

# **A Comparison Between Specific Autism-Spectrum Disorders According to Clinical and Demographic Factors in Children, Adolescents, and Young Adults**

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## **Abstract**

Kanner-type autism and Asperger's disorder are characterized by deficits in communication, socialization, or both. Little work has been done to compare Kanner-type autism with Asperger's disorder in terms of demographic and clinical variables. This chart-review study compares Asperger's syndrome, Kanner-type autism, and Asperger's syndrome comorbid with other neuropsychiatric disorders. It also compares Kanner-type autism comorbid with other neuropsychiatric disorders, finding that neuropsychiatric comorbidity was common. Overall, there were few differences between groups, but allergies,

pregnancy complications, family history, maternal and paternal age, birth order, and medical problems may distinguish between groups. Asperger's disorder accompanied by other neuropsychiatric illness was more likely to be associated with pregnancy and medical complications and less likely to have a family history of autism-spectrum disorders and neuropsychiatric illness than were cases of uncomplicated Asperger's disorder and Kanner-type autism. Kanner-type autism complicated by other neuropsychiatric disorders was less likely to have a family history of neuropsychiatric disorders than Kanner-type autism.

Kanner-type autism can be a pervasive and severely disabling developmental disorder characterized by deficits in language and other aspects of communication, deficits in social interaction, and a restricted range of behavior and interests (Firestone & Steinberg, 2007; Reichenberg et al., 2006). Another pervasive developmental condition, Asperger's disorder, is similar to Kanner-type autism in that it is characterized by deficits in communication and socialization, although people with Asperger's disorder generally have fewer communication deficits than individuals with Kanner-type autism (Countryman, 2008; South et al., 2005). Despite relatively intact intelligence and verbal ability, people with Asperger's disorder typically have significant difficulty in social functioning (Gutstein & Whitney, 2002). Both Asperger's disorder and Kanner-type autism are autism-spectrum disorders (ASDs). Because of the lingering difficulty distinguishing between the different ASDs (Gutstein & Whitney, 2002) and the apparent complexity of the etiology of the ASDs (Lainhart et al., 2005), we report data in this paper from a retrospective study comparing clinical and demographic features of Asperger's disorder and Kanner-type autism.

While the exact prevalence of Kanner-type autism and Asperger's disorder is unknown, findings from an epidemiological study suggested that ASDs as a whole occur in 6.2 children out of every 1,000 (Nicholas et al, 2008)). Moreover, the diagnosis of Kanner-type autism appears to be increasing, but it is unknown whether this represents an actual increase in prevalence or is due to increased awareness or other diagnostic patterns (Schechter & Grether, 2008). Despite intense study, the causes of Kanner-type autism and

Asperger's disorder remain unknown. A number of findings, however, indicate a neurobiological etiology, and research has focused on genetic, anatomical, intrauterine, immunological, and environmental influences in Kanner-type autism and Asperger's disorder (Greenspan & Weider, 1997; Lainhart et al., 2005; Solomon et al., 2007; Weiss et al., 2008). Heritability estimates of 90 percent indicate a considerable genetic contribution to Kanner-type autism (Freitag, 2007; Weiss et al., 2008). Although genetic factors are considered important in the etiology of Kanner-type autism, environmental factors are likely involved as well (Freeman et al., 1991; Skuse, 2007). For example, Reichenberg et al. (2006) found an association between advanced paternal age and Kanner-type autism. Birth order may also be relevant to understanding some of the causes of Kanner-type autism (Glasson et al., 2004). Like many other diseases (e.g., cardiovascular disease, Alzheimer's disease, and schizophrenia), Kanner-type autism and Asperger's disorder are likely etiologically complex conditions entailing genetic, neurobiological, psychological, and environmental factors (Lainhart et al., 2005).

To date, it is unclear whether Kanner-type autism and Asperger's disorder are separate disorders or whether they fall along a continuum (Baskin et al., 2006). Accordingly, researchers have not always distinguished between people with autism or high-functioning autism (Gutstein & Whitney, 2002). In fact, Kanner-type autism and Asperger's disorder are collectively often referred to as autism-spectrum disorders (ASDs), a designation that underscores the difficulty in separating Kanner-type autism from Asperger's disorder. Regardless of whether they are separate disorders or exist along a continuum, ASDs are quite heterogeneous and affect each individual differently in terms of learning ability, learning style, socialization, and communication (Greenspan & Weider, 1997; Gutstein et al., 2007; Solomon et al., 2007).

