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Objective: The aims of the present study was to investigate communication impairments in a Norwegian sample of children with Attention Deficit Hyperactivity Disorder (AD/HD) and children with Asperger syndrome (AS) and to explore whether children with AD/HD can be differentiated from children with AS in terms of their language profiles on the Norwegian adaptation of the Children's Communication Checklist Second Edition (CCC-2). **Method**: The CCC-2 was completed by the parents, and altogether 77 children aged 6-15 years participated in the study. **Results**: Communication impairments were as common in a group of children with AD/HD as in a group of children with AS. Although a similar pattern appeared on most CCC-2 scales, children with AD/HD and children with AS could be distinguished from each other in terms of their language profiles on the subscales assessing stereotyped language and nonverbal communication. **Conclusion**: Language abilities should be taken into account when standard assessments of AD/HD and AS are performed and before therapies are initiated.

Key words: Communication impairments, AD/HD, Asperger syndrome, CCC-2

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Within communication three intersecting areas of language, content, form and pragmatics (use), are equally important, and problems may arise as a result of impairments within any of these areas (Geurts & Embrechts, 2008; Landa, 2005; Spanoudis, Natsopoulos, & Panayiotou, 2007). Communicative competence has an impact on how children think, learn and develop social relationships. Being the ultimate purpose of language, communication also includes non-linguistic parameters such as gesture, eye-contact and turn-taking abilities. Thus communication impairments encompass a wide range of difficulties affecting language as well as verbal and nonverbal pragmatic skills (Lust, 2006; Norbury, Tomblin, & Bishop, 2008). Pragmatics may be defined as the appropriate use and interpretation of language in different contexts and is usually viewed as one of the three basic components of language mentioned above (Blom & Lahey, 1978; Fujiki & Brinton, 2009, Tannock & Schachar, 1996).

Communication problems have been reported both in children with attention deficit hyperactivity disorder (AD/HD) (Bignell & Cain, 2007; Bishop & Baird, 2001;Tannock & Schachar, 1996) and in children with Asperger syndrome (AS) (Bishop & Baird, 2001;Tager-Flusberg, 2006). AD/HD is the most frequently diagnosed psychiatric disorder in childhood with a reported prevalence between 3 % and 7 % (Jitendra, DuPaul, Someki, & Tresco, 2008; Leblanc et al., 2008; Sciutto & Eisenberg, 2007). Although language related problems are not among the cardinal features or required to fulfil current diagnostic criteria of AD/HD according to DSM-IV-TR (APA, 2000), several studies have revealed a high prevalence of communication difficulties among these children. Out of a cohort of 3208 children aged 6-11 years, Tirosh and Cohen (1998) identified a substantial overlap between language deficits and attention deficit disorder, which is consistent with previous findings from clinical samples, 45 % of the children fulfilled the criteria for both diagnoses. In line with this, more recently

Bruce, Thernlund and Nettelbladt (2006) reported language impairments in 67 % of a clinical sample of 76 Swedish children (mean age 11 years) diagnosed with AD/HD. Cohen et al. (2000) found that almost 64 % of 7 -14 year old children who were child psychiatric outpatients, fulfilled criteria for language impairment, and a diagnosis of AD/HD was given to 46 % of these children. They claimed that systematic assessment of language is rarely completed in children with AD/HD and suggested that a possible reason for this might be that the language deficits primarily are found in the area of pragmatics. Camarata and Gibson (1999) also held that studies assessing pragmatic language skills in children with AD/HD are rare, and they underlined that this aspect of language may be especially vulnerable to disruption for children receiving this diagnosis.

Pragmatic difficulties are also reported in children within a broad range of different diagnostic backgrounds beside children with AD/HD, e.g. in children with language impairments (Bishop, 1998), in children with autism spectrum disorders (Geurts & Embrechts, 2008), in children with cerebral palsy (Holck, Nettelbladt, & Dahlgren Sandberg, 2009) and in children with Williams syndrome (Laws & Bishop, 2004). Bishop and Baird (2001) found that children with AD/HD scored as low as children with Asperger syndrome (AS) on the pragmatic composite of the Children's Communication Checklist (CCC, Bishop, 1998). In the Netherlands, Geurts et al. (2004) investigated whether children (aged 5-14 years) with AD/HD, children with high functioning autism (HFA) and normal controls could be differentiated using the CCC. They found that all groups could be differentiated from each other on the pragmatic composite of the CCC with the AD/HD group being in between normal controls and HFA. In a Dutch community sample of 4 year old children, Ketalaars, Cuperus, Jansonius and Verhoeven (2009) found a strong connection between behavioural problems and pragmatic language problems. Hyperactivity showed especially high

correlations with pragmatic competence. Based on these findings they claimed that early assessment of pragmatic competence may lead to early detection of AD/HD.

