The Language Profile of School-Aged Children with Fetal Alcohol Spectrum Disorder (FASD)

Le profil linguistique d'enfants d'âge scolaire ayant un trouble du spectre de l'alcoolisation fœtale (SAF)

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KEY WORDS

FETAL ALCOHOL SPECTRUM DISORDER (FASD)

PARTIAL FETAL ALCOHOL SYNDROME (PFAS)

ALCOHOL RELATED NEURODEVELOPMENTAL DISORDER (ARND)

PRENATAL ALCOHOL EXPOSURE

LANGUAGE DEVELOPMENT

LANGUAGE DISORDERS

CLINICAL EVALUATION OF LANGUAGE FUNDAMENTALS-4TH EDITION (CELF-4)

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Abstract

A population-based study of school age children diagnosed with FASD was conducted to evaluate the language abilities of these children and describe their language strengths and weaknesses. A retrospective chart review methodology was applied to examine language abilities of children diagnosed with FASD. Secondary data from 124 children aged 5 to 18 years, who were diagnosed with FASD between January 2005 and October 2010, were included in the study. Results from the CELF-4 language assessment tool were analyzed to compare the language abilities of these children. This study revealed globally poor performance across expressive and receptive language abilities, suggesting that language development is significantly affected by prenatal alcohol exposure. The Core Language Index Scores (total test scores) showed almost 70% of the participants received a language rating of "severe" (indicating significant communication impairments). About 20% had a rating of either "moderate" or "mild", and fewer than 15% had a rating of "average". Approximately 85% of the sample experienced mild to severe language delays in the index categories. The 5 to 8 year old age group had the highest average scores in all index categories, whereas the 9 year-olds consistently had the lowest average scores. The changing profile by age group is significant with important ramifications on longitudinal language testing and programming. A better understanding of language abilities in children with prenatal alcohol exposure may lead to improved planning for language interventions.

Abrégé

Une étude d'une population d'enfants d'âge scolaire ayant un diagnostic de SAF a été faite afin d'évaluer les habiletés langagières de ces enfants et de décrire leurs forces et leurs faiblesses au plan du langage. Une méthodologie d'examen rétrospectif des dossiers fut appliquée. Des données secondaires de 124 enfants âgés de 5 à 18 ans ayant le diagnostic de SAF, recueillies entre janvier 2005 et octobre 2010, furent inclues dans l'étude. Les résultats de l'outil d'évaluation langagière CELF-4 ont été analysés pour comparer les habiletés linguistiques de ces enfants. Cette étude a révélé une performance généralement pauvre pour les habiletés langagières expressives et réceptives, ce qui suggère que le développement langagier est affecté de façon significative par l'exposition prénatale à l'alcool. Les scores de base des indices langagiers (CLIS) (résultat total des tests) démontrent que presque 70 % des participants ont reçu une cote « sévère » (indiquant des troubles importants de communication). Environ 20 % ont reçu une cote de degré « modéré » ou « léger » et moins de 15 % ont reçu une cote de degré « moyen ». Environ 85 % des participants accusaient un retard de langage de léger à sévère dans les catégories d'indices. Le groupe des cinq à huit ans avait les taux moyens les plus élevés dans toutes les catégories d'indices, alors que les enfants de neuf ans avaient constamment les taux moyens les plus bas. Le changement de profil selon le groupe d'âge est significatif, ce qui a des ramifications importantes sur l'évaluation et la programmation longitudinale du langage. Une meilleure compréhension des habiletés langagières des enfants exposés à l'alcool en période prénatale pourra contribuer à l'amélioration des interventions dans le domaine du langage.

