

A DIFFERENTIAL APPROACH FOR EXAMINING THE BEHAVIORAL PHENOTYPE OF FETAL ALCOHOL SPECTRUM DISORDERS

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ABSTRACT

Background

In 2006, Nash and colleagues published results suggesting that individual items from the Child Behavior Checklist (CBCL) could be used as a screening tool that was highly sensitive in differentiating children with FASD from controls and children with Attention Deficit Hyperactivity Disorder (ADHD). Since many of the items referred to features of Oppositional Defiant/Conduct Disorder (ODD/CD), it was not clear whether the items reflected comorbidity with ODD/CD, or were unique to children with FASD.

Objectives

The present study sought to replicate the results of our 2006 paper using a new and larger sample, which also includes a group of children diagnosed with ODD/CD.

Methods

Retrospective psychological chart review was conducted on 56 children with FASD, 50 with ADHD, 60 with ODD/CD, and 50 normal control (NC) children. Receiver operating characteristic curve (ROC) analysis of CBCL items discriminating FASD from NC was used to compare FASD to the ADHD and ODD/CD groups.

Results

ROC analyses showed scores of a) 3 or higher on 10 items differentiated FASD from NC with a sensitivity of 98%, specificity of 42% and b) 2 or higher on 5 items reflecting oppositional behaviors differentiated FASD from ADHD with a sensitivity of 89% and specificity of 42%.

Conclusion

Our findings partially replicate the results of our 2006 study and additionally elucidate the behavioural differences between children with FASD and those with ODD/CD. The proposed screening tool is currently the only tool available that is empirically derived and able to differentiate children with FASD from children with clinically similar profiles.

Key Words: *Fetal alcohol spectrum disorder, screening, attention deficit hyperactivity disorder, oppositional defiant, conduct disorder*

Alcohol is a powerful teratogen with significant effects on the developing brain. The various conditions arising from prenatal alcohol exposure, such as Fetal Alcohol Syndrome (FAS) and Alcohol Related Neurodevelopmental Disorder (ARND), are known collectively as Fetal Alcohol Spectrum Disorders (FASD). Individuals with FASD often

show a profile of reduced IQ^{1,2}, cognitive and learning disabilities³ and severe behavior problems.⁴ Attention problems are among the most prevalent⁵⁻⁸ with approximately 70% of children with FASD having a clinically diagnosed attention disorder.⁹ Indeed, attention deficit/hyperactivity disorder (ADHD) is 3 - 9 times higher in children with FASD than the

general population.⁵ Moreover, children with FASD are also at high risk for other forms of psychopathology⁹⁻¹¹ with oppositional defiant/conduct disorder (ODD/CD) being the next most common to ADHD.^{12,13}

Not surprisingly, children with FASD show many of the same behavior problems as children with ODD/CD, including deficits in moral development¹⁴, lack of social judgment^{5,15}, and failure to learn from experience.¹ While studies using parent and teacher questionnaires also report attention and disruptive behavior problems⁴, no study has directly compared the behavioral profiles of children with FASD to those with ODD/CD. Given that information regarding the specific profile of behavior disturbance in children with FASD is essential for a differential diagnosis, a comparison of the behavior problems between children with FASD and other psychopathologies is warranted. Indeed, many children with FASD are diagnosed with other psychopathological conditions such as ADHD or ODD/CD, which do not truly reflect the strengths and weaknesses unique to FASD and may affect treatment.⁹

A large proportion of individuals with FASD require extensive mental health services throughout their lifetime, therefore the costs associated with FASD are staggering. In Canada it is estimated that \$344 million is spent annually on affected youth.¹⁶ Given that incarceration and difficult-to-measure costs such as, lost productivity, alcoholism, and poor quality of life, are excluded from these estimates - the actual cost of FASD is likely much higher.¹⁷ In view of an early landmark paper reporting that diagnosis at a young age was a significant factor in reducing these later secondary adverse outcomes, due to earlier entry into the mental health or special education system.¹⁸ It is essential that children need to be identified earlier. Unfortunately, a large proportion of children with FASD fail to receive any diagnosis because skilled professionals and adequate mental health services are often lacking, especially if children reside in rural and remote areas, which represents an important public health concern.

Screening instruments are effective tools that can help expedite the diagnostic process by identifying children most in need of a

comprehensive evaluation. To be effective, however, a screening tool must be sensitive and specific to the effects of prenatal alcohol exposure, easy to administer, applicable in a variety of contexts, and culturally appropriate.¹⁹ Because children with FASD are often diagnosed and treated for a comorbid disorder rather than for FASD, the effects of the alcohol-related disorder is often overlooked and not treated. Therefore, to be able to differentially diagnose children on the FASD spectrum from those with other psychiatric disturbances of childhood is critical; however, techniques to do so are not readily available.