Children with AS constitute a subgroup within the autism spectrum that displays a specific pattern according to current diagnostic criteria (WHO, 1992; APA, 2000); they should not show any clinically significant delay in language development or cognitive abilities (Vertè et al., 2006). However, pragmatic deficits are described as universal symptoms in both children and adults with AS by many research teams (Loucas et al., 2008; Loukusa et al., 2007; Rapin & Dunn, 2003; Ruser et al., 2007; Tager-Flusberg, 2006). According to Rapin & Dunn (2003) and Geurts & Embrechts (2008) difficulties with the structural domains of language may resolve, while the pragmatic problems seem to remain lifelong, thus indicating a possible mismatch between current diagnostic criteria and the definitions used by some clinicians. Loukusa et al. (2007) found an impaired ability to answer contextually demanding questions among children with both AS and HFA, supporting the hypothesis that even in the presence of normal linguistic abilities children with AS/HFA might exhibit pragmatic impairments. In the Netherlands, when investigating children with HFA, children with AS, children with pervasive developmental disorder not otherwise classified (PDD-NOS) and typically developing controls, Vertè et al. (2006) found pragmatic impairments in all clinical groups with 72 % of the children with HFA, 70 % of the children with AS, and 55 % of the children with PDD-NOS scoring below cut off on the CCC.

Commonly pragmatics is divided into three separate domains: (1) discourse management (how to initiate, maintain and end a conversation), (2) communicative intention (how to request, tease or inform), and (3) presupposition (assumptions about the interlocutor and the context) (Fujiki & Brinton, 2009; Geurts et al., 2008; Landa, 2005). Children exhibiting pragmatic problems may have difficulties using nonverbal cues in a conversation to understand intended meaning, initiating conversation or narrating events coherently. They

may violate the rules of conversational exchange, find it difficult to repair communication that has broken down and interpret language in an over-literal manner. Furthermore, they may have difficulties conveying information through facial expression, gesture or prosody (Adams, Lloyd, Aldred, & Baxendale, 2006; Camarata & Gibson, 1999; Fujiki & Brinton, 2009; Gilmour, Hill, Place, & Skuse, 2004; Merrison & Merrison, 2005; Ruser et al., 2007; Ryder, Leinonen, & Schulz, 2008). Research, as well as formal assessment of children's language abilities has largely focused on the content and form of language, while less attention has been paid to language use (Cohen, Barwick, Horodezky, Vallance, & Im, 1998; Im-Bolter & Cohen, 2007). This may in part be due to the fact that this aspect of language is not assessed adequately by the most commonly used clinical instruments (Bishop, Laws, Adams, & Norbury, 2006; Towbin, Pradella, Gorrindo, Pine, & Leibenluft, 2005). Different methods for the assessment of pragmatics exist, e.g. coding systems of naturalistic interaction, semi-structured conversational tasks, standardized test and checklists or questionnaires. However, assessing pragmatics within a single environment such as a clinic or a classroom might be problematic as pragmatic function is by definition context dependent and difficulties within this area tend to be more apparent in everyday life than in structured test situations (Botting, 2004, Dewart & Summers, 1995; Farmer & Oliver, 2005).

The development of the Children's Communication Checklist (CCC; Bishop, 1998) and the revised version the Children's Communication Checklist Second Edition (CCC-2; Bishop, 2003) was motivated by the lack of assessment tools sensitive to pragmatic impairments. These questionnaires are to be completed by parents, teachers or other persons that know the child well. They have been shown to provide valuable information of children's communicative skills not readily obtained by standardized language tests and they are known for sufficient discriminant validity and satisfactory inter-rater reliability (Bishop, Maybery, Wong, Maley, & Hallmayer, 2006; Bishop & Norbury, 2005; Farmer & Oliver, 2005; Geurts

et al., 2008). The revised version, the CCC-2, includes scales assessing both structural aspects and pragmatic aspects of language. The questionnaire was not developed intending to differentiate between children with AS and AD/HD but has been shown effective distinguishing children with communication impairments from typically developing children as well as identifying children who exhibit pragmatic impairments disproportionate to structural aspects of language (Bishop, 2003). It should be noted that these data are from the UK version assessing English speaking children. The CCC-2 has also been shown to be effective in an Australian sample although a lower cut-off had to be used in order for the instrument to differentiate as efficient as in the original UK study (Bishop, 2003). The present study builds on results obtained using a Norwegian adaptation of the CCC-2 (Helland, Biringer, Helland, & Heimann, 2009). As communication impairments have been reported both for children with AD/HD and children with AS, and as the results from previous studies have shown diverging results as how well the scale differentiates between children with AS and children with AD/HD (Bishop & Baird, 2001; Geurts et al., 2004) we wanted to explore whether these two diagnostic groups would show different profiles or not on the Norwegian adaptation of the CCC-2.

Considering the social disabilities associated with communication impairments as well as the fact that most therapies, including social skills training techniques used with AD/HD children are verbally based, it appears important to systematically evaluate language and communication competence in children with psychiatric disorders as part of the assessment procedure before therapies are initiated (Cohen et al., 2000; Helland & Heimann, 2007). To our knowledge no studies investigating communication impairments in children with AD/HD and children with AS have been performed on a Norwegian sample so far, this motivating the first aim of the present study: to investigate the pattern of communication impairments in children with AD/HD and children with AS since a diagnostic instrument developed in one

culture is not guaranteed to produce similar results in another culture (Canino & Algeira, 2008). The second aim was to explore whether children with AD/HD can be differentiated from children with AS and typically developing children in terms of their language profiles on the Norwegian adaptation of the CCC-2.

