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Attention-Deficit/Hyperactivity Disorder in Preschoolers: The Accuracy of a Short Screener

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Objective: Although early and accurate screening is required for the remediation of attention-deficit/hyperactivity disorder (ADHD), possible gender differences have not been extensively studied. We examined the classification accuracy of the parent and preschool teacher version of the Strengths and Difficulties Questionnaire (SDQ) hyperactivity−inattention (HI) subscale in girls and boys.

Method: The study was part of the Norwegian Mother and Child Cohort Study (MoBa). Parents and preschool teachers rated a total of 238 girls and 276 boys (mean age 3.5 years) with the SDQ HI subscale. Blinded to the parent and teacher ratings, interviewers classified the children by ADHD diagnoses with the Preschool Age Psychiatric Assessment Interview.

Results: Areas under the curves for the parent HI subscale scores were good for both girls and boys (0.87 and 0.80, respectively). Preschool teacher classifications were fair (0.76) for girls and poor (0.62) for boys, a significant difference ($p = .017$). The subscale accurately identified children without ADHD at low parent scores (≤4), and fairly accurately identified ADHD at high scores (≥9), with maximum probabilities of finding true cases of 0.75 in girls and 0.55 in boys. Intermediate scores gave the best balance between sensitivity and specificity with low probabilities of correctly identifying children with ADHD.

Conclusion: The parental SDQ HI subscale was useful for screening for ADHD in preschool girls and boys. For preschool teachers, the subscale was useful for screening girls.

Key words: ADHD, Strengths and Difficulties Questionnaire (SDQ), psychometrics

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Attention-deficit/hyperactivity disorder (ADHD) is characterized by symptoms of hyperactivity−impulsivity and inattention, often begins during preschool years,[1] and has been found to be 2 to 9 times more frequent in boys than in girls.[2] Throughout life, ADHD is associated with increased risk of many problems, including other psychiatric disorders, educational and work failure, accidents, addictions, and premature death, especially in those in which the condition is diagnosed late.[3,4] Preschool ADHD symptoms have been found to be associated with these problems, and early detection of ADHD has been recommended.[5,6] However, because it is important not to raise concern unduly for children who show age-appropriate behavior, and to avoid falsely labeling them with ADHD, accurate screening is essential.

One promising measure for the early detection of ADHD is the hyperactivity−inattention (HI) subscale of the Strengths and Difficulties Questionnaire (SDQ), widely used because of its brevity, availability, and satisfactory psychometric properties.[7,8] The HI subscale consists of 5 items about hyperactivity-impulsivity and inattention, and has been put forward as a good screener for ADHD in schoolchildren, in both epidemiological[9] and clinical studies.[10,11] Psychometric SDQ studies in preschool children are still limited, but satisfactory internal consistencies for the parent and teacher SDQ HI subscales have been reported.[12-18]

We identified 4 studies that included preschoolers and investigated the screening accuracy of the SDQ HI subscale for ADHD.[10,15,19,20] Two community studies (n = 18,232, age range 5–15 years; n = 1341, age 3 years)[15,20] concluded that the parent SDQ HI subscale discriminated well between children with and without ADHD. A longitudinal study (age range 5–7 years) found that HI subscale scores ≥6 and reported impact by parents and teachers gave about a 20-fold increased risk of subsequent ADHD.[19] In addition, a clinical study of children aged 3–17 years found that parent SDQ HI ratings for preschoolers had screening ability for ADHD similar to that for older children, but was limited by the inclusion of few preschoolers (n = 31).[10]

In schoolchildren, the discriminative property of the SDQ HI subscale has been found to be as strong for

teachers as for parents.[7] For preschoolers, data are limited on the utility of collecting teacher SDQ ratings. However, one community study of 622 children 3 years of age compared the parent and teacher HI subscale with the ADHD diagnosis obtained from parent interviews, and concluded that the HI subscale discriminated well for both parents and teachers (areas under the curve [AUCs] of 0.87 and 0.81, respectively).[15] In contrast, a community study of children 4 years of age (n = 845) that compared parent and teacher SDQ with information on emotional and behavioral disorders (based on parent interviews) reported good screening efficiency of parent, but not teacher, SDQ ratings.[21] That study did not investigate the HI subscale accuracy in detecting ADHD specifically, but ADHD was included among behavioral disorders.[21] None of these studies investigated potential gender differences in parent and teacher SDQ ratings.