Pen-and-paper questionnaires that can be readily completed by parents and caregivers offer an effective method of FASD screening and so can serve as a first step to determine whether or not a child truly warrants being seen by a team of specialists required to conduct the necessary assessment. While such an approach has been effective in identifying other mental health disorders such as depression²⁰ and alcoholism²¹, its suitability for children with FASD has only recently been considered.²² As part of this effort, we developed a 10-item screening tool based on items from a standardized behavior problems questionnaire known as the Child Behavior Checklist (CBCL). We compared children with FASD to children with ADHD and typically developing children.²³ However, many of the items reflected features of ODD/CD. We were not certain whether the particular set of items comprising our tool reflected comorbidity with ODD/CD, or represented a unique and distinct feature of FASD. Consequently, a tool is required that accurately and reliably differentiates a diagnosis on the FASD spectrum from other childhood disorders, particularly ODD/CD.

To address these outstanding issues, we sought to: 1) replicate our 2006 paper using a larger and different sample of children with FASD, children with ADHD, and controls and 2) further determine the specificity of our screening tool by also comparing the FASD group with children with ODD/CD. Our ultimate goal was to construct a valid and reliable screening tool for FASD capable of differentiating children with FASD from other childhood psychopathologies including ODD/CD.

METHODS

Participants

The sample included 220 children aged 6 to 18 years, 56 with an FASD, 50 with ADHD, 60 with ODD/CD and 53 typically developing normal control (NC) children. The FASD group was recruited from the Motherisk Follow-up Clinic, which is located at The Hospital for Sick Children in Toronto. Children were brought to this clinic because their caregivers were concerned about whether the child's prenatal alcohol exposure was contributing to his or her presenting behavior problems.²⁴ In most cases seen our clinic, problematic drinking led to heavy prenatal alcohol exposure. In this clinic, an FAS or ARND diagnosis is based on the Canadian diagnostic guidelines¹⁹, which were derived from the Washington 4-digit code²⁵ and IOM criteria²⁶, but designed to provide more specific criteria for behavioural characteristics. The Motherisk approach requires the children to have ARND as specified by the Canadian system, with or without the physical symptomatology. If the child presents with both significant facial and growth features the child is considered to have FAS.

Following detailed neuropsychological and speech language assessments, the psychological team assigns children scores based on their performance. A score of '4' requires an IQ below 70, and three significant areas of deficit, as specified by the Canadian Guidelines. A score of '3' requires an IQ above 70, with at least three significant areas of deficit; a score of '2' requires an IQ above 70 with at least 2 significant areas of deficit; and a score of '1' requires an IQ above 70 and no more than one significantly deficient area. A diagnosis of ARND requires a score above 3. To be diagnosed with FAS a child must present with the physical symptomatology, and have a score of 1 or above.

To be included in the FASD group, children had to have a documented history of prenatal exposure to alcohol and a diagnosis of ARND, as indicated by a score of 3 or 4, or FAS. Five children had a score of 4, and, also met criteria for FAS, while remaining children had a score of 3, and were diagnosed as ARND. While 100% of children in the FASD group were exposed to alcohol, 44.6% were additionally exposed to drugs

(Table 1). Children were excluded if their exposure history was unconfirmed, their primary exposure was to a substance other than alcohol (e.g., cocaine, heroin, marijuana), or their score was 2 or below. As is importantly highlighted²⁷, several diagnostic centres use different nomenclature to refer to different diagnostic categories on the FASD spectrum. Therefore, in an effort to maintain consistency among different diagnostic centres, a score of 3 is similar to either an ARND or p/FAS diagnosis, while a score of 4 is similar to an FAS diagnosis. 'Brain' scores of 1 and 2 are indicative of PAE, without meeting diagnostic criteria based on the Canadian guidelines.

The ADHD group consisted of 50 children recruited through a data pool of previous ADHD participants in our laboratory. All children had received an ADHD diagnosis using DSM-IV-TR criteria. All children had a previous diagnosis of ADHD, from a developmental pediatrician (MD), psychiatrist (MD), or clinical psychologist (PhD), at the time their parents completed the CBCL. Diagnosis was made using a combination of clinical interview, parent questionnaires, teacher questionnaires, and formal psychological testing. Any child with a history of prenatal drug or alcohol exposure, defined as > than 2 drinks during pregnancy, was excluded from this study, which was ascertained from family history forms, and interview records in the child's medical chart. At time of recruitment, 30 children were taking medications, 12 were not - medication status of the remaining eight children was not available.