Method

Participants

Two clinical groups of children in the age range 6-15 years participated in this study, an AD/HD group and an AS group. The children were recruited from an outpatient clinic, a Norwegian support system for special education and from two different parent support groups, one for AD/HD and one for autism. This particular age range was selected because most children are diagnosed within this age range. Furthermore, in Norway this is the age for compulsory schooling. Through these institutions a letter of information, a letter of informed consent to fill out, and a copy of the CCC-2 were sent to parents of all together 173 children. A total of 67 (39 %) of the forms of consent and questionnaires were returned, out of these 49 were included in the study meeting the following criteria: a diagnosis of either AD/HD or AS and no mental retardation according to parental reports (for 20 of the children in the clinical groups the diagnosis were also confirmed by clinical psychologists or psychiatrists), Norwegian as their first language, being able to speak in sentences, no sensory neural hearing loss and consistently completed questionnaires according to the criteria specified by Bishop (2003). The AD/HD group consisted of 28 children (Mean age =11.0 ; SD=2.3) (21 boys) and the AS group consisted of 21 children (M=10.8; SD= 2.4) (17 boys).

Typically developing children (TD) aged 6-12 years were recruited to take part in a former validation study of the Norwegian adaptation of the CCC-2 (Helland et al., 2009). None of these children had any known learning disabilities or specific language problems, nor had they any problems with communication according to their parents. From this sample

(n=108) 18 children were selected to serve as a typically developing comparison group. For each child in the AD/HD group a typically developing child of same age and gender were randomly drawn from this sample. As the present study covered a broader age range (6-15 years) than our former study, additional 42 children in the age span 12 to 15 years were recruited from regular schools using the same procedure as in the above mentioned study, and from this sample 10 children were drawn. Thus, the TD group consisted of 28 children of similar mean age and similar distribution of boys and girls matched with the AD/HD group. The study was approved by the Regional Committee for Medical and Health Research Ethics, University of Bergen.

Measures

The CCC-2 (Bishop, 2003; Norwegian adaptation: Helland & Møllerhaug, 2006) is designed to identify children with communication impairments as well as to discriminate children with specific language impairment (SLI) from children with pragmatic language impairment disproportionate to their structural language abilities. The questionnaire is to be completed by parents (or others who have known the child for at least three months). The CCC-2 contains 70 items grouped into 10 subscales with seven items in each subscale, five items describing difficulties and two items describing strengths.

<center>* Table 1 in about here*</center>

The separate subscales (see Table 1) include items assessing e.g. whether the child simplifies words by leaving out sounds (scale A), produces long and complicated sentences (scale B), mixes up words that sound similar (scale C), explains a past event clearly (scale D), starts conversations with strangers (scale E), uses favourite sentences in contexts where they are inappropriate (scale F), shows variable ability to communicate in different situations (scale G), does not respond to conversational initiatives from others (scale H), verbally hurts others unintentionally (scale I) or shows interests in unusual activities (scale J). Each item is scored

on a four point scale where the informants are asked to judge how often they have observed the described behaviour: a) less than once a week (or never), b) at least once a week, but not every day, c) once or twice a day, and d) several times (more than twice a day) or always. A high raw score reflects poorer performance. In addition a General Communication Composite (GCC), formed by summing the scaled scores of the eight first subscales (A-H), may be calculated. This is an overall measure of communication skills, effective at discriminating children likely to have communication problems from typically developing children. A second composite score is the Social Interaction Deviance Composite (SIDC). This is a difference score, formed by subtracting the sum of the scaled scores of scale A, B, C, and D from the sum of scales E, H, I, J (see Table 2). It is designed to identify children with pragmatic difficulties disproportionate to their structural language abilities (Bishop, 2003; Bishop, Maybery et al. 2006; Helland et al., 2009). If there are missing data for any of the separate scales comprising the SIDC, then this composite is not computed. According to the UK standardization, the SIDC is only to be interpreted if the child also scores below cut-off on the GCC, an exception is scores of -15 or less, as scores this extreme is expected to be clinically significant even if the GCC is within normal limits. The raw scores are converted into standardised scores scaled with a mean of 10 and a SD of 3 by an automated scoring program that comes with the CCC-2 (Bishop, 2003). In the present paper, scaled scores (higher score indicating better performance) are only reported for the GCC and the SIDC. The Norwegian version of the CCC-2 had been evaluated on a sample of 153 children aged 6-12 revealing good internal consistency (alpha ranging from 0.73 to 0.89) (Helland et al., 2009).

Statistical analyses

Group differences for the subscales and the composite scores of the CCC-2 were analyzed using one-way multivariate analyses of variance (MANOVA) with group (three levels) as between factor. Post hoc analyses were conducted using the Bonferroni method.

Results

Based on our previous findings (Helland et al., 2009), a cutoff at or below 64 scaled

scores on the GCC was selected for identifying children with clinically significant

communication problems. In the AD/HD group a total of 23 out of 28 children (82.1 %)

obtained a score this low. The corresponding number in the AS group was 19 out of 21

children (90.5 %). In the TD group only one child out of 28 (3.6 %) scored below cutoff. On

the SIDC, 16 out of the 23 children in the AD/HD group who were identified with

communication problems obtained a score indicative of pragmatic impairment. One additional

child scored in the clinical range even with the GCC within normal limits. In the AS group 16

out of 19 children (missing SIDC scores for two children) obtained a score indicating

pragmatic impairment. The corresponding number in the TD group was one child. Figures 1a

and 1b show the distribution of scaled scores on the GCC and the SIDC in each group.