It has long been recognized that there may be substantial biases when parents and teachers rate girls' and boys' behavior.[22] For the SDQ HI subscale, girls have been reported to have lower mean scores than boys,[15,23-26] and one study (n = 71,840) emphasized that analyses should be made separately for girls and boys to avoid masking potential gender differences.[24] In a clinical study (n = 523), the parent SDQ scores were poorer at detecting ADHD—inattention subtype in girls than in boys among schoolchildren. This did not apply for preschoolers; however, only 31 preschoolers participated, which makes it difficult to draw conclusions about gender differences.[10]

Earlier studies of SDQ screening accuracies have shown good group-level statistics (sensitivity, specificity, and both positive and negative predictive values) and have discussed which HI subscale cutoff levels provide the most accurate screening. A cutoff level of 7/10 was used in epidemiological studies,[27,28] but a cutoff score of 4 gave the most acceptable sensitivity levels (88% for parents, 98% for teachers) in a Scandinavian community study.[9] However, these studies did not consider the best way of interpreting the different parent and teacher scores, and did not discuss the use of multiple cutoffs, as recently recommended.[29]

In the present study, we investigated the classification accuracy of the SDQ HI subscale in preschoolers by comparing parent and preschool teacher ratings (both separately and combined) with diagnostic information about ADHD retrieved from parent interviews. We focused on possible gender differences by performing separate analyses for girls and boys, and used a multi-threshold approach to interpret the screening accuracy of the HI subscale. We hypothesized that the parent and teacher SDQ HI subscales would have acceptable psychometric properties; however, as studies of possible gender differences in the screening accuracy of parent and teacher ratings are limited, we did not make any a priori hypotheses.

METHOD

Study Participants

The Norwegian Mother and Child Cohort Study (MoBa) is an ongoing, prospective, population-based cohort study of Norwegian-speaking pregnant women conducted by the Norwegian Institute of Public Health (41% participation rate).[30] The current article is based on a clinical substudy on ADHD, which oversampled children at risk for ADHD by using the MoBa questionnaire at child age 3 years. The questionnaire included 11 items about ADHD: 6 items from the Child Behavior Checklist/1.5-5,[31] and 5 items from the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*).[32] Children with scores at or above the 90th percentile on these 11 items (n = 2798) were invited to participate, along with randomly selected children (n = 654). Of these, 35% agreed to participate, and 1195 children took part in a 1-day clinical assessment that included diagnostic interviews with parents (with few exceptions mothers) from 2007 to 2011. About 95% of 3.5-year-old children in Norway attended preschool during this period. There were no statistically significant differences between high-scoring and randomly selected participants regarding background factors and pre- and perinatal risk factors, except for a lower level of maternal education in the high-scoring participants. Four weeks before the assessments (child mean age 3.5 years), parents received screening questionnaires by mail, including the parent and teacher SDQ. The parents gave the teacher versions to the preschool teachers, who then mailed their responses directly to the study administrator. Both parents and teachers responded to the questionnaires before the day of the clinical assessment. The SDQ was distributed to the first 44% of those who agreed to participate (n = 514; 238 girls and 276 boys); these participants comprised the sample for the present study. Of these, 81% (n = 417) scored at or above the 90th percentile on the 11 items, and 19% (n = 97) were randomly selected from MoBa.

Measures

Child gender and birth date were obtained from the Norwegian Medical Birth Registry.

Preschool Age Psychiatric Assessment Interview. Diagnostic assessment of the child was based on the Preschool Age Psychiatric Assessment (PAPA) interview with the caregiver, developed for children from 2 to 5 years of age.[33] The PAPA is interviewer based, meaning that the interviewer asks questions until she or he can decide whether the symptoms

meet the definitions provided in a glossary. Only ADHD symptoms lasting ≥3 months were counted as present. Blinded to parent and teacher screening ratings, trained graduate psychology students (under supervision) conducted the interviews. An interrater reliability check was carried out by a second blinded rater who rescored audiotapes of 79 randomly selected interviews. The average intraclass correlation (ICC) for the total number of ADHD symptoms was 0.98.