The ODD/CD group comprised 60 children whose assessment records were ascertained through the Youthdale Treatment Centre who were attending as outpatients, between January 2004 and March 2006 and whose parents provided written consent for their child's clinical data to be used for research purposes. Only children with a confirmed primary diagnosis of ODD or CD, using DSM-IV-TR criteria were included. All children had a diagnosis of ODD/CD, from a developmental pediatrician (MD), psychiatrist (MD), or clinical psychologist (PhD) at the time their caregivers completed the CBCL. Diagnosis was made using a combination of clinical interview, parent questionnaires, teacher questionnaires, and formal psychological testing.

Excluded were children with a history of prenatal drug or alcohol exposure, which was ascertained from family history forms, and interview records in the child's medical chart. Approximately 30% of cases met this criteria and another 20% were excluded because we did not have sufficient validation of the child's prenatal exposure history. Thirty-one of the children had a co-morbid diagnosis of ADHD, 25 of whom were taking medication for their attention problems; 43 children were on medication for their behavior problems.

The NC group consisted of 53 previous control participants in other studies in our laboratory. Excluded were children with a history of prenatal drug or alcohol exposure, and a diagnosis of ADHD or ODD/CD. All procedures were approved by the Research Ethics Boards of both, The Hospital for Sick Children and Youthdale Treatment Centre.

Procedures

For all groups, information was obtained via retrospective chart review on maternal learning disabilities, paternal substance abuse, maternal psychiatric history, paternal psychiatric history, adoption or foster care, number of foster care placements, abuse, neglect, and socioeconomic status (SES; measured using the Hollingshead Four-Factor Index). From each child's chart, relevant CBCL data were extracted for each case using the items from our previous screener.²³

Data Analyses

Analysis of variance (ANOVA) and chi-square tests were used to compare groups on demographic variables. As a first step, we compared endorsement rates for pairs of groups (FASD vs. NC, FASD vs. ADHD, FASD vs. ODD/CD) using the chi-square test. Receiver Operating Characteristic (ROC) curve analyses were then performed for different group pairs

using the sum of items most strongly differentiating each pair. Area-under-the-curve (AUC) values were used to classify cases as being FASD or NC, FASD or ADHD, and FASD or ODD/CD based on the number of endorsed items and critical cutoff values. ROC analyses provide two important measures: 'sensitivity,' which measures the proportion of actual positives which are correctly identified as such (e.g. the percentage of exposed children who are correctly identified as having the condition), while 'specificity' measures the proportion of negatives which are correctly identified (e.g. the percentage of unexposed children who are correctly identified as not having the condition).

RESULTS

Demographic Information

Table 1 presents the demographic data for the four groups and Table 2, detailed information for the FASD group. Most children in the FASD group were in foster care and had received more than one placement. Abuse and neglect were common and seen in 52% and 63% of FASD cases respectively. Groups differed significantly in gender [$\chi^2(3) = 9.7, p < .03$] with the ADHD group having the highest male to female ratio (4:1), which reflects usual prevalence rates for ADHD in the general population. There was a significant effect of age, [$F(3, 210) = 27.0, p < .01$] with children in the ODD/CD being significantly older than children in the FASD, ADHD and NC groups. There was also a significant effect of SES, [$F(3, 199) = 23.8, p < .00$] reflected in children in the NC and ADHD having significantly higher SES than children in the FASD and ODD/CD groups. Lastly, children in the FASD group were significantly more likely to have been exposed to cigarettes compared to children with ADHD, ODD/CD and NC's [$\chi^2(3) = 97.5, p < .00$].

TABLE 1 Demographic Information

	FASD (n=56)	ADHD (n=50)	ODD/CD (n=61)	NC (n=53)	p-value
Age	10.87 (SD 2.75)	9.36 (SD 1.70)	12.90 (SD 1.59)	9.81 (SD 2.41)	<.001
Gender (% Male)	62	82	59	54.7	<.01
SES (%)¹					
High ²	26.8	46.0	27.1	83.3	<.001
Medium ³	41.1	30.0	49.2	16.7	
Low ⁴	32.1	24.0	23.7	0	
Cigarette Exposure (%)					
Yes	41.1	8.0	8.2	3.8	<.001
No	3.6	50.0	91.8	96.2	
Unknown	53.6	42.0	0	0	
Attention Meds (%)					
Yes	55.4	60.0	41.0	0	<.001
No	44.6	24.0	59.0	100	
Unknown	0	2.0	0	0	
Psychiatric Meds (%)					
Yes	32.1	8.0	70.5	7.5	<.001
No	53.6	54.0	29.5	92.5	
Unknown	14.3	62.0	0	0	

