no
11	17	14	36	61	c	no	no	c	c	no	c	c	c	no	c	c	no	c	c	c	AD
12	47	3	72	78	c	no	no	no	no	no	c	no	no	no	no	c	no	no	no	no	no
13	30	6	62	80	no	no	no	no	no	no	c	no	c	c	no	c	no	no	no	no	no
14	48	8	42	58	no	no	no	c	c	no	c	no	c	c	c	p	c	no	no	no	PDD*
15	10	8	43	50	p	no	no	no	no	no	c	c	c	no	no	c	c	no	no	no	no
16	11	13	46	74	no	p	c	c	p	no	c	c	no	c	c	no	no	no	no	no	PDD
17	68	16	40	61	no	no	no	no	no	c	no	c	p	no	c	no	no	no	no	no	no

Note: c = current, p = past, no = never met criteria or diagnosis, AD = autistic disorder, PDD = pervasive developmental disorder, not otherwise specified, \* = met criteria for AD in the past.

emotions, abnormal seeking of comfort, impaired imitation), whereas items A4 and A5 refer to deficits in social play and the ability to establish developmentally appropriate relationships with peers. Within this category, over one-half of the fra X group met present criteria for items A4 or A5. Category B describes abnormalities in verbal and nonverbal communication and imaginative activity. Within this category, a large percentage of the fra X group was positive on items B2, B4, and B5. Over 80% of the fra X group (14 of 17 subjects) met present criteria for item B2 (abnormal nonverbal communication), largely because of the gaze aversion shown by these subjects. More than one-half of the fra X subjects also demonstrated current abnormalities in the production of speech, particularly abnormalities of rate, volume, and rhythm (item B4; 11 of 17 subjects) and abnormalities in the form or content of speech, particularly echolalia and perseveration (item B5; 10 of 17 subjects). With category C, a large majority of the fra X group demonstrated stereotyped body movements, usually hand-flapping and rocking (item C1; 14 of 17 subjects) and unusual responses to sensory stimuli such as tactile hypersensitivity, repetitive smelling of nonfood objects, and auditory hypersensitivity (item C2; 10 of 17 subjects).

*Autistic behavior, IQ and age.* Table 1 presents the age, composite and verbal reasoning IQ scores, percent fragility, and diagnostic criteria data for individual subjects in this study. The verbal reasoning (V-R) score is included as an indicator of the subject's ability in verbal expression, comprehension, and inductive reasoning (Thorndike et al., 1986). This area score has also been shown to have the highest correlation with the WISC-R verbal score (Thorndike et al., 1986).

The following subgroupings and comparisons were made within the fra X sample to investigate the relationship of autistic behavior to IQ and age: (1) current PDD diagnosis

(autistic disorder or PDDNOS; N = 10) versus no current PDD diagnosis (N = 7), (2) current or past PDD (N = 11) versus no current or past PDD diagnosis (N = 6) and, (3) current or past autistic disorder (N = 6) versus no history of autistic disorder (N = 11). These analyses failed to reveal a significant difference between subgroups for age or either IQ measure in the comparisons described above. However, it should be noted that except for one subject with the highest composite IQ (88), all other fra X males who had a past or present diagnosis of AD were in the lower composite IQ group. Additional division of the subjects into younger (N = 9; age range = 3 to 9 years) versus older (N = 8; age range = 11 to 24 years) groups was accomplished by using a median split for the age variable. Division of the subjects into higher IQ (composite scores = 50 to 88, N = 7; V-R scores = 62-84, N = 9) versus lower IQ (composite scores = 36 to 49, N = 10; V-R scores = 41-61, N = 8) subgroups was also performed. These categorizations were used to additionally investigate the association between age and IQ and the diagnostic categories of AD and PDD NOS. These analyses also failed to show any difference between subgroup pairing when defined in this manner. Finally, the relationships between autistic behavior and age or IQ were investigated by using the number of autistic criteria fulfilled by each fra X subject at the time of the evaluation as a variable. However, since this variable was not felt to be continuous, the Spearman rank correlation coefficient was used. The Spearman correlation coefficients for age versus number of autistic criteria and IQ (both composite and V-R) versus number of autistic criteria were not significant. Similar results were obtained even when the autistic subject with the "higher" IQ was excluded from the analyses further indicating that there was no evidence of a relationship between the presence of autistic behavior and age or IQ in these fra X subjects.