Given the growing understanding of the putative complex etiology of ASDs, a clearer understanding of the demographic and clinical characteristics of ASDs may better guide genetic, neurobiological, environmental, and psychological studies into the basis and nature of ASDs, as well as inform clinical, behavioral, educational, and psychopharmacological intervention. Further, a better

understanding of the factors differentiating Kanner-type autism from Asperger's disorder would also help guide research into the etiology of and educational and clinical interventions for, ASDs. Even though it is now recognized that ASDs exist on a continuum ranging in severity from mild to severe, certain clinical and developmental concerns emerge across the lifespan for people with an ASD. This includes the need for early identification and for integrated education- and research-based interventions and skill-building practices for children, adolescents, and young adults with ASDs. There also is an additional need to assemble a comprehensive system using and integrating a continuum of overlapping services, programs, and national and state funding to assist people with ASDs at all stages of development (Firestone & Steinberg, 2007; Gutstein et al., 2007; Seltzer & Krauss, 2002; Solomon et al., 2007).

Based on these factors, the primary aim of this research study was to conduct a retrospective analysis comparing the demographic characteristics, clinical characteristics, and risk factors for Kanner-type autism and Asperger's disorder in a private, community-based, North American clinic specializing in the treatment of ASDs.

## **Methods**

### ***Subjects***

All study subjects came from a private, community-based clinic specializing in the treatment of ASDs in children, adolescents, and young adults. The Brigham Young University Institutional Review Board approved the research and its associated procedures. To obtain subjects for this research, clinic staff randomly asked the parents or caregivers of potential subjects whether they would consider having their children voluntarily participate in this research. In the cases where the participants themselves were capable of determining whether they would like to be involved in the research, clinic staff also asked the potential subjects if they would like to participate in the research. Inclusion criteria for the study were: (1) a willingness to participate in the study, (2) enrollment in the clinic, and (3) a diagnosis of an ASD.

### ***Diagnostic Classification and Data Extraction***

After participants and their parents provided written informed consent, two members of the research group (trained by the principal investigators in the extraction of data from clinical records) retrospectively reviewed the patients' medical and developmental files. These researchers recorded specific information about age, gender, primary ASD diagnosis, intellectual function, a history of developmental regression, comorbid neuropsychiatric diagnoses, medical history including pregnancy and birth complications, allergies, gastrointestinal problems, season of birth, birth order, medication use, family history of ASDs and other neuropsychiatric conditions, reported family income, paternal and maternal age at the time of the patient's birth, parental educational attainment, parental occupation, and medication status.

On the basis of the information about the primary diagnosis (either Asperger's disorder or Kanner-type autism) and the presence or absence of other neuropsychiatric disorders, subjects were classified into one of four groups: 1) Asperger's disorder, 2) Kanner-type autism, 3) Asperger's disorder with at least one other neuropsychiatric condition, and 4) Kanner-type autism with at least one other neuropsychiatric condition. These four groups were compared on the collected variables listed above.

To determine intellectual function, records from previously administered standardized tests of intellectual ability or speech-and-language testing, rendering chronological scores according to age and ability, were used. For the purposes of our analysis, the subjects were classified into below-average, average, or above-average intellectual function because the methods used to assess intellectual function varied from subject to subject. In determining socioeconomic status of the subject's family of origin, we used caregivers' reports of family income to classify them into low, middle, upper-middle, and upper categories according to the ranges used by the Bureau of Labor and Statistics for the state in which the study was conducted (Bureau of Labor and Statistics, [www.bls.gov](http://www.bls.gov)).

No *a-priori* hypotheses about the differences between the Asperger's disorder and autism groupings were made. Rather, the

study focused on assessing several different potentially relevant variables.

Chi square and the Z test of two proportions were used for all comparisons when the necessary minimum frequency criteria were met. When frequency criteria were not met, Fisher's Exact Test was used. All tests were run using the FREQ procedure of SAS (SAS Institute, Inc., Cary, North Carolina) and Microsoft Excel (Seattle, Washington). Effect sizes reported as contingency coefficients were also calculated along with the significance testing.