ADHD Outcome. From the PAPA interview, ADHD was defined by the presence of at least 6 of 9 symptoms of either hyperactivity−impulsivity or inattention (ADHD hyperactive/impulsive or inattentive subtypes) or both (ADHD combined subtype), as defined by the *DSM-IV-TR*.[32] The symptoms were reported by parents to be pervasive across at least 2 settings. In all, 88 children fulfilled the criteria: 73% hyperactive−impulsive (n = 65, 29 girls), 3% inattentive (n = 3, 2 girls), and 23% combined subtype (n = 20, 8 girls). Because of oversampling for ADHD symptoms when children were 3 years, the proportion of ADHD was 16% for girls and 17% for boys, higher than the 1.9% to 3.3% prevalence rates reported in previous PAPA preschool studies.[34,35]

Screening Measures. The SDQ (available at http://www.sdqinfo.org/), consists of 25 questions using a 3-point Likert scale (not true, somewhat true, and certainly true; range 0–2), about behavior during the past 6 months. We used the Norwegian SDQ version 4–16 years for parents and teachers. The psychometric properties of the SDQ have been found to be satisfactory.[7,8,24,36] There are 5 five-item SDQ subscales (emotional symptoms, conduct problems, hyperactivity−inattention, peer relationship problems, and prosocial behavior). The first 4 problem subscales may be added to give a total difficulties score. In our sample, the screening accuracy of the total difficulties scores was similar to that of the HI subscale from both parents and teachers. For simplicity, we included only the HI subscale. Cronbach α values on the HI subscale were 0.79 for parents and 0.86 for teachers.

Ethics Considerations

Informed consent was obtained from participants upon recruitment to the MoBa and the ADHD substudy, and both had obtained a license from the Norwegian Data Inspectorate. The study was approved by the Regional Committee for Medical Research Ethics.

Data Analysis

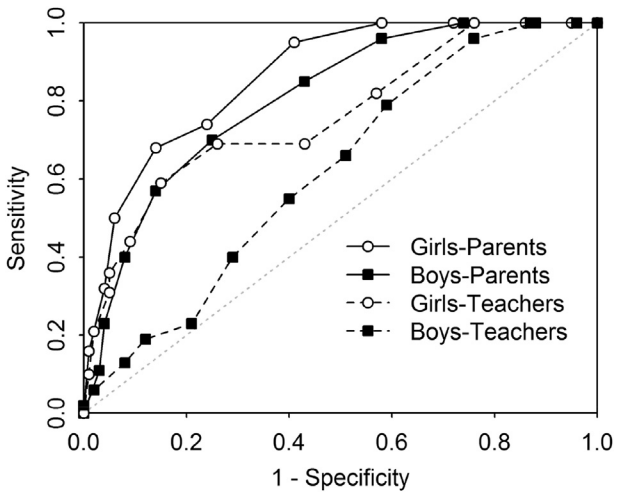
Statistical analyses were performed using SPSS, version 23, and R 3.2.2 software.[37] Internal consistencies were analyzed using Cronbach α, with differences between means of continuous variables measured by *t* tests. Receiver operating characteristic (ROC) analyses were used to estimate areas under the curve (AUCs) to quantify the accuracy of the SDQ HI subscales. The ROC curve graphically represents the probability of true-positive results of ADHD as a function of the probability of false-positive results of this subscale. We used the following guideline for evaluating AUC values: <0.70, poor; 0.70 to 0.79, fair; 0.80 to 0.89, good; and 0.90 to 1.00, excellent.[38] We estimated sensitivity (the probability of a measure to classify correctly a case as positive) and specificity (the probability of a measure to identify correctly noncases as negative) for each step of the scale for girls and boys. We calculated the positive predictive values (PPV, the probability of a true case given a positive test), negative predictive values (NPV, the probability of a true noncase given a negative test), the positive likelihood ratios (LRs) (the probability of a child who has the disorder testing positive divided by the probability of a child who does not have the disorder testing positive), and negative LRs (the probability of a child who has the disorder testing negative divided by the probability of a child who does not have the disorder testing negative). LRs between 0 and 1 argue against the presence of the disorder; the closer they are to 0, the less likely the disorder. Correspondingly, LRs >1 argue for the presence of the disorder, and LRs of 1 lack diagnostic value.[39] LRs are derived from sensitivity and specificity, and are independent of the proportion of the disorder within the sample; they are therefore more likely to generalize outside the sample.[40] Statistical tests to compare ROC curves were conducted with the R-package pROC.[41] For paired samples (parents versus teachers for girls and boys), statistical comparisons were done using Bootstrap tests for 2 correlated ROC curves. For unpaired samples (girls versus boys for parents and teachers), the DeLong test for 2 ROC curves was used.

