A Comparison of *DSM-IV* Pervasive Developmental Disorder and *DSM-5* Autism Spectrum Disorder Prevalence in an Epidemiologic Sample

Young Shin Kim, MD, MS, MPH, PhD, Eric Fombonne, MD, Yun-Joo Koh, PhD, Soo-Jeong Kim, MD, Keun-Ah Cheon, MD, PhD, Bennett L. Leventhal, MD

Objective: Changes in autism diagnostic criteria found in *DSM-5* may affect autism spectrum disorder (ASD) prevalence, research findings, diagnostic processes, and eligibility for clinical and other services. Using our published, total-population Korean prevalence data, we compute *DSM-5* ASD and social communication disorder (SCD) prevalence and compare them with *DSM-IV* pervasive developmental disorder (PDD) prevalence estimates. We also describe individuals previously diagnosed with *DSM-IV* PDD when diagnoses change with *DSM-5* criteria. **Method:** The target population was all children from 7 to 12 years of age in a South Korean community (N = 55,266), those in regular and special education schools, and a disability registry. We used the Autism Spectrum Screening Questionnaire for systematic, multi-informant screening. Parents of screen-positive children were offered comprehensive assessments using standardized diagnostic procedures, including the Autism Diagnostic Interview–Revised and Autism Diagnostic Observation Schedule. Best-estimate clinical diagnoses were made using *DSM-IV* PDD and *DSM-5* ASD and SCD criteria. **Results:** *DSM-5* ASD estimated prevalence was 2.20% (95% confidence interval = 1.77–3.64). Combined *DSM-5* ASD and SCD prevalence was virtually the same as *DSM-IV* PDD prevalence (2.64%). Most children with autistic disorder (99%), Asperger disorder (92%), and PDD-NOS (63%) met *DSM-5* ASD criteria, whereas 1%, 8%, and 32%, respectively, met SCD criteria. All remaining children (2%) had other psychopathology, principally attention-deficit/hyperactivity disorder and anxiety disorder. **Conclusion:** Our findings suggest that most individuals with a prior *DSM-IV* PDD meet *DSM-5* diagnostic criteria for ASD and SCD. PDD, ASD or SCD; extant diagnostic criteria identify a large, clinically meaningful group of individuals and families who require evidence-based services. J. Am. Acad. Child Adolesc. Psychiatry, 2014;53(5):500–508. **Key Words:** ASD, SCD, *DSM-IV*, *DSM-5*, prevalence

Studies of autism spectrum disorders (ASD), conducted since 1985, have reported progressively higher prevalence, with estimates ranging from 0.07% to 2.64%.[1-4] Evidence suggests that most prevalence changes are attributable to a combination of: greater public awareness, better case ascertainment, lower age at diagnosis, diagnostic substitution, and changes in the diagnostic constructs and corresponding diagnostic criteria.[3]

In the American Psychiatric Association's *Diagnostic and Statistical Manual for Mental Disorders, 5th Edition* (*DSM-5*), released in May 2013,[5] changes include major alterations in criteria for developmental disorders, in particular, the *DSM-IV* diagnostic criteria for pervasive developmental disorder (PDD). These changes include the following: elimination of PDD and the 5

This article is discussed in an editorial by Dr. Bryan H. King on page 494.

Clinical guidance is available at the end of this article.

An interview with the author is available by podcast at www.jaacap.org or by scanning the QR code to the right.

subtypes found in *DSM-IV*; creation of a new diagnostic category of ASD that is adapted to the individual's clinical presentation by inclusion of clinical specifiers and associated features; changing from the *DSM-IV* PDD 3-domain criteria that included social reciprocity, communication, and restricted and repetitive behaviors (RRB) to 2 *DSM-5* ASD domain criteria composed of social communication/interaction and RRB; for *DSM-5*, inclusion of sensory symptoms in the RRB component of diagnostic criteria; and, for *DSM-5*, changing the specification of the age of onset from "age 3" to "early childhood." In addition, *DSM-5* adds a new diagnostic category, "social communication disorder (SCD)." SCD appears to include individuals who primarily have problems with the pragmatic aspects of social communication. According to *DSM-5*, individuals with SCD have difficulties similar to those with ASD, but these problems are restricted solely to the realm of social communication and do not include the *DSM-5* RRB criteria found in ASD.[6]

Apparent differences between *DSM-IV* PDD and *DSM-5* ASD criteria have led to debates, in both the scientific and lay communities, over whether these changes in diagnostic criteria will materially affect ASD prevalence, alter the way in which individuals will be diagnosed with ASD, and, possibly, affect the eligibility of individuals for clinical and other services. Such debates are creating controversy amongst professionals, as well as confusion and anxiety for service providers, policy makers, and, most importantly, for patients and their families.[7]

A number of investigators have attempted to address these important concerns by examining the reliability of the *DSM-5* ASD criteria (with its sensitivity and specificity) against *DSM-IV* ASD criteria, primarily using clinic-based samples of individuals with ASD. Results of these studies include sensitivity ranging from 46% to 96% and specificity from 53% to 100% (some were based on different versions of draft *DSM-5* criteria[8-13]). These studies appear to indicate that the *DSM-5* ASD criteria have reasonable sensitivity and specificity against *DSM-IV* criteria. Nonetheless, there has been considerable debate, concern, and speculation with respect to how many individuals with *DSM-IV* PDD diagnoses will "lose diagnoses" with the advent of *DSM-5*.