## Results

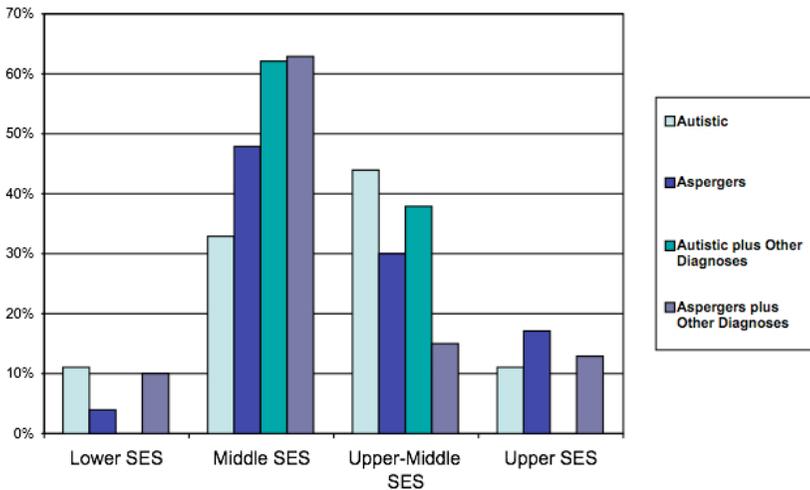
In all, 96 families provided informed consent for study participation. Of these, we excluded 11 potential subjects because of a lack of an ASD diagnosis, leaving 85 subjects for analysis. The mean age of the sample was 11.17 years (range: 3.17 to 27.50; standard deviation = 5.00).

In this sample, 23 (25.1%) subjects had Asperger's disorder, nine (10.6%) had Kanner-type autism, 40 (47.1%) had Asperger's disorder complicated by at least one other neuropsychiatric condition, and 13 (15.3%) had Kanner-type autism complicated by at least one other neuropsychiatric condition. This sample had considerable comorbidity. Of the 22 people with Kanner-type autism, 13 (59.1%) had other neuropsychiatric illness, and 40 of the 63 (63.5%) people with Asperger's disorder had comorbid neuropsychiatric illness.

In this study, subjects came predominantly from the middle and upper-middle socioeconomic categories. That is, most of the sample was restricted to subjects whose parents or caregivers were predominantly in the middle or upper-middle socioeconomic levels, implying a limit to generalizability but providing a socioeconomic control to the sample as well. Within each socioeconomic-status category, the relative distribution of diagnostic categories was not significantly different as indicated in *Figure 1*, suggesting that in this sample no particular parental socioeconomic level appears to be more associated with any one of our diagnostic categories compared to the others.

The majority of the subjects had average or above-average

Figure 1. Percentage distribution of socioeconomic status for each of the four diagnostic categories.

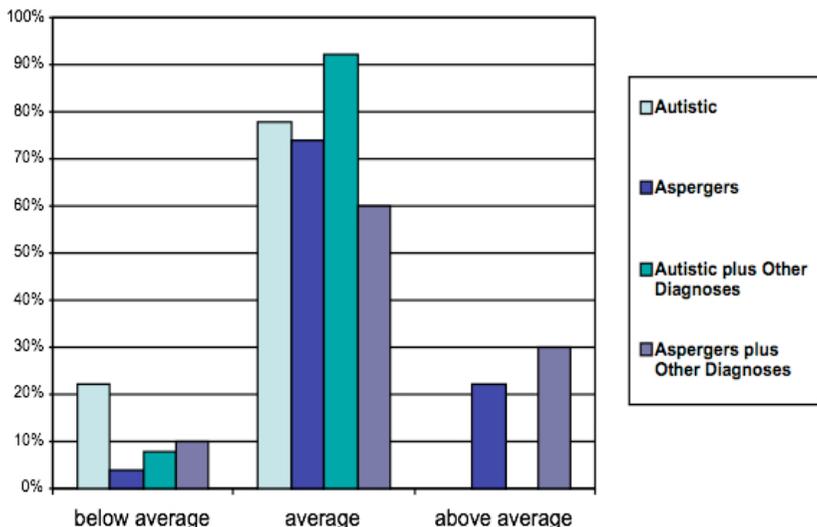


The Fisher's Exact Test comparing the relative socioeconomic distribution across the four diagnostic categories is not significant.

intellectual ability, with only three subjects having below-average intellectual ability. While this indicated an atypical sample in that approximately 70 percent of all people with Kanner-type autism have mental retardation (Volkmar et al., 2005), it also in a sense controlled for intellectual function by examining primarily ASD subjects within a relatively narrow range of intellectual ability. Accordingly, the interpretation of the findings from this study requires awareness that the sample is restricted to subjects whose intellectual ability is limited primarily to the normal range. Furthermore, the distribution of diagnostic categories did not significantly differ according to the level of intellectual ability (Figure 2).