* Figures 1a and 1b in about here *

The results for the three groups on the CCC-2 are shown in Table 1. MANOVA

revealed significant differences among the three groups on the dependent measures, Wilks'

Lambda .21, F (20,126) = 7.34, $p < .001$. The multivariate η^2 based on Wilks' Lambda was

.54.

CCC-2 scales

The clinical groups differed from the TD group on nine out of ten scales (Table 1). No

significant group difference was found on the scale measuring syntax. On the speech scale,

the AD/HD group differed significantly (being more impaired) from the TD group, whereas

no difference was found between the AD/HD group and the AS group or between the AS

group and the TD group. On the stereotyped language scale and the nonverbal communication

scale the AD/HD group differed significantly from the AS group (the AS group being the

most impaired). Both clinical groups differed significantly from the TD group as well (see

Figures 2a and b). When inspecting the stereotyped language scale it was evident that while none of the typically developing children received a raw score of 4 or more, this was true for 28.6 % of the AD/HD group and 57.1 % of the AS group. On the nonverbal communication scale, a raw score of 4 or more identified 3.6 % of the TD group compared to 50 % of the AD/HD group and 81 % of the AS group.

Figures 2a and 2b in about here

The children in the clinical groups differed from the TD children (being more impaired), but could not be differed from each other, on six scales: semantics, coherence, inappropriate initiation, use of context, social relations and interests.

Table 2 in about here

Composite scores

When the composite scores, the GCC and the SIDC were used as dependent measures, there was also a main effect of group, Wilks' Lambda .31, F (4, 142) = 28.07 $p < .001$, $\eta^2 =$ .44. On the GCC, the TD children obtained the highest ratings (less difficulties). The AD/HD group and the AS group both evidenced significant communication problems compared to the TD group, but the two clinical groups could not be differentiated from each other on this general communication measure. On the second composite score, the SIDC, the AS group, not unexpectedly, differed from the TD group (being more impaired). The children in the AD/HD group could not be differentiated from the children in the TD group on this composite score (Table 2). Although the scores of the AD/HD children were descriptively lower than those of the TD children, this difference failed to reach statistical significance. However, the AD/HD group and the AS group differed significantly from each other, the AS children showing more pragmatic difficulties than the AD/HD group. In the AS group 6 children (31.6 %) had a SIDC score of − 15 or lower compared to 4 children (14.3 %) in the AD/HD group.

Discussion

The aims of the study reported here were to investigate communication impairments in a Norwegian sample of children with AD/HD and children with AS and to explore whether these clinical groups could be distinguished from each other in terms of their language profiles on the Norwegian adaptation of the CCC-2. The main results showed that the vast majority of children with AD/HD as well as those with AS encounter communication impairments. Clinically significant communications problems were identified in 82.1 % of the AD/HD group and in 90.5 % of the AS group; the corresponding number in the TD group was 3.6 %. The two clinical groups could not be differentiated from each other on an overall measure of communication, the GCC, but they both scored significantly lower than the TD group. These results are in line with those of Geurts and Embrechts (2008) who reported that both children with ASD and children with AD/HD had communication impairments compared to typically developing children and that the two clinical groups could not be differentiated from each other on the GCC. On the second composite, the SIDC, 69.6 % of the children in the AD/HD group who were identified as communication impaired, obtained a score indicating more problems with pragmatic language aspects relative to language structure, in the AS group the same applied to 84.7 % of the children. Only one child in the TD group was identified as communication impaired, and this child showed pragmatic impairment. The AS group differed significantly from the AD/HD group as well as from the TD group (more impaired). This finding is in line with previous research showing that the SIDC tend to be lower in children with AS (Bishop, Maybery, et al., 2006; Norbury, Nash, Baird, & Bishop, 2004). Thus it is possible that this composite may give a clinician valuable information when differentiating children with AS and children with AD/HD. On this measure the AD/HD group could not be differentiated from the TD group, although the scores of the AD/HD children were descriptively lower than those of the TD children, this difference

failed to reach statistical significance. It should be noted though, that when used by clinicians the SIDC is not intended to be interpreted in children scoring within the normal range on the GCC (> 64).

The language profiles on the CCC-2 revealed that children with AD/HD could only be differentiated from children with AS on two scales, the stereotyped language scale and the nonverbal communication scale. On these scales the AD/HD group performed better than the AS group. It is possible that these two scales highlight problems that are especially prominent in AS like over-precise pronunciation of word, use of favourite phrases, poor eye contact and lack of facial expression and that they therefore may give additional diagnostic information when identifying children with AS within a clinical context. As children with AD/HD may show some autistic symptoms and children with AS may exhibit problems regarding attention and hyperactivity, it is possible that these scales may help assist in differentiating between the two clinical groups.