To answer these questions, in this article we will directly compare *DSM-IV*–based and *DSM-5*–based ASD prevalence estimates while also determining which individuals, if any, classified as *DSM-IV* PDD will not meet *DSM-5* ASD diagnostic criteria. We will use rigorous epidemiologic methods with a total population approach that includes both clinical and non-clinical populations of individuals with ASD, and systematic standardized screening and diagnostic assessment. Using our total-population prevalence data from a recently completed and published study from a Korean cohort,[4] we will do the following:

- Compute the *DSM-5*–based ASD and SCD prevalence estimates among children 7 to 12 years of age
- Compare *DSM-5* ASD and SCD prevalence estimates with *DSM-IV* PDD prevalence estimates
- Describe demographic, ASD-related clinical and other associated characteristics of those individuals with *DSM-IV* PDD diagnoses who were classified with ASD or SCD in *DSM-5* versus those individuals with *DSM-IV* PDD who no longer fell into either of these *DSM-5* categories.

METHOD

Study Subjects

The target population (N =55,266) included all children born from 1993 to 1999 (7–12 years of age at screening) in a suburb of Seoul, South Korea. Total population screening was conducted with both the Parents' and Teachers' Autism Spectrum Screening Questionnaire (ASSQ), using the mandatory elementary education system and Disability Registry (DR). This total population approach allowed us to include and examine children with ASD who have used service systems, including health care and educational services (a clinical ASD population whom we labeled the "high probability group" [HPG]), as well as those children with ASD who never received any services (a non-clinical sample with ASD whom we labeled the "general population sample" [GPS]).

Children were considered to be screen positive with Teacher-ASSQ scores ≥10 and/or Parent-ASSQ scores in the top 2nd percentile. Additional screen-positive individuals came from a random sample of 50% of children in the 3rd percentile, and 33% of students in the 4th and 5th percentiles of Parent-ASSQ scores for children in regular education schools. All children in the DR and attending special education schools with diagnoses of ASD/intellectual disability (ID) were considered screen positive. Screen-positive children were evaluated using standardized diagnostic assessments, as follows: the Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview–Revised (ADI-R), cognitive tests (Korean Wechsler Intelligence Scale for Children–III and Leiter

International Performance Scale–Revised), and Behavioral Assessment System for Children II–Parent Report Scale (BASC II-PRS) validated in Korean children. Final best estimate clinical diagnoses were made using all systematically obtained, relevant data based on *DSM-IV* PDD diagnostic criteria. Each diagnostic team included 1 board-certified Korean child psychiatrist, trained both in Korea and the United States, plus a second board-certified child psychiatrist or child psychologist (team 1: Drs. Y.S. Kim and Cheon; team 2: Drs. Koh and S.-J. Kim). Disagreements were resolved by reaching consensus between diagnosing clinicians. There was 98% agreement among Korean diagnosticians and 100% agreement among North American senior investigators (Drs. Fombonne and Leventhal). The 2% initially discordant diagnoses were resolved in discussions among all investigators. Detailed case identification processes, validity, and reliability of best estimate diagnoses are described in our 2011 publication.[4]

Using this identical study population, case identification, confirmative diagnosis, and statistical methods, we re-evaluated all of the screen-positive individuals who completed confirmative diagnostic assessment from our original study to establish diagnoses for *DSM-IV* PDD subtypes, *DSM-5* ASD, and *DSM-5* SCD, and to compute *DSM-5*–based ASD and SCD prevalence estimates. Of 292 cases, 60 (21%) were randomly chosen to examine diagnostic reliability for *DSM-5* ASD and SCD criteria, for which each Korean team reached consensus diagnoses in all cases.

In addition to the reassessment of diagnoses for all cases, we divided the children who were ASSQ screen positive and completed diagnostic assessment in 3 groups, according to the level of agreement between *DSM-IV* PDD and *DSM-5* ASD diagnostic criteria:

- Divergent (D): children with a *DSM-IV* PDD diagnosis who did not have a *DSM-5* ASD diagnosis; (*DSM-IV* PDD[+]/*DSM-5* ASD[−]; discrepant cases of *DSM-IV* PDD[−]/*DSM-5* ASD[+] were absent and therefore not included in the analyses). Divergent cases were further divided into 2 groups according to the new diagnoses received, including D-SCD (those with final diagnoses of SCD with/without comorbid psychiatric disorders) and D-other (those with final diagnoses of other psychiatric disorders).
- ASD Convergent: children who met both *DSM-IV* PDD criteria and *DSM-5* ASD criteria (*DSM-IV* PDD [+]/*DSM-5*ASD[+])
- No ASD Convergent: children who did not meet either *DSM-IV* PDD or *DSM-5* ASD criteria after completion of the full assessment (*DSM-IV* PDD [−]/*DSM-5* ASD [−]).