Consistent with previous findings suggesting a male/female ratio of approximately four to one in pervasive developmental disorders (Countryman, 2008), males dominated all of the diagnostic categories (percent male: Asperger's disorder = 91.3%; Kanner-type autism = 77.8%; Asperger's disorder complicated by at least one other neuropsychiatric condition = 85.0%; Kanner-type autism complicated by at least one other neuropsychiatric condition = 84.6 %.). As such, we found a male predominance even in our socioeconomically and intellectually restricted sample. That is, the male predominance

Figure 2. Percentage distribution of intellectual ability for each of the four diagnostic categories.



The Fisher's exact test comparing the relative distribution of intellectual ability across the four categories is not significant.

was preserved in a middle-class sample of intellectually normal subjects. Moreover, there were no significant differences in gender distribution between groups (Table 1). In Table 1, the percentages of the clinical and demographic variables are found for each of the four diagnostic groups (Asperger's disorder, Kanner-autism, Asperger's disorder complicated by at least one other neuropsychiatric illness, and Kanner-type autism complicated by at least one other neuropsychiatric illness). The results of Z tests (or Fisher's Exact Tests where Z tests were not possible) comparing 11 clinical and demographic characteristics between groups are also shown in Table 1. As seen, there were few [13 out of 99 calculations (13.1%)] significant differences between groups overall across the 11 variables (percent male, allergies, history of regression, gastrointestinal complications, medications, family history of ASD, pregnancy complications, birth complications, family history of neuropsychiatric illness, medical problems, prematurity). No significant differences between diagnostic groups were found in gender distribution, developmental regression, gastrointestinal complications, birth complications, and prematurity.

*Table 1.*

Percent in each diagnostic category with 11 demographic and clinical characteristics and the results of Z tests (or Fisher's Exact Tests where Z tests not possible) for each of the 11 characteristics on each of nine analyses (Aut vs ASP, Aut+ vs Asp+, Aut vs Aut+, Asp vs Asp+, Aut/Aut+ vs Asp/Asp+, Aut vs the other three groups, Asp vs the other three groups, Aut+ vs the other three groups, and Asp+ vs the other three groups)

	Asp	Aut	Asp+	Aut+
Percent male	91.3	77.8	85.0	84.6
Percent with history of allergies	17.4*	55.6	37.5*	15.4
Percent with regression	4.3	0.0	12.5	7.7
Percent with GI complications	4.3	22.2	17.5	7.7
Percent with medications	43.5**	33.3**	70.0**	61.5**
Percent with relatives with an ASD	56.5***	55.6***	55.0***	30.8***
Percent with problems in pregnancy	26.1#	44.4#	55.0#	30.8#
Percent with birth complications	21.7	22.2	35.0	53.8
Percent with family history of neuropsychiatric illness	95.7##	100.0##	77.5##	61.5##
Percent with medical problems	65.2###	77.8###	85.0###	69.2###
Percent with prematurity	26.1	22.2	17.5	7.7

Asp = Asperger's disorder

Aut = Kanner-type autism

Asp+ = Asperger's disorder plus at least one other neuropsychiatric illness

Aut+ = Kanner-type autism plus at least one other neuropsychiatric illness

GI = gastrointestinal

\* Asp+ had significantly more allergies than Asp ( $z=1.674$ ,  $p=.0470$ ,  $C=.206$ )

\*\* Asp+ had significantly more medication use than Asp ( $z=2.072$ ,  $p=.0192$ ,  $C=.253$ ) and than the other three diagnostic categories as a group ( $z=2.173$ ,  $p=.0149$ ,  $C=.229$ )