It is an interesting finding though, that the communication problems encountered by the clinical groups are not restricted to pragmatics. Problems within three out of four scales measuring language structure/content; speech output, semantics and coherence are evident compared to TD children. This finding is somewhat contradictory to that of Geurts and Embrechts (2008) who found no group differences on speech output, syntax and semantics in a comparable study using the CCC-2. Furthermore, while our AD/HD group was significantly impaired relative to the TD group on the speech output scale, Geurts et al. (2004) found that their AD/HD group did not differ from the normal controls on this scale on parent reports in a study using the original CCC. This may of course reflect differences between the samples, but also the fact that the CCC and the CCC-2 might not be directly comparable. Our findings of relatively unimpaired syntax, no significant differences between the clinical groups and the typically developing group were evident on this scale, is in line with the results

of a former study on a Norwegian sample (Helland and Heimann, 2007). In this study the clinical group (children referred to psychiatric services), differed significantly from the comparison group on all subscales of the original CCC, except the one measuring syntax. Furthermore, Geurts and Embrechts (2008) also reported unimpaired syntax in their study using the CCC-2.

The finding that the AD/HD group and the AS group received similar scores on the social relations and interests scales were somewhat surprising, as these scales are reported to be sensitive to autistic-like behaviors (Bishop, 2003). One might speculate if the social relations problems reported by the AD/HD group in part arise as results of their rather profound impairments in structural as well as pragmatic language aspects; alternatively some children with AD/HD may have underlying difficulties in social understanding comparable to children with AS. The differential diagnosis between AD/HD and AS may be problematic (Geurts et al., 2004) and we only have diagnosis confirmed by clinicians for part of the children in the clinical groups (20 out of 49), as they were assigned to the AD/HD group or the AS group based on parental information. Therefore, we cannot completely exclude the possibility that some children in our sample had co-morbid disorders unknown to us.

The similarities found between the AD/HD group and the AS group on most CCC-2 scales might indicate that a considerable continuity exists between disorders that have traditionally been regarded as rather distinct from one another and that a sharp division between pervasive and specific developmental disorders does not exist (Bishop & Baird, 2001; Bishop & Norbury, 2002; Gilmour, Hill, Place, & Skuse, 2004). An alternative interpretation would of course be that the CCC-2 lacks in specificity for evaluating communicative skills that may distinguish AD/HD from AS.

Strength and limitations

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Several methodological limitations have to be considered when evaluating the results of the present study. The high percentage (82.1 %) of children in the AD/HD group displaying clinical significant communication impairments was somewhat unexpected, although comparable findings are reported in other studies (Bruce et al., 2006; Tannock & Schachar, 1996). It is possible that our findings may in part be due to selection bias. Considering the heterogeneity of children diagnosed with AD/HD, we suspect that parents who were concerned with their children's communication skills may be overrepresented among the respondents in this study. Not knowing whether the children were on medication or not when the CCC-2 evaluation was carried out, is another limitation as one might speculate if medication would lead to improved performance. Furthermore, one has to bear in mind that the diagnosis of AD/HD or AS, the absence of mental retardation as well as the evaluation of the children's communication, are based on parental reports. It is possible that a different pattern would have emerged if confirmed diagnosis had been available for all the children in the clinical groups, if a more comprehensive language assessment using standardized tests had been administered to each child individually and if information of the severity of the children's clinical symptoms and their verbal and nonverbal abilities were available (Geurts & Embrechts, 2008; Helland & Heimann, 2007). However, the results of the children with a confirmed diagnosis (n=20) did not differ from the results of the children with just parent reported diagnosis (n= 29) on the GCC, this indicating that the diagnosis reported by parents are reliable. Furthermore, Bishop & Baird (2001) found parental reports tightly linked to the child's diagnosis in a study using the original CCC. More research is needed to investigate if this applies to the CCC-2 as well. Bishop and Baird (2001) also investigated if the pragmatic composite was related to intellectual abilities. They found that no significant relation existed neither with verbal or nonverbal abilities based on parental reports.

The fact that we do not have any information regarding parental socioeconomic status might also affect our findings. However, Norway enjoys an extensive welfare state with a relatively egalitarian income distribution and most residents have a relatively high standard of living. Due to a combination of high labor marked participation and the universal character of the social security system Norway have few poor residents compared to most other European countries (Halvorsen & Stjernø, 2008). The participating families were residents in rural districts on the west coast of Norway and thus significant differences regarding socioeconomic status among the participants would not be expected. It is an aim for further research to investigate if our findings are replicable if, for instance, all children at an outpatient clinic referred for AD/HD or AS are administered the CCC-2 as part of the standard assessment procedure.

The results of the current study suggests that communication impairments of clinical significance are as common in a group of children with AD/HD as in a group of children with AS. Furthermore, our findings indicate that although a similar pattern appears on most CCC-2 scales, children with AD/HD and children with AS can be distinguished from each other in terms of their language profiles on the scales assessing stereotyped language and nonverbal communication, the AS group being the most impaired. The results reported here underline the importance of routine screening of communication to be performed as part of the assessment procedure for both disorders and before treatment is initiated. At present, this is not the usual procedure in Norway. The area of language and communication is often not assessed at all, and whether or not an evaluation is performed seems heavily dependent on the interests of each individual professional. Therapeutic outcome as well as school achievements might be adversely affected if communication difficulties are not taken into consideration. Children with AD/HD are at risk for developing behavior problems that are often more salient and thus overshadowing less apparent communication problems. Identifying such problems

may contribute to better understanding of the children, thus improving their relationships with teachers and parents which in turn hopefully will prevent even more serious problems to develop.