RESULTS

The ROC curves (Figure 1) show good screening accuracy for the parent SDQ HI subscale, whereas the teacher subscale showed fair and poor accuracy for girls and boys, respectively.

There were significantly higher mean HI scores for girls and boys who met ADHD criteria than for children who did not (Table 1). For girls and boys, parent and teacher scores discriminated true-positive and true-negative cases significantly better than chance (see Table 1 for AUC values). Furthermore, parent ratings significantly outperformed teacher ratings (girls: D = 3.22, $p = .001$; boys: D = 4.04, $p < .001$, respectively). There was no significant difference between parent ratings for girls and boys (D = 1.32,

FIGURE 1 Receiver Operating Characteristic (ROC) Curves for the Parent and Teacher Strengths and Difficulties Questionnaire Hyperactivity–Inattention (SDQ HI) Subscale Scores for Preschool Girls and Boys



df = 500.47, p = .18), but teacher ratings performed significantly better for girls than for boys (D = 2.40, df = 477.87, p = .0017). Excluding the randomly selected children from the analyses gave similar AUCs for both parent and teachers for girls, and for parent ratings for boys, but teacher ratings no longer discriminated significantly for boys (AUC = 0.59, 95% CI = 0.50–0.67, p = .08).

Sensitivity, specificity, positive and negative predictive values (PPV and NPV, respectively), and positive and negative LRs (+LR and –LR, respectively) for the parent and teacher SDQ HI subscale cutoff scores for girls and boys are shown in Table 2.

The parent subscale accurately identified children without ADHD with low scores for girls (≤4) and boys (≤3) (–LR = 0). High parent subscale scores of 9 or 10 gave +LR of 8.9 and 15.6 in girls and 5.8 and 3.9 in boys, yielding probabilities for finding true ADHD cases for children with these scores (PPV) of 0.63 to 0.75 in girls and 0.55 to 0.45 in boys. Intermediate scores gave the best trade-off between sensitivity and specificity, and were best for a score of 6 with a sensitivity of 74% and 70% and specificity of 76% and 75% in girls and boys, respectively. In this cohort, the probability of correctly identifying ADHD at this score was 0.37 in both girls and boys.

Teacher ratings for girls showed the same pattern of low scores correctly identifying girls who did not meet the ADHD criteria, and high scores (≥9) yielding +LR of 9.6, giving a probability for correctly identifying a girl with the diagnosis at this score of 0.67. The teacher ratings for boys were less clear, with scores from 1 to 9 giving a +LR just above 1 (1.14–1.64). A teacher score of 10 in boys gave a +LR of 3.48, with a probability of 0.43 for a boy with this score fulfilling ADHD criteria. Figure 2 presents the proportion of true-positive ADHD cases (%) at different parent and teacher scores for girls and boys.

Combining parent and teacher scores did not improve sensitivity and specificity over the use of just one informant. A cutoff ≥6 from both parent and teacher gave a sensitivity of 37% and specificity of 96% (PPV = 0.64; NPV = 0.88) for girls; for boys, the sensitivity was 29% and specificity was 86% (PPV = 0.31; NPV = 0.85). No other combinations of parent and teacher cutoff levels yielded any improvement in the screening accuracy.

DISCUSSION

Accurate screening methods should ensure that more preschoolers are referred for assessment to provide the opportunity to remediate ADHD. Our main findings indicate that the parent SDQ hyperactivity girls–inattention subscale is an accurate screening measure for ADHD in preschool girls and boys, consistent with our hypothesis. However, teacher ratings discriminated significantly less

TABLE 1 *t* Test Comparisons and Areas Under the Curve of Parent (p) and Teacher (t) Strengths and Difficulties Questionnaire Hyperactivity–Inattention (SDQ HI) Subscales for Preschool Girls and Boys With and Without Attention-Deficit/Hyperactivity Disorder (ADHD)

	ADHD Mean (SD)	No ADHD Mean (SD)	*t* Test	*p*	AUC (95% CI)
Girls (n = ADHD/no ADHD)					
p-SDQ HI (38/197)	7.34 (1.89)	4.01 (2.25)	8.57	<.001	0.87 (.81–.92)
t-SDQ HI (39/188)	5.21 (3.12)	2.40 (2.25)	5.33	<.001	0.76 (.67–.85)
Boys (n = ADHD/no ADHD)					
p-SDQ HI (47/222)	6.83 (2.01)	4.12 (2.30)	7.50	<.001	0.80 (.75–.87)
t-SDQ HI (47/218)	4.98 (2.55)	3.87 (2.81)	2.50	<.001	0.62 (.54–.70)

Note: AUC = area under the curve.