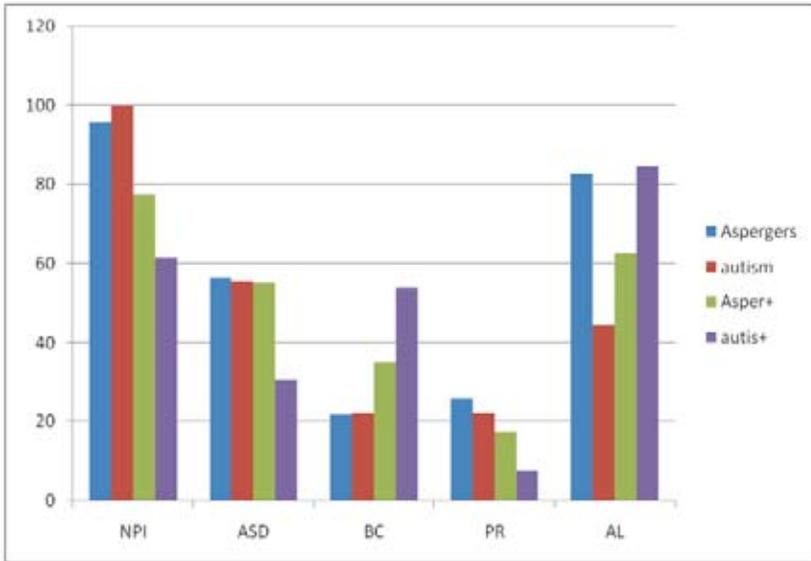
\*\*\* Aut+ had significantly fewer relatives with an ASD than the other three diagnostic categories as a group ( $z=1.646$ ,  $p=.0499$ ,  $C=.176$ )

# Asp+ had more pregnancy complications than Asp ( $z=2.224$ ,  $p=.0131$ ,  $C=.270$ ); Asp had significantly fewer pregnancy complications than the other three diagnostic categories as a group ( $z=1.849$ ,  $p=.0323$ ,  $C=.197$ ); and Asp+ had significantly more pregnancy complications than the other three diagnostic categories as a group ( $z=2.225$ ,  $p=.0130$ ,  $C=.235$ ).

### Aut was significantly more likely that Aut+ to have a family history of neuropsychiatric illness ( $z=2.117$ ,  $p=.0172$ ,  $C=.411$ ); Asp was more likely to have a family history of neuropsychiatric illness than Asp+ ( $z=1.898$ ,  $p=.0288$ ,  $C=.233$ ); Asp was significantly more likely than the other three diagnostic categories as a group to have a family history of a neuropsychiatric illness ( $z=1.959$ ,  $p=.0251$ ,  $C=.226$ ); and Aut+ was significantly less likely to have a family history of neuropsychiatric illness than the other three diagnostic categories as a group ( $z=2.139$ ,  $p=.0162$ ,  $C=.226$ ).

#### Asp+ was had significantly more medical problems than Asp ( $z=1.818$ ,  $p=.0345$ ,  $C=.223$ ), and Asp+ had significantly more medical problems than did the other three diagnostic categories as a group ( $z=1.748$ ,  $p=.0402$ ,  $C=.186$ ).

Figure 3. Comparison of the four diagnostic categories on five of eleven characteristics.



Autism = Kanner-type autism

Asper+ = Asperger’s disorder complicated by at least one other neuropsychiatric illness

Autis+= Kanner-type autism complicated by at least one other neuropsychiatric illness

NPI = family history of neuropsychiatric illness

ASD = family history of autism-spectrum disorder

BC = birth complications

PR = prematurity

AL = history of allergies

Despite the overall similarity in clinical and demographic variables among the diagnostic categories, several clinical and demographic characteristics did distinguish between groups. Asperger’s disorder complicated by other neuropsychiatric illness had significantly more allergies than Asperger’s disorder ( $z=1.674$ ,  $p=.0470$ ,  $C=.206$ ). Further, Asperger’s disorder complicated by other neuropsychiatric disorders had significantly more medication use than Asperger’s disorder ( $z=2.072$ ,  $p=.0192$ ,  $C=.253$ ) and than the other three diagnostic categories as a group ( $z=2.173$ ,  $p=.0149$ ,  $C=.229$ ).