*Developmental progression.* When examined as a percentage of the number of subjects meeting a specific *DSM-III-R* criteria, the behavioral criteria most likely to show remission over time among the fra X group included increased awareness of other's emotions (60% remission rate; three of five subjects) and more appropriate seeking of comfort at times of distress (75% remission rates; three of four subjects).

### Discussion

Although descriptions of autistic behavior in fra X males have been reported in the scientific literature since 1982 (Brown et al., 1982; Meryash et al., 1982), there have been few details presented regarding the specific topography of these behaviors and their associations with factors such as age and IQ. Much of the published work on autism and fra X has concentrated on diagnostic issues: What proportion of autistic individuals test positive for the fra X chromosome, and what percentage of fra X males meet diagnostic criteria for autism? Despite this interest in diagnostic issues regarding fra X and autism, little attention has been focused on a pertinent related question. That is, precisely what behaviors do fra X males display that have led some clinicians and researchers to believe that there may be a significant association between this genetic condition and autism?

The increased quantity and descriptive nature of behavioral criteria contained in the *DSM-III-R* diagnostic criteria for autistic disorder permitted an initial step toward answering this question. Results in this study suggest that, as predicted, fra X males demonstrate a relatively specific subset of behaviors and symptoms from the autistic spectrum. With respect to social abilities, most of the fra X males evaluated for this study did not show significant impairment in reciprocal interaction with caregivers, such as behaviors indicating lack of awareness of the feelings of others, impaired imitation, or absent/unusual seeking of comfort. The few subjects who did demonstrate these manifestations of inadequate attachment to caregivers tended to show remission of these behaviors over time. However, long-lasting social disability was apparent in interaction with peers, even when the developmental level of the child was taken into consideration. This finding may, in part, explain why there is disagreement concerning the issue of autistic behavior in fra X males. Clinicians employing a more "traditional" (pre-*DSM-III-R*) definition for autism (Bregman et al., 1988) and/or failing to collect detailed information about peer interaction may be more likely to interpret the fra X child's developmentally appropriate interaction with, and attachment to, caregivers as being incompatible with a PDD diagnosis. Conversely, educational or clinical staff, directly observing or eliciting detailed information about peer interaction, may be more inclined to consider the diagnosis when the social disability is considered in the context of the fra X male's communication, motor, and sensory abnormalities.

Although all of the fra X males demonstrated some form of communication with others, many qualitative disturbances in both verbal and nonverbal communication were reported. These included abnormalities of eye to eye gaze

and gesture, peculiarities in speech production, echolalia, and perseveration. Persistent problems with stereotypic motor behavior and unusual responses to particular sensory stimuli were also described for most of the fra X males evaluated in this study. Nearly all of these behaviors began at an early age and showed little sign of remitting in older subjects.

Within this fra X group, IQ did not appear to be associated with the severity of autistic behavior. As Table 1 indicates, fra X males tend to show significant relative strength in the verbal reasoning area (Freud and Reiss, 1989a). Yet, paradoxically, fra X males do not use these skills for social interaction opportunities with peers. The lack of a relationship between IQ and autistic behavior in these fra X males suggests that cytogenetic testing for the fra X chromosome in patients with pervasive developmental disorder not be restricted to those individuals with mental retardation. It also suggests that there is a core neurobiological dysfunction leading to behavioral disturbance in a fra X males that is, at least partially, independent of dysfunction in cognitive processes measured by IQ.

Overall, there was little evidence to support the predicted relation between age and autistic symptoms in the fra X group. However, diagnostic data suggested that there was some evidence for improvement in some of the subjects in this study. Interestingly, behavioral improvements in these subjects were in areas not part of the fra X pattern of social and communication deficits suggested in this report. Specifically, behavioral improvement was most likely to be in the areas of more appropriate attachment to caregivers as shown by increased awareness of other's feelings and more appropriate seeking of comfort. The apparent lack of improvement in peer social interaction and communication also lends support to the idea of a specific profile of autistic behavioral disturbance in fra X males. This information is important for educational and psychological planning for the fra X male. In particular, these individuals may need specialized interventions, such as social skills and language therapy, throughout childhood and the young adult years.