TABLE 2 Group-Level Statistics for the Strengths and Difficulties Questionnaire Hyperactivity–Inattention Subscale (SDQ HI)

SDQ cutoff	Parents						Teachers					
	Se (%)	Sp (%)	PPV	NPV	+LR (CI)	−LR (CI)	Se (%)	Sp (%)	PPV	NPV	+LR (CI)	−LR (CI)
Girls												
1	100	5	0.17	1.00	1.05 (1.02–1.09)	0	100	24	0.21	1.00	1.31 (1.21–1.42)	0
2	100	14	0.18	1.00	1.16 (1.10–1.23)	0	82	43	0.23	0.92	1.43 (1.18–1.73)	0.42 (0.21–0.84)
3	100	28	0.21	1.00	1.40 (1.28–1.53)	0	69	57	0.25	0.90	1.61 (1.23–2.10)	0.54 (0.33–0.88)
4	100	42	0.25	1.00	1.73 (1.53–1.95)	0	69	74	0.36	0.92	2.71 (1.97–3.74)	0.41 (0.26–0.67)
5	95	59	0.31	0.98	2.30 (1.92–2.77)	0.09 (0.02–0.35)	59	85	0.44	0.91	3.82 (2.50–5.85)	0.49 (0.33–0.71)
6	74	76	0.37	0.94	3.02 (2.22–4.13)	0.35 (0.20–0.60)	44	91	0.50	0.89	4.82 (2.71–8.58)	0.62 (0.47–0.82)
7	68	86	0.48	0.93	4.81 (3.21–7.22)	0.37 (0.23–0.59)	36	95	0.58	0.88	6.75 (3.24–14.07)	0.68 (0.53–0.86)
8	50	94	0.61	0.91	8.21 (4.36–15.47)	0.53 (0.39–0.73)	31	95	0.57	0.87	6.43 (2.91–14.20)	0.73 (0.59–0.90)
9	32	96	0.63	0.88	8.89 (3.74–21.11)	0.71 (0.57–0.88)	21	98	0.67	0.86	9.64 (3.05–30.44)	0.81 (0.69–0.95)
10	16	99	0.75	0.86	15.55 (3.26–74.18)	0.85 (0.74–0.98)	10	99	0.67	0.84	9.64 (1.83–50.81)	0.91 (0.81–1.01)
Boys												
1	100	04	0.18	1.00	1.04 (1.01–1.07)	0	100	12	0.20	1.00	1.14 (1.08–1.19)	0
2	100	14	0.20	1.00	1.16 (1.10–1.22)	0	96	24	0.21	0.96	1.26 (1.14–1.38)	0.18 (0.05–0.71)
3	100	26	0.22	1.00	1.35 (1.25–1.46)	0	79	41	0.22	0.90	1.33 (1.11–1.60)	0.52 (0.29–0.92)
4	96	42	0.26	0.98	1.65 (1.45–1.87)	0.10 (0.03–0.40)	66	50	0.22	0.87	1.31 (1.02–1.67)	0.69 (0.45–1.05)
5	85	57	0.29	0.95	1.97 (1.62–2.39)	0.26 (0.13–0.52)	55	60	0.23	0.86	1.37 (1.01–1.86)	0.75 (0.54–1.05)
6	70	75	0.37	0.92	2.78 (2.08–3.73)	0.40 (0.26–0.62)	40	71	0.23	0.85	1.38 (0.92–2.06)	0.84 (0.66–1.08)
7	57	86	0.47	0.91	4.11 (2.73–6.19)	0.49 (0.35–0.69)	23	79	0.19	0.83	1.11 (0.62–1.98)	0.97 (0.82–1.15)
8	40	92	0.51	0.83	4.99 (2.84–8.75)	0.65 (0.51–0.82)	19	88	0.25	0.83	1.55 (0.78–3.07)	0.92 (0.80–1.07)
9	23	96	0.55	0.86	5.77 (2.54–13.14)	0.80 (0.68–0.94)	13	92	0.26	0.83	1.64 (0.68–3.93)	0.95 (0.84–1.06)
10	11	97	0.45[a]	0.82	3.94 (1.25–12.36)	0.92 (0.83–1.02)	06	98	0.43	0.83	3.48 (0.81–15.03)	0.95 (0.88–1.03)