¹SES data not available for all children; ²SES = 1 or 2; ³SES = 3; ⁴SES = 4 or 5

TABLE 2 Background Characteristics of Clinical Groups (%)

Family Status	FASD (n = 56)	ADHD (n = 50)	ODD/CD (n = 60)	p-value
Foster	67.8	0	42.6	p < .000
Adopted	30.3	2.0	1.6	p < .000
Biological Parent	2.0	98.0	65.8	p < .000
Exposure History				
Alcohol Only	16.1	0	0	p < .000
Alcohol and Drugs	44.6	0	0	p < .000
Cigarettes	8.0	8.0 ¹	8.2	p < .000
Abuse History				
Abuse	51.8	2.0	37.7	p < .000
Neglect	62.5	2.0	1.6	p < .000
Foster Care Placements				
0	1.8	0	57.4	p < .000
1	41.1	0	1.6	p < .000
>1	53.1	0	54.0	p < .000

Group Differences on Individual CBCL Items

Findings from the Greenbaum (2000) study were used to select individual items from the CBCL questionnaire²⁸ to be studied presently. In that study, endorsement rates were defined accordingly: 1 if the item was endorsed as Somewhat True, 2 if the item was endorsed as Very True, or 0 if a child received a Not True rating. Using this approach, we also identified the same 12 items as having higher endorsement rates in FASD than NC:

- “acts too young for his/her age”
[$\chi^2(1) = 15.7, p < .01$],
- “argues a lot”
[$\chi^2(1) = 34.0, p < .01$],
- “can’t concentrate/pay attention for long”
[$\chi^2(1) = 58.0, p < .01$],
- “can’t sit still, restless/hyperactive”
[$\chi^2(1) = 43.2, p < .01$],
- “cruelty, bullying, meanness to others”
[$\chi^2(1) = 16.5, p < .01$],
- “disobedient at home”
[$\chi^2(1) = 29.4, p < .01$],
- “doesn’t seem to feel guilty after misbehaving”
[$\chi^2(1) = 14.4, p < .01$],
- “impulsive acts without thinking”
[$\chi^2(1) = 35.4, p < .01$],
- “showing off/clowning”
[$\chi^2(1) = 35.2, p < .01$],
- “steals at home”
[$\chi^2(1) = 24.5, p < .01$],
- “steals outside”
[$\chi^2(1) = 12.7, p < .01$], and
- “lying/cheating”
[$\chi^2(1) = 7.6, p < .01$].

FASD also had significantly higher endorsement rates than ADHD for the following five items:

- “acts young”
[$\chi^2(1) = 5.0, p < .03$],
- “cruelty bullying, meanness to others”
[$\chi^2(1) = 8.7, p < .00$],
- “doesn’t seem to feel guilty after misbehaving”
[$\chi^2(1) = 17.7, p < .00$],
- “steals at home”
[$\chi^2(1) = 17.0, p < .00$], and
- “steals outside the home”
[$\chi^2(1) = 9.7, p < .00$].

Groups did not differ on the following items:

- “argues a lot”
[$\chi^2(1) = 0.82, p = .37$],
- “can’t concentrate/pay attention for long”
[$\chi^2(1) = 1.6, p = .21$],
- “can’t sit still; restless/hyperactive”
[$\chi^2(1) = 1.6, p = .21$],
- “disobedient at home”
[$\chi^2(1) = 1.7, p = .19$],
- “impulsive acts without thinking”
[$\chi^2(1) = 1.5, p = .22$],
- “showing off/clowning”
[$\chi^2(1) = 0.69, p = .41$], and
- “lying/cheating”
[$\chi^2(1) = 0.36, p = .55$].

Children in the FASD group received a higher score than ODD/CD on only one item, namely “acts young” [$\chi^2(1) = 7.2, p < .01$]. In contrast, ODD/CD were found to have higher endorsement rates than FASD on “cruelty, bullying, meanness to others” [$\chi^2(1) = 2.2, p < .02$] and “steals at home” [$\chi^2(1) = 8.0, p < .01$]. Groups did not differ on the following items:

- “argues a lot”
[$\chi^2(1) = 1.2, p = .27$],
- “can’t concentrate/pay attention for long”
[$\chi^2(1) = 0.26, p = .61$],
- “can’t sit still, restless/hyperactive”
[$\chi^2(1) = 43.2, p < .01$],
- “disobedient at home”
[$\chi^2(1) = 29.4, p < .01$],
- “doesn’t seem to feel guilty after misbehaving”
[$\chi^2(1) = 0.0, p = .96$],
- “impulsive acts without thinking”
[$\chi^2(1) = 0.47, p = .49$],
- “showing off/clowning”
[$\chi^2(1) = 0.01, p = .91$],
- “steals outside”
[$\chi^2(1) = 2.4, p < .01$], and
- “lying/cheating”
[$\chi^2(1) = 0.23, p = .63$].