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Table 1: Means and standard deviations for CCC-2 raw scores (a high score indicates poor performance) for the three groups[1]

	Groups						Main effect		
	TD		ADHD		AS				
Gender (male/female)	21/7		21/7		15/4				
	M	SD	M	SD	M	SD	$F(2,72) =$	η^2	Post hoc
A. Speech	0.07	0.26	2.18	3.33	1.00	1.86	6.10**	.15	AD/HD > TD **
B. Syntax	0.50	0.92	2.14	2.76	2.37	2.41	5.77**	.14	n.s
C. Semantics	1.25	1.30	5.75	3.08	5.68	2.80	28.69***	.44	AD/HD, AS > TD***
D. Coherence	0.89	1.34	6.71	4.21	7.58	3.58	32.18***	.47	AD/HD, AS > TD***
E. Inappropriate initiation	2.11	2.08	8.71	4.44	11.37	4.14	41.94***	.54	AD/HD, AS > TD***
F. Stereotyped language	0.50	0.69	3.54	2.99	6.16	3.86	25.64***	.42	AS >AD/HD** > TD**
G. Use of context	0.86	1.18	6.29	3.67	9.16	5.57	32.09***	.47	AD/HD, AS > TD***
H. Nonverbal communication	0.96	1.82	4.46	2.98	9.16	4.75	37.28***	.51	AS > AD/HD*** > TD***
I. Social relations	0.79	1.29	6.61	3.90	8.11	4.59	32.34***	.47	AD/HD, AS > TD***
J. Interests	1.79	1.66	7.43	3.56	10.05	4.17	42.70***	.54	AD/HD, AS > TD***

**$p < .01$; *** $p <.001$ [1] Due to the fact that the MANOVA procedure excludes data on all dependent variables for an individual if a score is missing on any dependant

variable, the analyses for the AS group are based on 19 individuals although the group in fact consisted of 21 individuals.

Table 2: Group means and standard deviations for the GCC and the SIDC scaled scores (a high score indicates better performance)

	Groups								
	TD		ADHD		AS				
Gender (male/female)	21/7		21/7		15/4		Main effect		
	M	SD	M	SD	M	SD	$F(2,72) =$	η^2	Post hoc
GCC	85.25	12.15	48.32	17.32	40.74	16.24	61.49***	.63	AD/HD, AS < TD***
SIDC	.00	5.61	- 3.86	9.40	- 11.16	7.90	11.69***	.25	AS < AD/HD, TD ***

*** $p < .001$
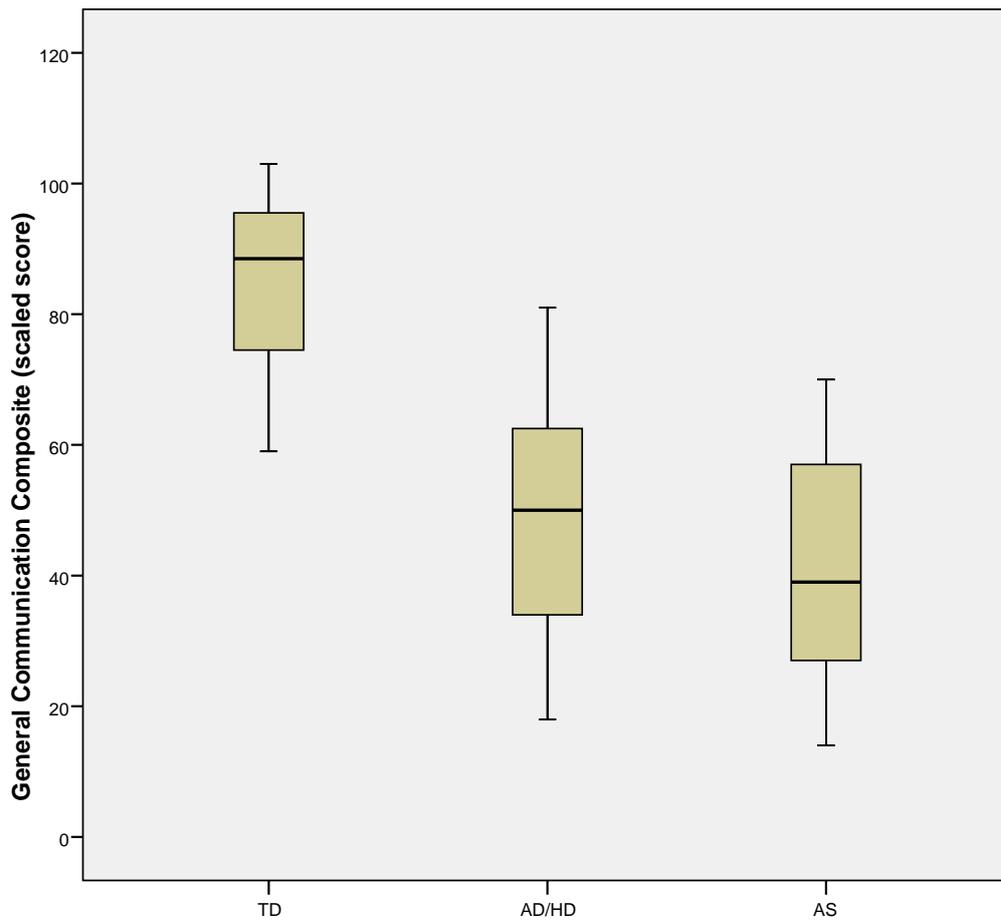
Figure 1a

Boxplot showing distribution of scaled scores on the General Communication Composite