The definitive answer to the question of whether the diagnosis of autistic disorder occurs in fra X males with a greater frequency and severity than expected requires a research design that uses age-, sex-, and cognitive level-matched individuals with other causes of developmental disability as comparison subjects (Einfeld, 1988). Such a project is currently in progress at The Kennedy Institute. However, the results from the study presented here suggest tentative answers to the questions of the frequency of autism in fra X syndrome. While only three of 17 subjects met full criteria for *DSM-III-R* autistic disorder, 10 met criteria for some type of PDD at the time of the evaluation. Therefore, the results support previous reports that suggest that the diagnosis of autistic disorder does not occur in the majority of fra X males (Bregman et al., 1988). At the same time, most of the fra X males did demonstrate a relatively specific subset of autistic behaviors that met criteria for some form of PDD. These results suggest that overemphasis on the issue of the diagnosis of autism in fra X males may detract from the significance of the occurrence of a specific be-

havioral phenotype in these individuals. Information regarding this phenotype is of importance to mental health professionals, educators, parents, genetics personnel, and other individuals coming into contact or working with fra X patients. If the association of a specific subset of autistic behavior and fra X syndrome in males is confirmed, the study of this genetic condition as a "prototype" condition for PDD (Reiss and Freund) could also have importance with respect to revealing underlying genetic, neurobiological, educational, and therapeutic principles which could be applied in the general population to children who manifest similar patterns of disability.

Although the conclusions presented in this report are supported by the data, there are additional factors which may have affected the collection and interpretation of information which deserve mention. First, data collection was based on a semistructured interview (the NDI) with the parents of the fra X subjects. Although this interview was designed to elicit an accurate, retrospective, and longitudinal survey of the occurrence of autistic behaviors, the validity of the information collected is largely dependent on the accuracy of the informants' memory. Therefore, it is likely that parents of older subjects had more decrement in their memory of specific behaviors than parents of younger children in the study. However, it is unlikely that this factor could have biased the data in a direction that supports the association between fra X syndrome and autistic behavior. Increasing time between the occurrence and reporting of symptoms would be expected to lead to a loss of pertinent information rather than the collection of inaccurate data. However, to minimize possible loss or distortion of information, several strategies in the data collection process were employed. First, in all cases but one, both parents of the subject were interviewed. Second, parents were instructed to use a high "threshold" for the reporting of behaviors occurring in the past only. That is, parents were asked to reply positive only if they had a distinct recollection of the behavior. Similarly, positive responses to questions on the NDI, indicating the past occurrence of a behavior, were only scored if the interviewer determined that the informant's reply was relatively rapid, unambiguous, and appeared clearly based on recollection.

Another issue regarding the validity of the information collected with the NDI is related to the fact that the mother of the male subject was always one of the parental informants interviewed for this study. Since all mothers of children affected with fra X syndrome are presumed to be carriers (heterozygous) for the fra X genetic abnormality (Sherman et al., 1988), one could argue that the partial expression of this genetic condition in the mother could have affected the validity of the information collected from her. However, the use of both parents in all but one case would have been likely to minimize any inaccurate reporting secondary to the mother's genetic status. More importantly, all of the mothers interviewed for this study had IQ's well within the normal range (Freund and Reiss, 1989b) and were, therefore, unlikely to misinterpret questions or provide incorrect information secondary to limited cognitive abilities.

Finally, the fact that this study was a cross-sectional sur-

vey of fra X males rather than longitudinal in nature may have introduced an age bias into the analysis of age effects on the occurrence of autistic behavior. In particular, nine of the subjects studied were under 10 years of age at the time of the evaluation. It is possible then, that the "older" subjects represented a different subgroup of more chronically disabled fra X males and that the younger subjects who were assessed will eventually show significant improvement in their behavior as they grow older. Although the issue of age bias can only be definitively addressed through the use of a multiyear longitudinal study of a cohort of fra X subjects, a survey of the original ascertainment procedures in making the genetic diagnosis of these subjects provides some indication that there is no fundamental difference between the older and younger subject groups. Specifically, all subjects seen in this study were referred for genetic testing for unexplained developmental disability.

In summary, these results indicate that the behavioral phenotype of the fra X syndrome in males includes a particular subset of behaviors from the autistic spectrum. With respect to social deficit, long considered a hallmark of the autistic syndrome (Kanner, 1943), the neurobiological dysfunction leading to autistic-like symptoms does not appear to affect the development of basic attachment behavior with caregivers. Rather, social dysfunction is most prominent when the fra X male is required to process, interpret, learn, and respond to more sophisticated and complicated social information from his peer environment. It is likely that the verbal and nonverbal communication deficits exhibited by fra X males, such as gaze avoidance, perseveration, echolalia, and unusual speech production, also have a major role in contributing to social dysfunction with peers.