Descriptive statistics for all groups are presented in Table 3. In order to address the issue of comorbidity of ADHD in the ODD/CD group, additional chi square analyses were completed to the exclusion of the children with both ODD/CD and ADHD. Children with FASD continued to have significantly more endorsements on the item “acts young” [$\chi^2(1) = 13.5, p < .01$], while children

in the ODD/CD group had higher endorsement rates for being “disobedient at home” [$\chi^2(1) = 4.1, p < .05$]. The previously significant items “cruelty, bullying, meanness to others” [$\chi^2(1) = 0.13, p = .72$] and “steals at home” [$\chi^2(1) = 1.7, p = .19$], were no longer significant. Descriptive statistics are presented in Table 4.

TABLE 3 Endorsement Rates for Individual CBCL Items

	FASD (%)	ADHD (%)	ODD/CD (%)	NC (%)	FASD vs. ADHD	FASD vs. ODD/CD	FASD vs. NC
Acts too young for his/her age	80.4	64.0	60.7	24.5	<.05	<.05	<.001
Argues a lot	94.6	90.0	98.3	34.0	ns	ns	<.001
Can't concentrate/pay attention for long	92.9	98.0	95.1	24.5	ns	ns	<.001
Can't sit still/restless hyperactive	83.9	92.0	83.6	24.5	ns	ns	<.001
Cruelty/bullying/meanness to others	66.1	38.0	85.2	5.7	<.01	<.05	<.001
Disobedient at home	87.5	78.0	98.3	24.5	ns	<.05	<.001
Doesn't seem to feel guilty after misbehaving	83.9	44.0	86.9	11.3	<.001	ns	<.001
Impulsive acts without thinking	94.6	88.0	95.1	30.2	ns	ns	<.001
Lying/cheating	82.1	74.0	91.8	17.0	ns	ns	<.001
Showing off clowning	86.4	74.0	75.4	26.4	ns	ns	<.001
Steals at home	66.1	26.0	60.7	1.9	<.001	ns	<.001
Steals outside the home	46.4	18.0	44.2	1.9	<.01	ns	<.001

TABLE 4 Endorsement Rates for Individual CBCL Items for the FASD group and ODD/CD Group Without a Comorbid ADHD Diagnosis Only

	FASD n = 56(%)	ODD/CD n = 31(%)	p-value
Acts too young for his/her age	80.4	45.0	<i>p</i> <.01
Argues a lot	94.6	96.8	<i>p</i> =.65
Can't concentrate/pay attention for long	92.9	93.5	<i>p</i> =.98
Can't sit still/restless hyperactive	83.9	71.0	<i>p</i> =.15
Cruelty/bullying/meanness to others	66.1	71.0	<i>p</i> =.72
Disobedient at home	87.5	97.7	<i>p</i> <.05
Doesn't seem to feel guilty after misbehaving	83.9	90.3	<i>p</i> =.40
Impulsive acts without thinking	94.6	90.3	<i>p</i> =.45
Lying/cheating	82.1	90.3	<i>p</i> =.31
Showing off clowning	86.4	70.0	<i>p</i> =.28
Steals at home	66.1	51.6	<i>p</i> =.19
Steals outside the home	46.4	46.4	<i>p</i> =.89

Formulation of a Screening Tool

To create the screening tool, our next step involved identifying specific items differentiating the various groups and then submitting them to ROC analyses. As shown in Figure 1, a comparison of FASD and NC groups indicated the largest Area Under the Curve (AUC) was achieved with .970 ($p < .001$); using a cutoff of 3 of 10 items, we were able to achieve sensitivity of 98% and specificity of 42%. It is important to note that although chi square analysis revealed 12 items to be significant, when submitted to a more rigorous statistical method designed for predicting group membership rather than measuring group

differences, only 10 of those 12 items were significant, thus producing the largest area under the curve. When compared with ADHD, the largest AUC was achieved with .78 ($p < .001$); using a cutoff of 2 out of 5 items, we attained sensitivity of 89% and specificity of 54% (Figure 2). A comparable ROC analysis could not be conducted between FASD and ODD/CD groups because only one item differentiated them; however, information from the chi-square analyses of items differentiating groups were used in formulating the tool. Table 5 shows our 3-step screening tool approach.