Data Analyses

The denominator used to compute ASD prevalence was the entire target population (N = 55,266) to reflect variance arising from non-participants.[4] Prevalence estimates by sex and ASD subtypes in the total population, as well as in the HPG and GPS, were computed using the SAS 9.1 Proc Frequency procedure (SAS Institute, Cary, NC).[4] Several strategies were used to adjust for missing data from screen-positive non-participants. Detailed methods to adjust for missing data and compute prevalence estimates are described in our 2011 publication.[4]

We used χ^2 statistics and analysis of variance (ANOVA) with Scheffé post hoc analyses to compare demographic, ASD-related clinical and other associated characteristics of these 3 groups. A detailed description of the participants is provided in our 2011 publication.[4]

RESULTS

Of 55,266 children 7 to 12 years of age, 36,886 children attended 33 participating elementary schools (from total 43 schools) and/or were enrolled in a DR. Parents of 23,337 children returned ASSQs (63% response). Of the 1,214 sampled screen-positive students, 869 (72%) parents consented to participate in the diagnostic stage (70% male), and 292 (34%) completed diagnostic assessment.

Prevalence Estimates of *DSM-IV* PDD

Using *DSM-IV* criteria, we previously reported an estimated PDD prevalence of 2.64% (95% CI = 1.91–3.37%) in a total population. We also found that the estimated *DSM-IV* PDD prevalence was 1.89% (1.43–2.36%) in the GPS and, total population prevalence estimate of ASD drawn from the HPG was 0.75% (0.58–0.93%), with a much higher proportion of children with ASD in the HPG. Total male and female *DSM-IV* PDD prevalence were 3.74% (2.57–4.90%) and 1.47% (0.60–2.37%), respectively, indicating a sex ratio of 2.5:1. In addition, we further classified *DSM-IV* PDD by subtypes and computed prevalence estimates for autistic disorder, Asperger disorder, and PDD-NOS, which were 1.04% (0.79–1.30%), 0.60% (0.33–0.87%), and 1.00% (0.66–1.34%), respectively (Table 1).

Prevalence Estimates of *DSM-5* ASD

The estimated total population prevalence of *DSM-5* ASD was 2.20% (1.77–2.64%). This is clearly different from the *DSM-IV* PDD-estimated total population prevalence of 2.64%. However, examination of these data suggests that the entirety of this difference comes from those individuals found in the generally higher-functioning, lower service use, GPS sample; that

TABLE 1 Prevalence Estimates:[a] *DSM-IV* Pervasive Developmental Disorder (PDD), *DSM-5* Autism Spectrum Disorder (ASD), and *DSM-5* Social Communication Disorder (SCD)

	DSM-IV PDD % (95% CI)	*DSM-5* ASD % (95% CI)	*DSM-5* SCD % (95% CI)	*DSM-5* ASD+SCD % (95% CI)
Population				
Total	2.64 (1.91-3.37)	2.20 (1.77-2.64)	0.49 (0.21-0.77)	2.70 (2.18-3.21)
GPS	1.89 (1.43-2.36)	1.46 (1.06-1.85)	0.49 (0.21-0.77)	1.95 (1.46-2.43)
HPG	0.75 (0.58-0.93)	0.75 (0.57-0.92)	0.00	0.75 (0.57-0.92)
DSM-IV PDD Subtypes				
Autistic Disorder	1.04 (0.79-1.30)	1.03 (0.78-1.29)	0.01 (0.00-0.03)	1.04 (0.79-1.30)
Asperger	0.60 (0.33-0.87)	0.55 (0.29-0.80)	0.05 (0.00-0.13)	0.59 (0.33-0.86)
PDD-NOS	1.00 (0.66-1.34)	0.63 (0.38-0.87)	0.32 (0.09-0.54)	0.94 (0.61-1.28)
Sex				
Male	3.74 (2.57-4.90)	3.16 (2.47-3.85)	0.56 (0.17-0.95)	3.71 (2.92-4.51)
Female	1.47 (0.60-2.37)	1.17 (0.62-1.72)	0.42 (0.02-0.81)	1.58 (0.90-2.26)

Note: GPS = general population sample; HPG = high-probability group; NOS = not otherwise specified.
[a]*From a representative total population of Korean school-aged children.*

is, the GPS *DSM-IV* PDD prevalence was 1.89% versus the GPS *DSM-5* ASD prevalence of 1.46% (1.06–1.85%). Furthermore, this conclusion is supported by analyses indicating that the estimated prevalence of *DSM-5* HPG ASD, 0.75% (0.58–0.93%), is virtually identical to the *DSM-IV* PDD prevalence in that same HPG population: 0.75% (0.57–0.92%).

Changes From *DSM-IV* PDD Diagnoses When *DSM-5* ASD Criteria Are Applied

This can be further divided into 3 important questions:

- What happens to the children with *DSM-IV* Autistic Disorder (n = 114) when *DSM-5* criteria are applied?
  Answer: 99% (n = 112) have *DSM-5* ASD; 1% (n = 2) have SCD.
- What happens to the children with *DSM-IV* Asperger disorder (n = 34) when *DSM-5* criteria are applied?
  Answer: 91% (n = 31) have *DSM-5* ASD; 6% (n = 2) have SCD; 3% (n = 1) have another psychiatric disorder.
- Finally, what happens to the children with *DSM-IV* PDD-NOS (n = 58) when *DSM-5* criteria are applied?
  Answer: 71% (n = 41) have *DSM-5* ASD; 22% (n = 13) have SCD; 7% (n = 4) have other, non-ASD or non-SCD disorders

DSM-5 male and female ASD prevalence estimates are 3.16% (2.47–3.85%) and 1.17% (0.62–1.72%), respectively, indicating a sex ratio of 2.7:1.