Introduction

Fetal Alcohol Spectrum Disorder (FASD) is an umbrella term that encompasses three specific medical diagnoses resulting from prenatal exposure to alcohol: Fetal Alcohol Syndrome (FAS), Partial Fetal Alcohol Syndrome (pFAS) and Alcohol Related Neurodevelopmental Disorder (ARND). FAS describes those individuals with a characteristic pattern of physical and neurological birth defects, including facial dysmorphology, growth deficiency, and neurobehavioural abnormalities; pFAS refers to those with facial dysmorphology and neurobehavioural abnormalities but no evidence of growth deficiency; ARND pertains to those individuals who have characteristic neurodevelopmental abnormalities but no dysmorphology or growth retardation. The spectrum of brain differences with FASD varies by individual and may cause different learning, behavioural and daily living challenges for each (Chudley et al., 2005). An estimated 9 in 1000 babies born in Canada are affected by FASD (Public Health Agency of Canada, 2005). Although there has been a substantial body of literature examining behavioural, psychosocial and cognitive impairments of FASD, there is a scarcity of research on prenatal alcohol exposure (PAE) and its effect on language development. Large-scale language and communication deficiencies have been described in individuals with FASD yet no consistent or conclusive pattern of deficits has been identified. Therefore, the objectives of this study were to: 1) examine the language abilities of school age children who have a formal diagnosis of either pFAS or ARND; and 2) describe the language strengths and weaknesses in this population. The present study will contribute relevant and unique information to the growing body of research about the language abilities of children with FASD. A better understanding of the language profiles of school aged children with FASD can assist the FASD diagnostic teams in assessing communication abilities and improve the services offered by speech-language pathologists (S-LPs).

Background

Making an FASD Diagnosis in Canada. The procedures used to diagnose a disorder due to prenatal alcohol exposure and determine an alcohol related diagnosis have changed considerably since FAS was first described by Jones and Smith (1973). The first Canadian Guidelines for the Diagnosis of FASD and its related disabilities were published in 2005 and were established to assist Canadian diagnostic teams in providing a consistent and objective diagnosis (Chudley et al., 2005). The Canadian Guidelines were harmonized with other international protocols resulting in a four digit diagnostic code now widely used in Canada (Chudley et al., 2005). This code addresses the severity of the four key diagnostic features of FASD in the following areas: growth deficiency; the facial phenotype; central nervous system damage or dysfunction; and gestational exposure to alcohol.

The following nine domains of the central nervous system receive neurobehavioural assessments: 1) communication; 2) hard and soft neurological signs including sensory motor deficits; 3) brain structure; 4) cognition; 5) academic achievement; 6) memory; 7) executive functioning; 8) attention; and 9) adaptive behaviour. A central nervous system domain, commonly referred to as a "brain domain" in clinical practice, is considered to be impaired when standardized scores are either two or more standard deviations below the mean or where there is a discrepancy of at least one standard deviation between subtests within domains. The Canadian Guidelines require impairment in three different domains before a diagnosis can be considered. Over the years, there has been an improved understanding of each of the brain domains through research. Without exception, research has improved our understanding and assessment of the relationships between various language components.

Assessing the Communication Brain Domain. Since FASD was first documented, a connection between prenatal alcohol exposure (PAE) and impaired language development has been considered. Early on, researchers theorized a connection between PAE and language, suggesting the need for special education services such as speech and language interventions (Streissguth, Herman, & Smith, 1978). Shortly thereafter, Sparks (1984) was among the first S-LPs to query if a specific relationship between PAE and language difficulties existed. Her formative work identified a stronger link between FASD and speech and language problems in children than had previously been reported. In the late 90s, further support came from Church & Kaltenbach (1997) who posited FAS may be the leading cause of hearing, speech, and language difficulties in children. Since then, studies examining deficiencies in children with FASD have described a number of communication deficiencies encompassing language areas such as: naming (Mattson, Riley, Gramling, Delis, & Jones, 1998); verbal fluency (Mattson & Riley, 1999; Schoenfeld, Mattson, Lang, Delis & Riley, 2001); grammar comprehension (Kodituwakku, 2009); central processing (Church & Kaltenbach, 1997); narrative discourse (Thorne, Coggins, Carmichael Olson, & Astley, 2007); and inappropriate use of social language (Coggins, Timler, & Olswang, 2007). The results of these studies, however, have not been consistent. Several studies have shown a significant correlation between global language development and PAE (Becker, Warr-Leeper & Leeper, 1990; Carney & Chermak, 1991) while others have not (Greene, Earnhart, Martier, Sokol, & Ager, 1990; Fried, O'Connell & Watkinson, 1992). Limitations such as small sample sizes,