FIG. 1 ROC Curve Showing Items Most Strongly Discriminating Children with FASD from Controls

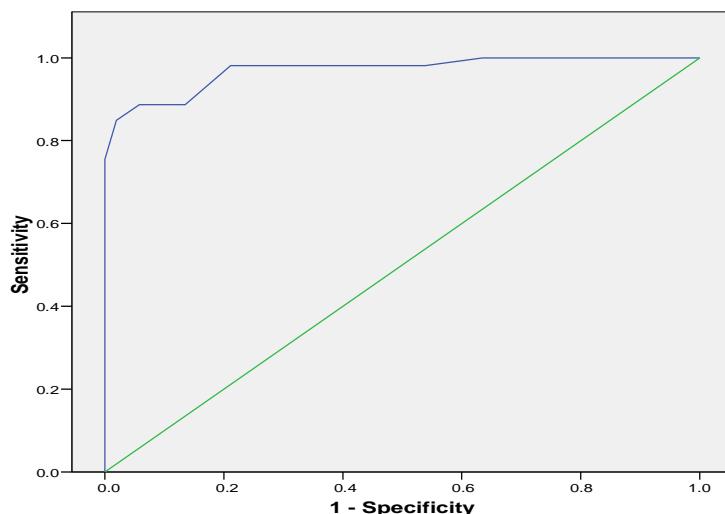
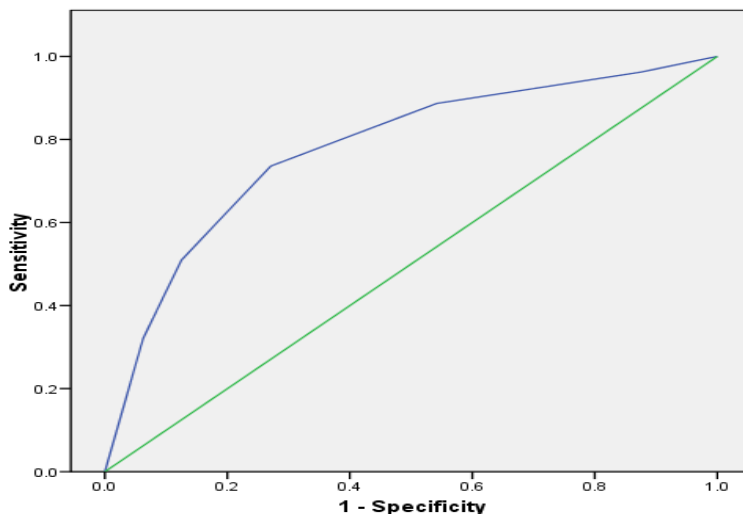


FIG. 2 ROC Curve Showing Items Most Strongly Discriminating Children with FASD from ADHD



The Neurobehavioural Screening Tool (NST) form is designed to be administered for caregivers of children and youth suspected of having a Fetal Alcohol Spectrum Disorder based on behavioral observations. The caregiver should know the child well enough to be able to answer all questions contained in NST. The form should be administered to the respondent by a qualified

health and social service professional, such as a social worker, law enforcement personnel, psychologist, or child and youth worker in the context of a clinical interview. The form should not be scored by the caregiver. The user should explain that the aim of the form is to gain a picture of the child's behaviour within the last 6 months (Table 5).