Asperger's disorder complicated by other neuropsychiatric illness had significantly more pregnancy complications than Asperger's disorder ( $z=2.224$ ,  $p=.0131$ ,  $C=.270$ ) and than the other three diagnostic categories as a group ( $z=2.225$ ,  $p=.0130$ ,  $C=.235$ ), while Asperger's disorder had significantly fewer pregnancy complications than the other three diagnostic categories as a group ( $z=1.849$ ,  $p=.0323$ ,  $C=.197$ ). Asperger's disorder complicated by other neuropsychiatric illness had significantly more medical problems than did Asperger's disorder ( $z=1.818$ ,  $p=.0345$ ,  $C=.223$ ) and the other three diagnostic categories as a group ( $z=1.748$ ,  $p=.0402$ ,  $C=.186$ ). Asperger's disorder was more likely to have a family history of neuropsychiatric illness than was Asperger's disorder complicated by other neuropsychiatric illness ( $z=1.898$ ,  $p=.0288$ ,  $C=.233$ ) and the other three diagnostic categories as a group ( $z=1.959$ ,  $p=.0251$ ,  $C=.226$ ). As a pattern, Asperger's disorder complicated by other neuropsychiatric illness compared to the other diagnostic categories seemed to be associated with more pregnancy and medical complications but less family history of neuropsychiatric illness (*Figure 3*).

A broadly similar pattern was found for family history with respect to Kanner-type autism. Kanner-type autism complicated by other neuropsychiatric illness had significantly fewer relatives with an ASD ( $z=1.646$ ,  $p=.0499$ ,  $C=.176$ ) and was significantly less likely to have a family history of neuropsychiatric illness ( $z=2.139$ ,  $p=.0162$ ,  $C=.226$ ) than the other three diagnostic categories as a group and Kanner-type autism ( $z=2.117$ ,  $p=.0172$ ,  $C=.411$ ) (*Figure 3*).

Differences in paternal age, maternal age, season of birth, and birth order between diagnostic groups (Asperger's disorder, Kanner-type autism, Asperger's disorder complicated by neuropsychiatric illness, and Kanner-type autism complicated by neuropsychiatric illness) were compared using Chi Square (or Fisher's Exact Tests when Chi Square was not feasible). Of the 36 calculations, three showed significant results, showing again few differences between the diagnostic groups. Kanner-type autism complicated by other neuropsychiatric conditions, however, had significantly younger fathers at the time of birth than the other three diagnostic categories as a group ( $p=.0462$ ,  $C=.306$ ). Kanner-type autism had significantly younger mothers than the other three diagnostic categories as a group

( $p=.0301$ ;  $C=.428$ ). The total Asperger's disorder group were more likely to have an earlier birth order than the total Kanner-type autism group ( $p=.0049$ ,  $C=.372$ ). There were no differences in season of birth between the four diagnostic groups.

## Discussion

This study compared Asperger's disorder, Asperger's disorder complicated by neuropsychiatric illness, Kanner-type autism, and Kanner-type autism complicated by neuropsychiatric illness in terms of clinical and demographic characteristics in a sample taken from a North American clinic specializing in the treatment of autism-spectrum disorders. In this sample, the majority of subjects had parents or caregivers from the middle and upper-middle socioeconomic levels and were of normal intelligence, restricting our sample primarily to subjects of normal intellectual ability. In general, few significant differences were found between diagnostic categories. Consistent with previous reports (Countryman, 2008), males predominated in our sample. However, there were no differences in the proportion of males in any of the four diagnostic groups.

A main finding in this study was the high prevalence of comorbidity. More than half of the subjects with Kanner-type autism and Asperger's disorder had other neuropsychiatric conditions. The high rate of comorbidity suggests a need for clinicians, parents, and teachers to be on the alert for factors in addition to those commonly associated with Asperger's disorder and autism. The finding of an increased use of medication by the group with Asperger's disorder complicated by other neuropsychiatric conditions shows that the added neuropsychiatric load tends to require increased clinical intervention, even though the exact reasons for the increased use of medication in this group are not clear. Future work might address the reasons that people with Asperger's disorder complicated by other neuropsychiatric comorbidity tend to be treated with more medication than the other three diagnostic categories as a group.

Despite the overall lack of differences between the diagnostic groups, there were several areas of significant difference. Allergies were more prevalent in Asperger's disorder complicated by other

neuropsychiatric diagnoses than in Asperger's disorder. Should the difference in allergies between Asperger's disorder and Asperger's disorder complicated by other neuropsychiatric conditions be verified in additional studies, it may imply different risk factors for or different developmental paths for Asperger's disorder compared to Asperger's disorder complicated by other neuropsychiatric conditions.

Although Niehus & Lord (2006) found a non-significant trend for more gastrointestinal problems in children with ASDs, we did not find evidence of any differences in the percentage of people with gastrointestinal problems between the four diagnostic groups. Similarly, the four diagnostic groups did not differ with respect to a history of regression, birth complications, or prematurity.