Prevalence Estimates of SCD

We computed the estimated prevalence for SCD as 0.49% (0.21–0.77%). SCD cases were identified only in the GPS (0.49%); that is, there were no SCD cases coming from the HPG group. Indeed, the largest proportion of children with *DSM-5* SCD was from those previously diagnosed with *DSM-IV* PDD-NOS (0.32% [0.09–0.54%]); very few of these children had been previously diagnosed with *DSM-IV* Asperger disorder (0.05% [9.00–0.13%]). Furthermore, male and female prevalence estimates for SCD were 0.56% (0.17–0.95%) and 0.42% (0.02–0.81%), respectively, with a sex ratio of 1.3:1.

Because *DSM-5* ASD and SCD together seem to almost completely overlap with *DSM-IV* PDD, we attempted to examine how many children actually met criteria for a disorder characterized by clinically significant difficulties with social reciprocity. To do this, we combined the data for *DSM-5* ASD and SCD to calculate the combined prevalence estimate. Using this strategy, it appears that the prevalence estimate for the *DSM-IV* PDD is almost identical to that of the combined *DSM-5* ASD + SCD (2.7%) for every category, including the total population, as well as the GPS, HPG, ASD subtypes, and sex (Table 1).

Characteristics of Convergent/Divergent Cases of *DSM-IV* PDD and *DSM-5* ASD Diagnoses

Finally, we examined the characteristics of those children whose diagnoses found convergence between *DSM-IV* and *DSM-5* and those whose diagnoses were divergent. Of 292 confirmative diagnostic assessment completers, 270 (92%) had

convergent diagnoses by *DSM-IV* PDD and *DSM-5* ASD criteria. That is, of these 292 screen-positive children, 63% (n = 184) eventually had both *DSM-IV* PDD and *DSM-5* ASD, thus indicating convergence between *DSM-IV* and *DSM-5*; another 29% (n = 86) did not have either a final *DSM-IV* PDD or *DSM-5* ASD diagnosis, meaning that they were also convergent but, in this instance, for no diagnosis.

However, there were 22 cases (8%) for which the *DSM-IV* PDD and *DSM-5* ASD diagnoses were divergent; that is, the *DSM-IV* PDD and the *DSM-5* ASD diagnoses did not overlap. Based on this, one can conclude that 92% of individuals received similar diagnoses when both *DSM-IV* and *DSM-5* criteria were applied. For the divergent cases, even though the PDD/ASD diagnoses did not overlap, all children still had a diagnosis of some form of developmental psychopathology. Of these 22 divergent cases, 17 (77%) moved from autistic disorder (n = 2), Asperger disorder (n = 2), and PDD-NOS (n = 13) to *DSM-5* SCD. In fact, all of the divergent *DSM-IV* autistic disorder cases moved to SCD, as did most of the Asperger and PDD-NOS cases. Ultimately, there were 5 case individuals who had a *DSM-IV* PDD diagnosis but did not meet criteria for either *DSM-5* ASD or SCD. One was a child with *DSM-IV* Asperger disorder who met criteria for attention-deficit/hyperactivity disorder (ADHD), as did 1 child with *DSM-IV* PDD-NOS. All of the remaining divergent PDD-NOS cases (n = 3) met criteria for anxiety disorder. There were no age differences among the 3 groups; however, more boys were present in the ASD-convergent group, compared to the divergent group and the screen-positive children who ultimately were in the "no ASD" (nASD)-convergent groups (Table 2).

Significant differences in several aspects of ASD-related clinical characteristics emerged among the 3 groups (Table 3):

- ASSQ mean scores differed only between the no ASD–convergent and the ASD-convergent groups, with significantly higher scores in the ASD-convergent group.
- SRS total and subscale scores, except the motivation subscale in the ASD-convergent group, were significantly higher than those in the remaining 2 groups.
- When ADI-R and ADOS algorithm scores were examined, social reciprocity differed from each other on both the ADOS and ADI-R, with higher levels of impairment in the ASD-convergent group followed by the ASD-divergent group and then the no ASD–convergent group.
- In contrast, the ADI-R communication scores were significantly higher only in the ASD-convergent group when compared to the other 2 groups.
- ADOS communication scores differed in all 3 groups, with the most impairment in the ASD-convergent group followed by the ASD-divergent group and then the no ASD–convergent group.
- In addition, stereotypy scores were significantly higher only in the ASD-convergent group when compared to the other 2 groups, using both the ADOS and ADI-R.