(GCC) measuring clinically significant communication problems for three groups of children:

Typically developing (TD), children with AD/HD and children with Asperger syndrome

(AS). Low scores indicating impairment with the AD/HD and the AS groups scoring
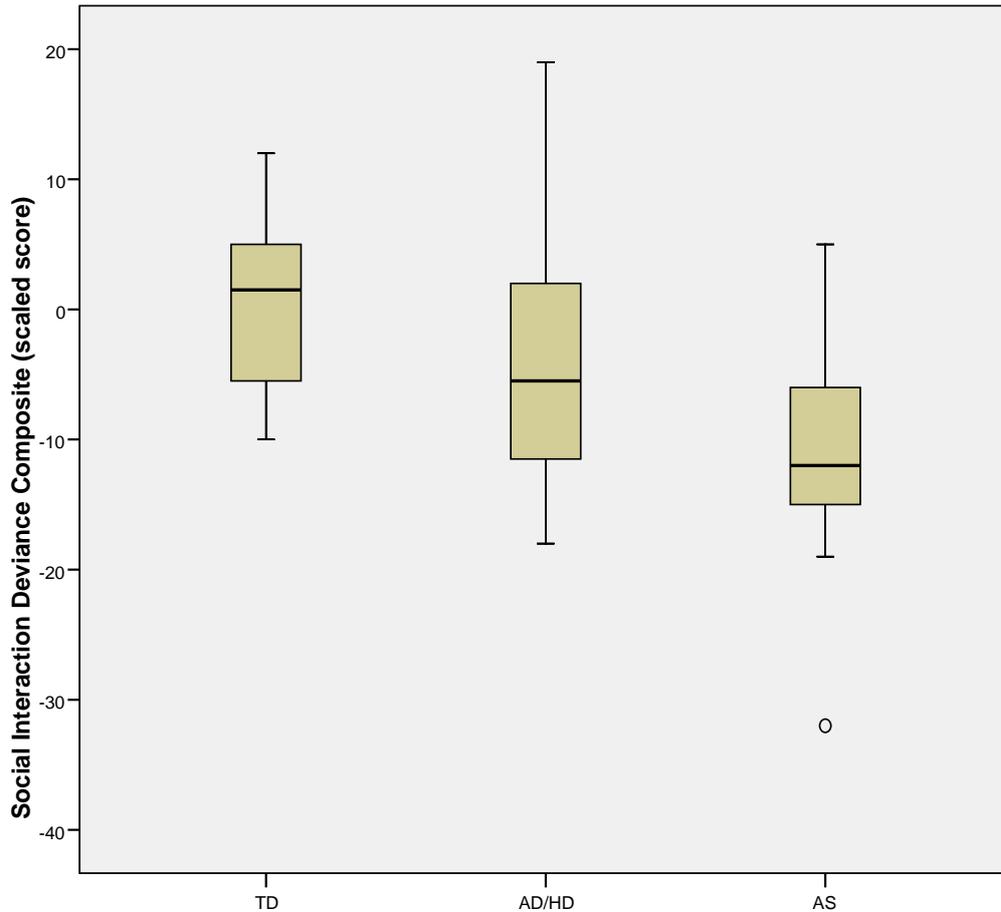
significantly lower than the TD group.