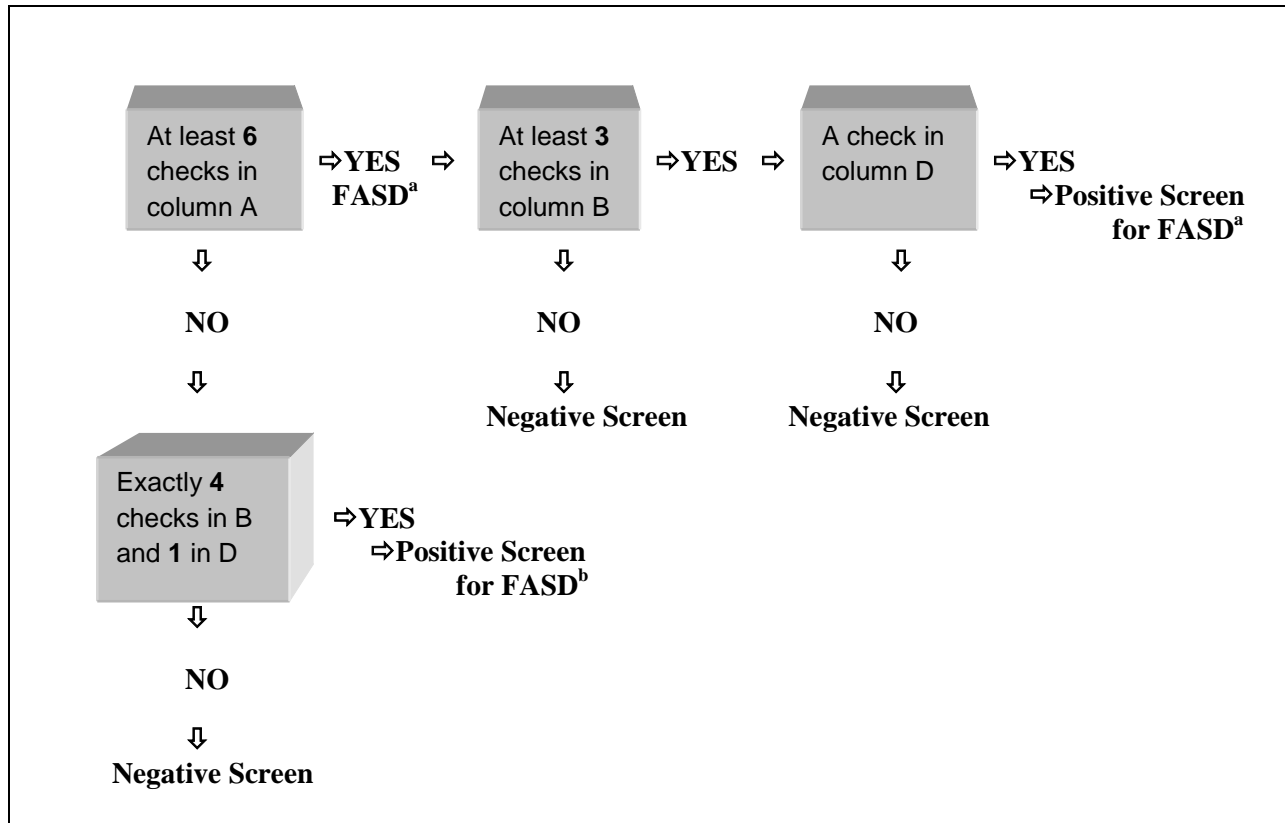
TABLE 5 Neurobehavioural Screening Tool (NST): Guidelines and Scoring

<p>1) Has your child been seen or accused of or thought to have act too young for his or her age? Place a checkmark <input checked="" type="checkbox"/> in all columns if 'YES' was endorsed</p>	YES	NO
<p>2) Has your child been seen or accused of or is thought to be disobedient at home? Place a checkmark <input checked="" type="checkbox"/> in columns 'A' and 'C' if 'YES' was endorsed</p>	YES	NO
<p>3) Has your child been seen or accused of or is thought to lie or cheat?</p>	YES	NO
<p>4) Has your child been seen or accused of/ or is thought to lack guilt after misbehaving? Place a checkmark <input checked="" type="checkbox"/> in columns 'A' and 'C' for each 'YES'</p>	YES	NO
<p>5) Has your child been seen or accused of or thought to have difficulty concentrating, and can't pay attention for long?</p>	YES	NO
<p>6) Has your child been seen or accused of or is thought to act impulsively and without thinking?</p>	YES	NO
<p>7) Has your child been seen or accused of or is thought to have difficulty sitting still is restless or hyperactive? Place a checkmark <input checked="" type="checkbox"/> in column 'A' for each 'YES' endorsed</p>	YES	NO
<p>8) Has your child been seen or accused of or is thought to display acts of cruelty, bullying or mean?</p>	YES	NO
<p>9) Has your child been seen or accused of or is thought to steal items from home?</p>	YES	NO
<p>10) Has your child been seen or accused of or is thought to steal items outside of the home? Place a checkmark <input checked="" type="checkbox"/> in column 'B' for each 'YES' endorsed</p>	YES	NO

A	B	C	D

SCORING STEPS

The NST must be scored according to the following steps



Statistical Properties

Positive Screen (a): Separates FASD from typically developing children with a 14% false positive rate and 18% false negative rate (sensitivity 86% & specificity 82%) and from children with ADHD with a 19% false positive rate and 28% false negative rate (sensitivity 81% & specificity 72%).

Positive Screen (b): Separates FASD, without ADHD symptoms, from typically developing children with a 30% false positive rate and a 20% false negative rate (sensitivity 70% & specificity 80%).