TABLE 2 Demographic Characteristics of *DSM-IV* Pervasive Developmental Disorder (PDD) – *DSM-5* Autism Spectrum Disorder (ASD) Convergent (C)/Divergent (D) Cases (N = 292)

	Divergent Group	Convergent Group		
	DIV[a] (n = 22)	C-nASD[b] (n = 86)	C-ASD[c] (n = 184)	*p*
Other diagnoses, n (%)				
SCD	14 (64)	2 (2)	0 (0)	
SCD and other psychiatric disorders	3 (14)	1 (1)	0 (0)	
Other psychiatric disorders	5 (22)	54 (63)	39 (21)	
No diagnoses	0 (0)	29 (34)	145 (79)	
Sex, n (%)[d]				
Male	14 (64)	54 (63)	145 (79)	
Female	8 (36)	32 (37)[c]	39 (21)[b]	.013
Age, y, mean ± SD[e]	10.6 ± 1.7	10.1 ± 1.8	10.1 ± 1.7	.494

Note: C-ASD = convergent for ASD (PDD[+]/ASD[+]); C-nASD = convergent for no ASD (PDD[−]/ASD[−]); DIV = divergent for DSM-IV PDD and DSM-5 ASD (PDD[+]/ASD[−]); SCD = social communication disorder.

[a,b,c] *Significant group differences.*

[d] *The χ^2 test (2 df) was used to examine sex differences.*

[e] *Analysis of variance (ANOVA) with Scheffé post hoc analyses was used to examine age differences among DIS, A-nASD, and A-ASD groups.*

TABLE 3 Autism Spectrum Disorder (ASD)–Related Clinical Characteristics of *DSM-IV* Pervasive Developmental Disorder (PDD)–*DSM-5* ASD Convergent (C)/Divergent (D) Cases (N = 292)

	Convergent Group (n = 274)		Divergent Group (n = 22)	
	C-nASD[a] (n = 86)	C-ASD[b] (n = 188)	D-SCD[c] (n = 17)	D-Other[d] (n = 5)
Intellectual deficit***	6 (7%)	58 (32%)	2 (11.8%)	0 (0.0%)
Performance IQ,*** mean ± SD	99 ± 18[b]	86 ± 27[a]	100 ± 17	97 ± 15
ASSQ parents,** mean (min, max)	20 (2, 46)[b]	27 (0, 54)[a]	21 (14, 28)	20 (6, 33)
ADI-R algorithm scores, mean ± SD				
Social reciprocity***	5.2 ± 4.0[b,c]	17.8 ± 7.5[a,c]	12.3 ± 6.5[a,b]	10.0 ± 7.0
Communication***	6.3 ± 3.7[b]	13.8 ± 4.9[a,c,d]	9.2 ± 3.8[b]	8.0 ± 4.7[b]
Stereotypies***	2.0 ± 1.5[b]	4.8 ± 2.5[a,c]	2.1 ± 2.3[b]	2.2 ± 0.8
Onset <36 months[d]***	30 (35.3%)	154 (84.6%)	4 (76.5%)	1 (40.4%)
ADOS algorithm scores, mean ± SD				
Social reciprocity***	2.8 ± 2.5[b,c,d]	8.7 ± 2.8[a]	7.1 ± 3.0[a]	6.6 ± 1.5[a]
Communication***	1.5 ± 1.2[b,c]	4.1 ± 2.1[a]	3.0 ± 2.0[a]	2.8 ± 1.6
Stereotypies***	0.7 ± 0.8[b]	1.9 ± 1.6[a,c]	0.7 ± 0.9[b]	0.2 ± 0.4
Imagination***	0.5 ± 0.6[b]	1.3 ± 1.0[a]	0.7 ± 0.8	1.0 ± 0.7

Note: ASSQ = Autism Spectrum Screening Questionnaire; ADI-R = Autism Diagnostic Interview–Revised; ADOS = Autism Diagnostic Observation Schedule; C-ASD = convergent for ASD (PDD[+]/ASD[+]); C-nASD = convergent for no ASD (PDD[−]/ASD[−]); D-social communication disorder (SCD) = divergent for DSM-IV PDD and DSM-5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM-5 SCD Diagnosis; D-other = divergent for DSM-IV PDD and DSM-5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM-5 other psychiatric disorders; max = maximum; min = minimum.

All other statistical tests were performed with analysis of variance with Scheffé post hoc analyses to examine differences in ASD-related clinical characteristics among C-nASD, C-ASD, D-SCD, and D-other groups.

*[a,b,c] Significant group differences by statistical tests (**p < .005; ***p < .001).*

[d] χ^2 test (2 df).

- Onset of symptoms differed among the 3 groups, with the earliest onset occurring in the ASD-convergent group, followed by ASD-divergent group and the no ASD–convergent group.
- Differences in imagination on the ADOS were observed only between the ASD-convergent and no ASD–convergent groups.

Table 4 summarizes the BASC II-PRS mean T scores of 9 clinical subscales, externalizing and internalizing subscales, and 5 adaptive composite scores in the 3 groups. Of the clinical subscales, the anxiety score for the divergent group was significantly higher compared to that of the ASD-convergent group; however, there were no differences between the remaining groups. The withdrawal score was significantly higher in the ASD-convergent group when compared to the no ASD–convergent group; however, no differences were noted between the remaining groups. Likewise, on the BASC adaptive scales, social skills, leadership, and communication scores were significantly lower in the ASD convergent group when compared to the no ASD–convergent group.