It is unclear what roles, if any, the sensory and motor abnormalities observed in fra X males play in the development and maintenance of social and communication deficits. As Ornitz (1983) has suggested in describing the functional neuroanatomy of autism, such deficits might be indicative of a "core" disturbance in the processing and modulation of externally and internally derived sensory information. As in autistic children (Ornitz, 1983), a primary deficit of this type could explain the secondary social and communication deficits observed in fra X males.

No matter how the issue of the association of fra X syndrome and autism is eventually resolved, the deficits in social interaction and communication exhibited by fra X males are of primary functional importance to these individuals' current and future adaption to their environment. The results reported here clearly indicate the need for additional research with individuals affected with the fra X syndrome. This condition is one of the most common genetic causes of developmental and behavioral disability in males and females and thus presents an important challenge to child psychiatrists and allied mental health professionals to develop a more comprehensive understanding of the characteristic disabilities occurring in affected children. In particular, increasingly specific and focused investigations are needed to provided a more detailed account of the developmental progression of social, communication, sensory, and motor abnormalities. It is only with such information

that more rational and effective interventions can be developed.

## Appendix

### *Diagnostic Criteria for Autistic Disorder and Pervasive Developmental Disorder, Not Otherwise Specified (PDDNOS)*

For *DSM-III-R* autistic disorder, at least eight of the following 16 items are present; these include at least two items from A, one from B, and one from C. For PDDNOS research criteria for least four of the following 16 items are present; these include at least one item from A, one from B, and one from C.

#### A. Qualitative impairment in reciprocal social interactions as manifested by the following:

- (1) marked lack of awareness of the existence or feelings of others (e.g., treats a person as if he or she were a piece of furniture; does not notice another person's distress; apparently has no concept of the need of others for privacy)
- (2) no or abnormal seeking of comfort at times of distress (e.g., does not come for comfort even when ill, hurt, or tired; seeks comfort in a stereotyped way (e.g., says "cheese, cheese, cheese" whenever hurt)
- (3) no or impaired imitation (e.g., does not wave bye-bye; does not copy mother's domestic activities; mechanical imitation of others' actions out of context)
- (4) no or abnormal social play (e.g., does not actively participate in simple games; prefers solitary play activities; involves other children in play only as "mechanical aids")
- (5) gross impairment in ability to make peer friendships (e.g., no interest in making peer friendships; despite interest in making friends, demonstrates lack of understanding of conventions of social interaction, for example, reads phone book to uninterested peer)

#### B. Qualitative impairment in verbal and nonverbal communication and in imaginative activity, as manifested by the following:

- (1) no mode of communication, such as communicative babbling, facial expression, gesture, mime, or spoken language.
- (2) markedly abnormal nonverbal communication, as in the use of eye-to-eye gaze, facial expression, body posture, or gestures to initiate or modulate social interaction (e.g., does not anticipate being held, stiffens when held, does not look at the person or smile when making a social approach, does not greet parents or visitors, has a fixed stare in social situations)
- (3) absence of imaginative activity, such as playacting of adult roles, fantasy characters, or animals; lack of interest in stories about imaginary events
- (4) marked abnormalities in the production of speech, including volume, pitch, stress, rate, rhythm, and

intonation (e.g., monotonous tone, question like melody, or high pitch)

- (5) marked abnormalities in the form or content of speech, including stereotyped and repetition of television commercial); use of "you" when "I" is meant (e.g., using "You want cookie?" to mean "I want a cookie."); idiosyncratic use of words or phrases (e.g., "Go on green riding," to mean "I want to go on the swing."); or frequent irrelevant remarks (e.g., starts talking about train schedules during a conversation about sports)
- (6) marked impairment in the ability to initiate or sustain a conversation with others, despite adequate speech (e.g., indulging in lengthy monologues on one subject, regardless of interjections from others)
- C. Markedly restricted repertoire of activities and interests, as manifested by the following:
  - (1) stereotyped body movements, (e.g., hand-flicking or -twisting, spinning, head banging, complex whole-body movements)
  - (2) persistent preoccupation with parts of objects (e.g., sniffing or smelling objects, repetitive feeling of texture of materials, spinning wheels of toy cars) or attachment to unusual objects (e.g., insists on carrying around a piece of string)
  - (3) marked distress over changes in trivial aspects of environment (e.g., when a vase is moved from usual position)
  - (4) unreasonable insistence on following routines in precise detail (e.g., insisting that exactly the same route always be followed when shopping)
  - (5) markedly restricted range of interests and a preoccupation with one narrow interest (e.g., interested only in lining up objects, in amassing facts about meteorology, or in pretending to be a fantasy character)
- D. Onset during infancy or childhood.

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