Note: If box 'D' is not checked this screener cannot separate FASD from ODD/CD.

DISCUSSION

The present study, using a different sample of children, partially replicated the results of our previous findings²³. Examination of individual item scores revealed that children with FASD differed from NC in behaviors reflecting immaturity, argumentativeness, inattention, and general disobedience. Although children with ADHD and ODD/CD showed many of the same behavior problems as children with FASD, children with ADHD were less likely than those with FASD to have behavior problems and act young; in contrast, children with ODD/CD were less likely than FASD to act young but were more cruel and disobedient at home.

Thus we were able to corroborate our previous findings in a different sample of children. Our present findings indicate that the same CBCL items from our previous study were highly discriminative of FASD and NC groups and that certain combinations of items differentiated children with FASD from unexposed children with ADHD and ODD/CD. This consistency, despite our using different children in each study, signifies these characteristics are consistent across different samples of children with FASD, validating this screening method. Also consistent with our previous work²³, we found that children with FASD exhibited poor attention and behavior suggestive of ADHD, but unlike ADHD displayed a greater lack of guilt after misbehaving, cruelty, tendency to act young for their age, and likelihood to steal. The latter finding supports previous research indicating poor social and moral development in children with FASD.^{13,14,29,30}

The present study, which for the first time included an ODD/CD comparison group, serves to address the outstanding question from our previous work²³ concerning whether the items differentiating FASD from ADHD reflected comorbidity with ODD/CD or were unique to FASD. Our results now show that children with FASD are significantly more likely than ODD/CD to act young, while being somewhat less disobedient at home and cruel. This finding suggests children with FASD may have a distinct profile of behavior problems from that seen in ODD/CD. Our finding of greater immaturity in children with FASD than ODD/CD (as well as

ADHD) is consistent with previous reports of arrested social development in this population.^{31,32} However, future studies with a larger sample are needed to determine if additional behavioural differences exist between FASD and ODD/CD. As well as, determine the extent to which the greater social immaturity observed in FASD can be attributed to poor cognitive abilities.

Given the issue of comorbidity with ADHD in the ODD/CD group, an additional analysis was completed without the comorbid group. While the FASD group continued to show endorsements for “acts young,” endorsements on cruelty, or stealing, no longer typified the ODD/CD group, which was instead rated as being significantly more disobedient at home. One reason for this change in items could reflect the fact that children meeting criteria for both ADHD and ODD/CD have more severe behavior problems overall.

The authors feel it is critical to highlight the fact that the NST is intended for screening purposes only and is not a diagnostic tool. It is essential that the rater of the NST be a caregiver who has known the child for at least 6 months, within the context of a home environment. The NST should be administered to the rater by a qualified health and social service professional, such as a social worker, law enforcement personnel, psychologist, or child and youth worker in the context of a clinical interview. Due to the sensitive nature of the screening process, and that the NST has only been validated for rating by caregivers, there is not yet an NST for use with other raters, who may also know the child well, such as teachers.

A number of limitations impede our having a full understanding of how prenatal alcohol exposure affects development, as is characteristic of most clinic-based research. First, because most children with FASD are not in the care of their biological mothers, exact information on dosage and timing of alcohol exposure was not available. Second, women who abuse alcohol typically smoke cigarettes. High rates of nicotine abuse alone have been shown to have negative postnatal consequences, while alcohol in combination with nicotine has been shown to increase these risks.^{33,34} In the current study, we could not adequately control for this factor because a confirmed history of smoking was unavailable in many cases.

Several methodological limitations are also specific to the current study. Since data were collected retrospectively, certain background information was not available, particularly for the ADHD group. Finally, because the proposed screening tool is intended to be used as a screening instrument, variables important at the stage of diagnosis, such as age, family histories, and SES were not controlled for in the analyses.

CONCLUSION

In summary, the present study identified a set of behavioral characteristics that distinguished children with FASD from children with two commonly associated childhood disorders, namely ADHD and ODD/CD. Clinicians and researchers working with children with FASD have long struggled to find appropriate interventions that meet the specific and diverse needs of this population, which may in part from the fact that the core disabilities of FASD are poorly understood. Our present work aimed at developing a screening tool, provided critical and unique information delineating the FASD profile from other psychopathological conditions and represents a critical step in alleviating this important public health concern.

Further information on the proposed screening tool as well as general screening for FASD can be found through the Canadian Association of Pediatric Health Centre's initiative for "Developing a National Screening Tool Kit for those Identified and Potentially Affected by FASD" (http://www.caphc.org/programs_fasd.html).

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