Among the 17 discordant case individuals who moved from *DSM-IV* PDD to SCD, the reason appears to be primarily related to a relatively low level of RRBs. For the 5 discordant case individuals who had other forms of psychopathology, based on maternal reports, all had social and behavioral disruptions that appear to be associated with ADHD or anxiety disorder (Tables 3 and 4).

DISCUSSION

Findings from this study show that the new *DSM-5* ASD criteria yield changes in estimated prevalence previously established using the *DSM-IV* PDD criteria. These changes include an approximate 17% decrease in the ASD prevalence from the prior *DSM-IV* PDD prevalence estimate of 2.64% to a *DSM-5* ASD prevalence of 2.20%. These findings are not surprising. When one examines the new *DSM-5* criteria, it can be expected that some individuals without relatively high levels of the designated "core" ASD symptoms (social reciprocity and RRB) will move to 1 of 2 categories: no diagnosis or SCD. Furthermore, it might have been reasonable to expect that those at greatest risk for such shifting are those individuals primarily with significant language deficits, high overall levels of functioning, low levels to no RRB, and who barely meet *DSM-IV* PDD-NOS criteria.

In fact, the *DSM-5* ASD criteria appear to offer meaningful clarifications relative to the previous diagnostic criteria, because almost all individuals with *DSM-IV* autistic disorder (98%) and Asperger disorder (92%) met *DSM-5* ASD diagnostic criteria.

TABLE 4 Characteristics of Other Clinical Features in *DSM-IV* Pervasive Developmental Disorder (PDD) − DSM5 Autism Spectrum Disorder (ASD) Convergent (C)/Divergent (D) Cases (N = 292)[e]

	Convergent Group (n = 134)		Divergent Group (n = 8)	
	C-nASD[a] (n = 49)	C-ASD[b] (n = 85)	D-SCD[c] (n = 7)	D-Other[d] (n = 1)
BASC Clinical Scale, mean ± SD				
Hyperactivity	67.3 ± 13.8	63.4 ± 15.9	59.7 ± 15.4	84.7
Aggression	64.9 ± 17.2	58.4 ± 14.4	65.9 ± 11.3	88.3
Conduct	62.8 ± 15.4	58.4 ± 14.1	60.1 ± 12.6	75.4
Anxiety*	57.3 ± 11.6	55.7 ± 12.3[c]	68.0 ± 19.3[b]	74.1
Depression	65.4 ± 15.2	64.7 ± 13.7	73.2 ± 12.2	69.8
Somatization	60.4 ± 15.0	54.3 ± 14.7	55.0 ± 10.3	66.5
Atypicality	71.2 ± 17.8	75.4 ± 20.0	69.5 ± 12.2	65.7
Withdrawal**	60.2 ± 14.5[b]	70.2 ± 16.7[a]	69.1 ± 22.2	67.3
Attention	62.7 ± 11.2	62.0 ± 11.0	58.1 ± 13.5	62.1
Externalizing	67.1 ± 15.6	61.5 ± 15.0	63.5 ± 10.5	87.3
Internalizing	62.6 ± 13.8	59.3 ± 13.5	68.2 ± 11.2	73.6
BASC Adaptive Scale, mean ± SD				
Adaptability	44.9 ± 10.0	41.0 ± 10.5	42.2 ± 15.5	26.3
Social Skill*	46.7 ± 10.3[b]	41.5 ± 10.8[a]	47.4 ± 10.9	39.9
Leadership**	46.2 ± 10.5[b]	39.7 ± 10.3[a]	42.6 ± 7.3	46.2
Activity of Daily Living	38.1 ± 10.6	38.2 ± 11.9	44.1 ± 10.7	44.5
Communication*	42.4 ± 11.7[b]	35.1 ± 13.9[a]	39.4 ± 13.5	44.3
BASC Composite Scale, mean ± SD				
Behavioral Symptom Index	67.1 ± 14.9	68.3 ± 14.4	68.2 ± 7.1	77.9
Adaptive skills*	51.4 ± 11.5[b]	45.6 ± 11.8[a]	51.5 ± 11.9	48.1

Note: BASC = Behavioral Assessment Scale for Children; C-ASD = convergent for ASD (PDD[+]/ASD[+]); C-nASD = convergent for no ASD (PDD[−]/ASD[−]); D-other: divergent for DSM-IV PDD and DSM-5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM-5 category other psychiatric disorders; D-social communication disorder (SCD) = divergent for DSM-IV PDD and DSM-5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM-5 SCD diagnosis.

*[a,b,c,d]Significant group differences (*p < .05; **p < .005).*

[e]Analysis of variance with Scheffé post hoc analyses was performed to examine differences in associated clinical features between D-SCD, A-nASD and A-ASD groups (the D-other group was excluded from post hoc analyses because it had only 1 group member).

The majority of individuals (71%) with a *DSM-IV* PDD-NOS diagnosis have *DSM-5* ASD, but a significant number (~29%) change. Such diagnostic changes occur exclusively among those individuals with a PDD-NOS diagnosis who were identified among the GPS, a group characterized by milder ASD symptoms, average intelligence, and less functional impairment.[4] In addition, these changes occurred evenly between boys and girls.