low doses of prenatal alcohol consumption, and large age ranges, may have contributed to the inconclusive findings.

The literature examining language development in children with FASD has not used consistent methodologies or instruments, nor have the existing studies applied consistent methods of diagnosing FASD (there is variation between and sometimes within countries). As the field can still be considered to be in its infancy, inconsistencies should be expected. Even so, language deficits in children with FASD are regularly reported. Several different language tests (e.g. Test of Language Development-Primary-4th edition, (Newcomer & Hammill, 2008) and Comprehensive Receptive Expressive Vocabulary Test-2nd edition (Wallace & Hammill, 2002)) have been utilized in studies and it is unclear how comparable those results are to the CELF-4 (Adnams et al., 2007; Aragon, et al., 2008; Carney & Chermak, 1991; Coggins et al., 2007; Kodituwakku et al., 2006; Wyper & Rasmussen, 2011). Assuming a broad level of similarity, it is not surprising that the literature indicates a widespread range of language and communication deficiencies in children with FASD. Knowing that language will likely be an issue for a child with FASD means that the role of S-LP in assessing and developing individual programming is critical. Improved identification of language strengths and limitations through yearly assessments using a standard protocol will allow for a strengths-based approach for a child with FASD. To encourage greater consistency in evaluation of language and communication abilities, Pan Canadian consultations were held to identify standardized tools and diagnostic categories.

In 2007, Pan Canadian consultations resulted in a list of standard tools appropriate for the assessment of children between 4 to 18 years of age when an FASD diagnosis is being considered. The four tools identified for evaluating language and communication for children aged 6 to 11 years included: 1) the Clinical Evaluation of Language Fundamentals -4th edition (CELF-4) (Semel, Wiig, & Secord, 2003); 2) the Test of Narrative Language (Gillam & Pearson, 2004); 3) the Test of Problem Solving 3 Elementary -3rd edition (Bowers, Huisingh, & LoGiudice, 2005); and 4) the Pragmatics Profile subtest from the CELF-4. For children ages 12 to 18 years, the three standard set of core language tests included: 1) the CELF-4; 2) Test of Problem Solving 2 Adolescents (Bowers, Huisingh, & LoGiudice, 2007); and 3) the CELF-4 Pragmatics Profile (Canada NorthWest FASD Research Group, 2009). Although the CELF-4 does have certain limitations in that it does not assess social language, problem solving or written language abilities, the Pan Canadian consultations with other S-LPs working in FASD diagnostic clinics determined that the CELF-4 was acceptable and appropriate to effectively test the communication domain (Canada NorthWest FASD Research Group, 2009). As a collective, the Manitoba FASD Centre[1] selected the CELF-4 as one of the assessment tools to evaluate language and communication.

Current Study

The specific goals of this research study were to: 1) determine if there are significant differences across age groups for the different measures derived from the CELF-4; 2) examine if there are significant difference in diagnosis for the different measures derived from the CELF-4; and 3) to analyze if there are significant differences in sex for the different measures derived from the CELF-4.