In contrast to birth complications and prematurity, the percentage of pregnancy complications did differ between the four diagnostic groups in that Asperger's disorder had more pregnancy complications than Asperger's disorder and the other three categories as a group. In addition, Asperger's disorder complicated by other neuropsychiatric conditions had more medical problems than the other three diagnostic categories as a group.

In terms of family history of other neuropsychiatric conditions and a family history of ASDs, the Kanner-type autism group that was complicated by comorbid neuropsychiatric disorders had a significantly lower rate of family histories of ASDs than the other three diagnostic categories as a group. Furthermore, the Kanner-type autism group complicated by neuropsychiatric comorbidity also differed from Kanner-type autism by being significantly less likely to have a family history of neuropsychiatric conditions. Likewise, Asperger's disorder complicated by other neuropsychiatric conditions was less likely than Asperger's disorder to have a family history of neuropsychiatric conditions.

Together, the overall findings of a comparatively low family-history loading and high rate of medical and pregnancy complications in the Asperger's disorder with neuropsychiatric complications and to some extent with the autism group complicated by neuropsychiatric comorbidity compared to the uncomplicated Asperger's disorder

and autism groups suggest a possibly greater role for brain injury from adverse gestational and medical events in neuropsychiatrically complicated cases of Asperger's disorder and autism than in cases without such complications. Alternatively, the same factors that lead to neuropsychiatrically complicated cases of Asperger's disorder and autism may also result in gestational and medical problems. If the medical and gestational events do lead at least in part to neuropsychiatrically complicated cases of Asperger's disorder and autism, obstetrical and pediatric care may carry preventive implications.

While both advanced paternal age (Reichenberg et al., 2006) and maternal age (Glasson et al., 2004) have been associated with Kanner-type autism, we found few differences between groups for either paternal or maternal age. Autism complicated by other neuropsychiatric disorders had younger fathers than the other three diagnostic categories as a group, and autism had young mothers than the other three categories as a group. Otherwise, there was little difference in parental age between group, indicating that parental age may not be strong a factor in determining the diagnostic course of an ASD. Similarly, Kanner-type autism is often associated with being firstborn (Glasson et al., 2004). In our sample, we found that the group composed of both autism subgroups were less likely to be first born than the combined Asperger's group. We found no evidence that season of birth differed significantly between our four groupings. Several limitations require consideration in the interpretation of our findings. While there were 85 subjects in the study, several of the subgroups were quite small. For example, the non-comorbid, Kanner-type autism group had only nine subjects. This small sample size makes the study's conclusions highly sensitive to additional data and argues that at best our findings should be considered tentative. Another limitation of the study was the use of patient and parent reports about medical, obstetrical, and regression history, parental age, family history, and socioeconomic status. In addition, the study relied on a variety of measures of intellectual function instead of re-testing subjects on the same measure, a practice that introduces the possibility for imprecise estimates of subjects' intellectual abilities. Additionally, there was no healthy control group for comparison in the study; instead the focus was on differences between the four clinical groupings in an attempt to identify demographic and clinical characteristics that distinguish

between Asperger's disorder, Kanner-type autism, Asperger's disorder complicated by neuropsychiatric comorbidity, and Kanner-type autism complicated by neuropsychiatric comorbidity. Nonetheless, a healthy control group would have enabled a clearer focus on those factors that distinguish ASDs as a group from healthy controls.

In conclusion, this retrospective, chart-review study found high rates of neuropsychiatric comorbidity in children, adolescents, and young adults presenting with ASDs, but differences in only a relatively few factors distinguished between Asperger's disorder, Kanner-type autism, Asperger's disorder complicated by other neuropsychiatric comorbidity, and Kanner-type autism complicated by other neuropsychiatric comorbidity. However, allergies, pregnancy complications, family history, maternal and paternal age, birth order, and medical problems may distinguish between groups, suggesting that risk factors among the four diagnostic groups may vary. Asperger's disorder was accompanied by other neuropsychiatric illness was more likely to be associated with pregnancy and medical complications and less likely to have a family history of autism-spectrum disorders and neuropsychiatric illness than were cases of uncomplicated Asperger's disorder and Kanner-type autism. Kanner-type autism complicated by other neuropsychiatric disorders was less likely to have a family history of neuropsychiatric disorders than Kanner-type autism, implying again that differences in etiology may differ among the four diagnostic groups. A small sample size and reliance upon self-reports necessitates replication of our findings in a larger, more diversified sample.

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