When reviewing profiles of the 22 case individuals with diagnostic shifts, we found that even though they were divergent on the basis of *DSM-IV* PDD and *DSM-5* ASD diagnoses, all of these children still had a diagnosis of some form of developmental psychopathology. In fact, all of the divergent *DSM-IV* autistic disorder case subjects moved to SCD, as did most of the Asperger disorder and PDD-NOS case subjects (76%).

Among the 17 divergent case individuals who moved from *DSM-IV* PDD to SCD, the reason was primarily related to a relatively low level of RRBs, as seen in the ADOS and ADI-R stereotypy scores (Table 3). The remaining 5 divergent case subjects had other forms of psychopathology, and also had lower SRS scores, higher BASC anxiety scores, and higher ADOS scores for overactivity and anxiety codes. Otherwise, they appeared similar to the other divergent case subjects with respect to demographics, cognitive level, ADOS and ADI-R algorithm scores, and parental ASSQ responses (data not shown). This suggests that for children who no longer met criteria for ASD or SCD, their social and behavioral disruptions were likely associated with ADHD or anxiety disorder; however, the sample size is too small for further meaningful statistical analyses.

We report that the estimated prevalence for SCD = 0.49% in this community-ascertained population of school-aged children. Although most SCD cases came from previous *DSM-IV* PDD-NOS cases, we identified 3 new SCD case subjects (2 girls and 1 boy) who did not have a prior PDD diagnosis. All of these children had significant difficulties in communication accompanied

by a moderate lack of social reciprocity, based on both parental survey and direct interview; in addition, they all have modest difficulties in communication, as well as mild social reciprocity problems, based on the clinical interviews with the children.

In the final analysis, the divergence rate between *DSM-IV* PDD and *DSM-5* ASD in the 292 screen-positive assessment completers is a modest but important 8%. Indeed, if one considers *DSM-5* ASD and SCD to be in the same domain as *DSM-IV* PDD, then the divergence rate drops to a remarkable 2%. It appears that when diagnostic category reassignment occurs, it is the result of 2 principal factors: for those case individuals moving to SCD, it is due to relatively low levels of RRBs, whereas for those individuals ending up with other psychiatric diagnoses, it is that the symptoms of those disorders marginally interfere with structured social behavior. Most importantly, irrespective of the final diagnosis, all patients with a *DSM-IV* PDD diagnosis still had significant psychopathology that merited follow-up and treatment.

This study provides comprehensive prevalence estimates by applying validated, reliable, gold-standard screening procedures and diagnostic methods in a total population sample.

Study limitations include that the SCD screening was conducted using the ASSQ, a screening questionnaire designed for ASD. Because the sensitivity and specificity of the ASSQ for SCD is unknown, the SCD prevalence might have been underestimated in this study. Other limitations stem from missing data for non-participants and the relatively small proportion of children in the total sample who received a full diagnostic assessment. However, these are ubiquitous problems that are seen in similar epidemiological studies.[14] Various model-building analyses, previously reported, indicated that error introduced by "missingness" is minimal,[4] but we report ASD and SCD prevalence estimates with due caution about the risks of over- and underestimation.

In summary, our findings suggest that most individuals with a prior *DSM-IV* diagnosis of PDD move to the *DSM-5* categories of ASD or SCD. In fact, fewer than 2% of *DSM-IV* PDD individuals had a *DSM-5* diagnosis other than ASD or SCD. Indeed, the combined prevalence of *DSM-5* ASD + SCD is virtually identical to that of the *DSM-IV* PDD for every category. These data provide essentially no support for the concerns that individuals affected by *DSM-IV* PDD will "lose a diagnosis" with the advent of the *DSM-5*. When ASD and SCD are combined, then virtually everyone with a *DSM-IV* PDD remains on the "new spectrum." Because until proved otherwise, the treatments for ASD and SCD remain the same or similar, and it is important for children moving to SCD (and their families) to continue receiving the interventions that they received with the *DSM-IV* PDD diagnosis. In addition, those falling out of the *DSM-5* ASD/SCD group appear to have other significant and impairing disorders that are also important and certainly deserve the care and attention appropriate for those conditions; clinicians should promptly point these children in the right directions, even if ASD is not that direction. Finally, there is a need to follow up the *DSM-IV–DSM-5*–divergent children to understand the natural course and outcomes of their conditions and how they are related or not related to ASD. However, in the final analysis, whether the label is PDD, ASD, or SCD, extant diagnostic criteria are helpful in identifying a relatively large, clinically meaningful group of individuals and families who deserve comprehensive evaluations and evidence-based treatments as early as possible. &

CG Clinical Guidance

- There has been concern that *DSM-5* Autism Spectrum Disorder, including the end of the Autism, Asperger and PDD diagnoses, will have an impact on prevalence along with eligibility for services and force alterations of practice guidelines.
- Hopefully allaying fears that *DSM-5* creates major diagnostic changes for patients, this study found that the *DSM-IV* PDD and *DSM-5* ASD prevalence are quite similar.
- The present study indicates that more than 90% of individuals with a *DSM-IV* PDD diagnosis will have a *DSM-5* ASD or SCD diagnosis.
- Those who no longer meet ASD criteria came from *DSM-IV* PDD-NOS and still have significant developmental psychopathology.
- For the practicing clinician, as well as for patients and their families, this study should provide reassurance that there can be a smooth transition from *DSM-IV* to *DSM-5* criteria that offer more clarity in the ASD diagnosis while adding the new but related disorder, SCD, as part of a continuum of neurodevelopmental disorders.