Note: +LR = positive likelihood ratio; –LR = negative likelihood ratio; NPV = negative predictive value; PPV = positive predictive value; SDQ = Strengths and Difficulties Questionnaire; Se = sensitivity; Sp = specificity. The proportions of girls and boys who fulfilled ADHD criteria in the sample were 16% and 17%, respectively.

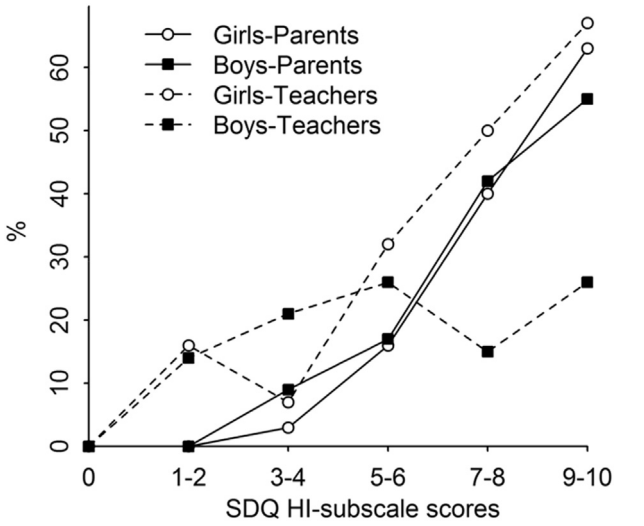
[a]*The fall in PPV at score 10 relative to score 9 was due to having few children at these high scores.*

accurately than parents and were particularly poor for boys. Combining parent and teacher subscale scores did not improve the accuracy of identifying children with ADHD. Still, if the collection of preschool teacher SDQ HI subscale ratings were to be prioritized, our findings suggest that this might be useful for girls.

The accuracy levels of the parent HI subscale for girls and boys in the present study were consistent with earlier studies including preschoolers.[20,21,42] Teacher ratings were less accurate than parent ratings in our sample; this may have been partly due to comparisons of screening ratings with diagnoses derived from interviews with parents, thus favoring the value of parent screening.[33] However, earlier preschool studies have also compared the teacher SDQ with parent interviews,[15,21] and one found that parents outperformed teachers.[21] Interestingly, our results are in conflict with studies in schoolchildren in which teachers' SDQ scores have been found to discriminate as well as those of parents.[7,43] It has been suggested that this difference between age groups may be explained by preschool teachers having fewer demands on rules and structure than do schoolteachers.[21,44] The often low agreement between parents and teachers in reporting behavioral disorders has been explained by variability in child behavior, situational demands, and informant perspective.[45] However, the possible difference between teacher reports for preschool and schoolchildren are not consistent, as a recent study of screening for ADHD in schoolchildren with the Achenbach Scales found that parent ratings outperformed those of teachers.[46]

Our finding that preschool teachers were significantly more accurate in detecting girls than boys with ADHD is consistent with a recent preschool community study that reported moderate accuracy (AUC = 0.77) for the teacher SDQ total difficulties score when detecting ADHD in girls, and poor accuracy (AUC = 0.68) in boys.[47] In addition, a community study in schoolchildren reported better teacher AUC for girls than for boys (based on nonoverlapping CI), although both performed well (0.96 and 0.92, respectively).[9] Our results indicate that boys may generally be viewed as active by the preschool teachers, making it challenging to separate age-appropriate behavior from ADHD symptoms, whereas active girls are more easily discriminated

FIGURE 2 Proportion of Girls and Boys With Attention-Deficit/Hyperactivity Disorder (ADHD) According to Information From a Parent Diagnostic Interview for Different Parent and Teacher Strengths and Difficulties Questionnaire Hyperactivity–Inattention (SDQ HI) Subscale Scores



from girls with low activity levels in the preschool setting (for greater mean difference, see Table 1). In support of this are findings that differences in hyperactivity levels between children with and without ADHD are greater among girls than among boys.[48]