Methods

Procedures. A retrospective chart review was conducted of 124 children between the ages of 5 and 18 years that had been assessed over a five and a half year period (January 2005 to October 2010) at the Manitoba FASD Centre. The Manitoba FASD Centre assessments adhere to the Canadian guidelines for FASD diagnosis (Chudley et. al., 2005) and all participants were administered the CELF-4 as part of the communication domain assessment. A diagnosis was only made collectively following the completion of assessments from a multidisciplinary team including an S-LP, occupational therapist, psychologist, developmental pediatrician, and a geneticist. This is not a "blind" approach as clinicians are aware that they are assessing a child who may have FASD. However, having multiple members contribute to the final decision increases objectivity. The subjects of this chart review were all assessed by the same S-LP. Ethics approval was obtained for this study by the Health Research Ethics Board, University of Manitoba.

Participants. A database was created by the S-LP team at the Manitoba FASD Centre in 2005, consisting of demographic information and scores of various language assessment instruments. Individuals assessed between January 2005 and October 2010 were extracted for the study by the principal investigator. To be included in the sample, participants needed to: a) be aged 5 to 18 years, b) have the language portion of CELF-4 completed, c) be English speaking, d) have been assessed by the same S-LP, and e) have received an FASD diagnosis based on the Canadian Guidelines. If data were missing from any component of the CELF-4 language assessment, the individual was excluded from the study. Of the 1078 children evaluated by the S-LP, 124 (11.83%), met the inclusion criteria.

Of the 124 children that met the criteria for the chart review, 23 (18.5%) had a diagnosis of pFAS and 101 (81.5%) had a diagnosis of ARND. No participants had a diagnosis of FAS. Of the total group, 78 (62.9%) of the subjects were male and 46 (37.1%) were female. Two-thirds of the sample (n=83) was based in an urban setting and one-third (n=41) had some

form of intervention (e.g., consultation or direct therapy) with S-LP services prior to the assessment. With regards to alcohol use, 47 (39.7%) of the biological mothers used *alcohol only*, 15 (12.1%) used a *combination of alcohol and tobacco*, and 62 (50.0%) reported using *alcohol* and *other substances* such as cocaine or marijuana. Family structure varied; half of the participants lived in foster care (n=63; 50.8%) with the remainder of the sample living with: 1) biological parent(s) (n=25; 20.2%); 2) an extended family member (n=27; 21.7%); or 3) an adoptive family (n=9; 7.3%). All of individuals in the sample spoke English as their first language, with a small proportion also speaking a second language (7.3%) (see Table 1). The demographics of the sample were consistent with the population seen at the Manitoba FASD Centre.

Measure. The CELF-4 is the third revision of The Clinical Evaluation of Language Fundamentals that was originally published in 1980 (Semel, Wiig, & Secord, 2003). It is an individually administered clinical tool used in the identification, diagnosis and follow-up evaluation of language and communication disorders in individuals 5 to 21 years old. Two separate test forms are used for individuals aged 5 to 8 and 9 to 21 years. These test forms are then differentiated by a variety of sub-tests which lead to further divisions in the age groupings: 1) 5 to 8 years; 2) 9 years; 3) 10 to 12 years; and 4) 13 to 21 years (See Table 2). Following the test administration, there are two important score categories. The first is the 'Core Language Score', which is a measure of the general language ability that quantifies a child's overall language performance. The second important category includes the 'language indices'. There are five language indices that provide additional details on language and communication and are calculated using 15 sub-test scaled scores (see Table 3).

The CELF-4 classifies language delay using the following severity rating scale: severe (standard scores < 70); moderate (standard scores between 71- 77); mild (standard scores between 78-85); average (standard scores between 86-114); and above average (standard scores >114) (Semel, Wiig, & Secord, 2003). As stated earlier, the Canadian Guidelines require impairment in three different domains before a diagnosis can be considered. The "communication brain domain" would be considered impaired if children receive a rating of severe, in that it is two standard deviations below the mean. For example, when using the CELF-4, a severity rating below a standard score of 70 indicates a severe impairment, and thus the communication domain would be identified as a significant deficit when considering for an FASD diagnosis. While internal consistency reliability estimates for the CELF-4 vary depending on the age group and subtest (α ranges from 0.77 to 0.92) they have shown adequate stability across time for all age bands (Semel, Wiig, & Secord, 2003).