Figure 1b

Boxplot showing distribution of scaled scores on the Social Interaction Deviance Composite
(SIDC) measuring pragmatic difficulties for the three groups of children: Typically
developing (TD), children with AD/HD and children with Asperger syndrome (AS). Low
scores indicating impairment with the AS group scoring significantly lower than the TD and
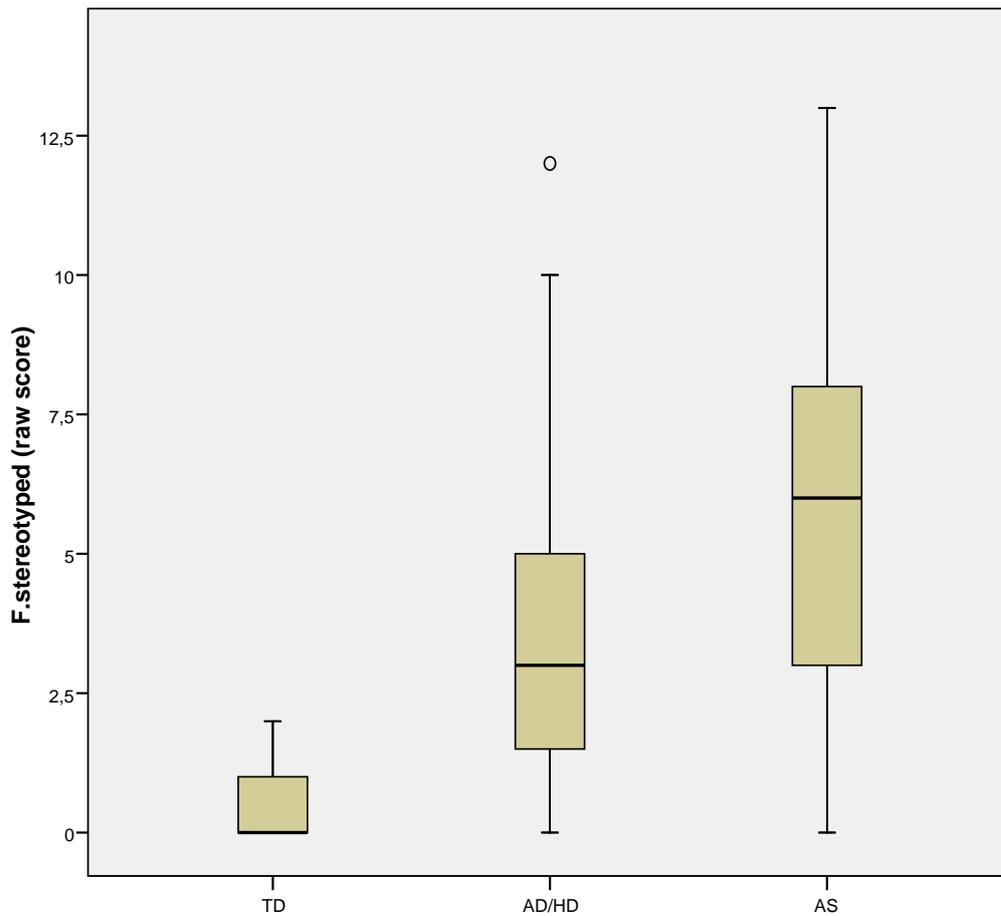the AD/HD groups.

Figure 2a

Boxplot showing distribution of raw scores on the stereotyped language scale for three groups of children: Typically developing (TD), children with AD/HD and children with Asperger syndrome (AS). High scores indicating impairments. All groups significantly different from each other.
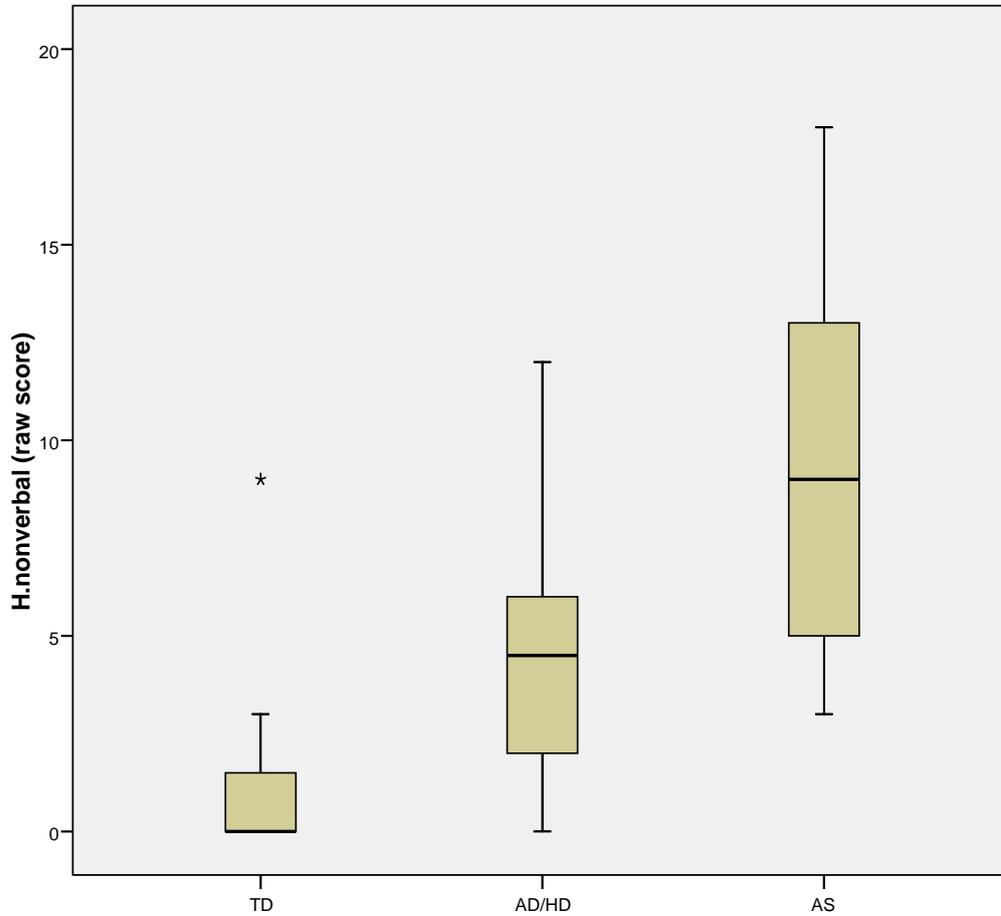
Figure 2b

Boxplot showing distribution of raw scores on the nonverbal communication scale for three groups of children: Typically developing (TD), children with AD/HD and children with Asperger syndrome (AS). High scores indicating impairments. All groups significantly different from each other.

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