The cutoff levels of the HI subscale have been widely discussed, as it is clinically important to identify levels that give the best balance between sensitivity and specificity. Inevitably, choosing one cutoff level on an ordinal scale will merge the number of false-positive and false-negative cases across several steps of the scale, giving risk of misclassifying children with a specific score, perhaps causing concern where none is needed, or missing children with ADHD who need further assessment. The clinicians must also consider the clinical context when screening. To exemplify, in our study, with a higher proportion of children with ADHD than in community studies, choosing the cutoff ≥ 6 for the parent HI subscale gave the best balance between sensitivity and specificity (girls 74% and 76%; boys 70% and 75%, respectively). This was lower than in a clinical study that reported a sensitivity level of 100% with a cutoff of 7 for detecting ADHD hyperactive–impulsive type,[10] but resembled the results of community studies with preschool and schoolchildren.[9,15,49] These differences illustrate how the proportion of children with ADHD within different contexts affects the probability of correct classification. In theory, however, the proportion of children with ADHD should not affect estimates of sensitivity, specificity, and LRs, and may generalize to other samples.

Using a multi-threshold approach may maximize the clinical utility of screening.[29] In our sample, low parent HI subscale scores (≤ 4) suggest that ADHD can be ruled out with confidence in both girls and boys, and is in line with other community studies,[9,21] whereas the highest scores (≥ 9) gave high +LRs of ADHD (15.55 and 5.77 in girls and boys, respectively). High cutoff levels lowered sensitivity, making it more likely that children with ADHD would be missed, whereas intermediate scores increased the number of false-positive results, indicating that clinicians need to interpret each score with both accuracy and uncertainty in mind.

Combining parent and teacher ratings to detect ADHD did not improve sensitivity/specificity values in our study. This deviates from findings by the developers of the SDQ, who recommend using multiple informants.[43] However, our results are consistent with those of a preschool study of 4-year-old children that found that adding teacher ratings to parent ratings for detecting behavioral disorders was of little value.[21] Our results add to this study, as we found different profiles for girls and boys. Teacher ratings discriminated fairly well for girls, poorly for boys, and did not add discriminative power to parents' ratings for girls or boys. A note of caution is warranted, however, as there is need for further replication to be confident of our findings.

Our study has important strengths, including the population-based cohort design and the use of the recommended gold standard for ADHD diagnoses, a parent diagnostic interview. However, the study also has several limitations. First, there were selection biases due to attrition in the MoBa[30] and the ADHD substudy.[50] One study of ADHD in MoBa, reported a lower proportion of ADHD, less psychosocial adversity, and better child global functioning compared to the general child population, but differences were small, and reasonable generalizability to the general child population was assumed.[51] The oversampling for ADHD symptoms at age 3 years gave about a 5- to 8-fold increase in the proportion of ADHD compared with preschool prevalence studies,[34,35] and will have increased the probability of finding true cases given a positive screen result. Our sample included children with psychiatric symptoms other than ADHD, such as oppositional defiant disorder (ODD). This could have led to false-positive results, as could demographic factors; however, including ODD and level of parental education in additional analyses gave no indication that these factors biased our main results. Our sample may resemble a primary health care unit, where concerned parents ask whether their active preschool child might have ADHD. Second, our diagnostic outcome was based solely on parent report, and although consistent with other studies,[15,21] it might contribute to the stronger

screening accuracy of the parent HI subscale scores compared with teacher ratings. However, this would not explain the difference found between girls and boys. Third, we used the SDQ version 4–16, and our participating children were about 3.5 years of age. The difference between the HI subscale in this version compared to the version for children 2 to 4 years of age is the impulsivity item, which, for the SDQ 4–16, reads "think things out before acting," whereas for the SDQ 2–4 reads: "can stop and think things out before acting." We do not believe that this created bias. Fourth, we did not include SDQ impact scores, as too few were reported to make this analysis meaningful. However, a recent Norwegian preschool community study found that impact scores did not improve prediction accuracy of the SDQ.[21]

In sum, the parent SDQ HI subscale scores discriminated well between preschoolers with and without ADHD, and did so significantly better than teacher scores for both girls and boys. We conclude that clinicians may prioritize parents when screening preschoolers for ADHD with the SDQ HI subscale.

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