Accepted January 8, 2014.

Dr. Y.S. Kim is with the Child Study Center, Yale University, New Haven, CT, the Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY, and Yonsei University, Seoul, South Korea. Dr. Fombonne is with Oregon Health and Science University, Portland, OR. Dr. Koh is with the Korea Institute for Children's Social Development ("Rudolph"), Seoul, South Korea. Dr. S.-J. Kim is with the University of Washington, Seattle, WA. Dr. Cheon is with Yonsei University, Seoul, South Korea. Dr. Leventhal is with Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY, Yonsei University, Seoul, South Korea, and the University of Illinois, Chicago, IL.

This research was funded by an Autism Speaks Pilot Research Grant and a Supplement Grant (7996), a Brain Research Foundation Research Grant, a Simons Foundation Autism Research Initiative Pilot Grant (137032 M134793), the National Institute for Mental Health (NIMH) Career Awards (5K01MH079317-02 [Y.S.K.] and K23MH082883 [S.J.K.]), the National Institute of Environmental Health Sciences (NIEHS) R01 Award (R01 ES021462-01), and the Korean Health Technology Research and Development Project, Ministry of Health and Welfare (HI12C0021; HI12C0245-A120029).

Additional funding was provided by the Jean Young and Walden W. Shaw Foundation, the Daniel X. and Mary Freedman Foundation, and the Dukyoung Foundation.

We are grateful to all of the schools and families that participated in the study. We thank Eugene Laska, PhD, with the Nathan S. Kline Institute for Psychiatric Research, for his statistical assistance.

Disclosures: Dr. Leventhal has a consulting relationship with Janssen Pharmaceuticals that is specific to a single project that has no involvement in medication development or marketing. Drs. Y.S. Kim, Fombonne, Koh, S.-J. Kim, and Cheon report no biomedical financial interests or potential conflicts of interest.

Correspondence to Bennett Leventhal, MD, Nathan Kline Institute for Psychiatric Research, 140 Old Orangeburg Road, Bldg 35, Orangeburg, NY 10962; e-mail: bennett.leventhal@nki.rfmh.org

http://dx.doi.org/10.1016/j.jaac.2013.12.021

REFERENCES

1. Baird G, Simonoff E, Pickles A, *et al*. Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP). Lancet. 2006;368:210-215.
2. Fombonne E. The epidemiology of autism: a review. Psychol Med. 1999;29:769-786.
3. Fombonne E. Epidemiology of pervasive developmental disorders. Pediatr Res. 2009;65:591-598.
4. Kim YS, Leventhal BL, Koh YJ, *et al*. Prevalence of autism spectrum disorders in a total population sample. Am J Psychiatry. 2011;168:904-912.
5. American Psychiatric Assocation. *DSM-5*. Washington, DC: American Psychiatric Association; 2013.
6. American Psychiatric Association. A05 Social Communication Disorder. Washington, DC: American Psychiatric Association; 2013.
7. Carey B. New definition of autism will exclude many, study suggests. New York Times, January 19, 2012.
8. Frazier TW, Youngstrom EA, Speer L, *et al*. Validation of proposed *DSM-5* criteria for autism spectrum disorder. J Am Acad Child Adolesc Psychiatry. 2012;51:28-40, e23.
9. Gibbs V, Aldridge F, Chandler F, Witzlsperger E, Smith K. Brief report: an exploratory study comparing diagnostic outcomes for autism spectrum disorders under *DSM-IV*-TR with the proposed *DSM-5* revision. J Autism Dev Disord. 2012;42:1750-1756.
10. Huerta M, Bishop SL, Duncan A, Hus V, Lord C. Application of *DSM-5* criteria for autism spectrum disorder to three samples of children with *DSM-IV* diagnoses of pervasive developmental disorders. Am J Psychiatry. 2012;169:1056-1064.
11. Mattila ML, Kielinen M, Linna SL, *et al*. Autism spectrum disorders according to *DSM-IV-TR* and comparison with *DSM-5* draft criteria: an epidemiological study. J Am Acad Child Adolesc Psychiatry. 2011;50:583-592, e511.
12. McPartland JC, Reichow B, Volkmar FR. Sensitivity and specificity of proposed *DSM-5* diagnostic criteria for autism spectrum disorder. J Am Acad Child Adolesc Psychiatry. 2012;51:368-383.
13. Taheri A, Perry A. Exploring the proposed *DSM-5* criteria in a clinical sample. J Autism Dev Disord. 2012;42:1810-1817.
14. Kelsey JL, Whittemore AS, Evans AL, Thompson WD. Methods in Observational Epidemiology. New York: Oxford University Press; 1996.