Analysis. The CELF-4 data were analyzed using SPSS (v.11.0). Frequency distributions were examined to identify and address potential outliers. In order to address the first objective of this study, the evaluation of language abilities, cross-tabulations were completed to provide the results by age group, including the core language score (total test score), and indices measuring receptive language, expressive language, language content, language structure, and language memory. Parametric tests (*t*-tests and ANOVAs) were conducted to assess the significance of between group differences. For example, it was important to determine if scores differed significantly by sex of participant as well as by age of participant. The second objective of the study was to describe strengths and limitations based on the CELF-4 total and index scores. To address this objective, age group results were plotted to determine performance differences among age groups and to compare each age group in the diagnosed sample to results for the general population. For all statistical tests, a level of significance of $p<0.05$ was chosen.

Results

The CELF-4's Core Language Index Score provides a broad assessment of an individual's overall language performance. No significant differences were found based on age of the participants (see Table 3). In this sample, two-thirds of the participants (n= 84; 67.7%) received a severity rating of *severe*. Approximately 10% of the sample (n=12; 9.7%) received a severity rating of *moderate*, 11 (8.9%) received a severity rating of *mild*, and 17 (13.7%) received a severity rating of *average*. The "communication brain domain" would be considered impaired if children receive a rating of severe, in that it is two standard deviations below the mean or there is a discrepancy of at least one standard deviation between subtests with domains. Although there was slight variation by indices, the trend was that the majority of the sample had some level of language delay with the greatest proportion being severely delayed.

When examining chi-square results by age groups and index categories, the Receptive Language Index Scores varied significantly by age group ($p<0.01$) as did the Language Structure Index Scores ($p=0.02$). The 5 to 8-year-olds had the highest average scores (higher scores indicates lower severity) in all three index categories yet the scores still indicated moderate to severe language difficulties. The average scores across all age groups and indices ranged from 60.2 to 76.6, again indicating severe language issues. There appears to be a complex pattern emerging. The highest scores, indicating better performance, were seen in the youngest group. In the 9 year-olds, there is a dip in scores which is followed by somewhat higher measures for the older group (see Table 4).

As the sample contained participants who could be classified into dichotomous groups, *t*-tests were used to determine if there were differences in scores by diagnosis. Although the scores for the pFAS sample (n=23) were consistently lower in all indices than those of the ARND population (n=101), these differences were not statistically significant (Table 5).

Finally, the test scores were also not statistically significant for differences by sex for all sub-groups. It also means that language scores did not vary a great deal when comparing children with different diagnoses. For example, a female with pFAS was not likely to have a significantly higher or lower score that a male with ARND.

Discussion

This study examined the use of a standardized comprehensive language assessment tool, the CELF-4, for evaluation of the language *abilities* in children diagnosed with FASD between the years 2005 and 2010. It is the first study to comprehensively examine language development in a large cohort of school age children formally diagnosed with FASD and using the Canadian guidelines. As such, it represents an important contribution to what is known about FASD, communication, and language measurement. Although it has been the perception that individuals with FASD have higher expressive language skills relative to their receptive language skills, this study did not support this perception. One key finding was that the majority of the clinical sample had language deficiencies: over 65% of the sample showed severe impairment and an additional 16% of the sample demonstrated a core language deficit that ranged from mild to moderate. Another key finding was that age seemed to be an important factor in some indices of the CELF-4: the Receptive and Expressive Language Index Scores showed significant difference by age as did Language Structure Index Scores. The youngest group consistently had the strongest results in all three subtests. A third key finding was that there were no significant differences in language scores when comparing children diagnosed with pFAS and ARND. This is a critical finding that warrants more investigation, particularly with a sample that includes children with FAS. In addition to profiling the language scores of FASD children, this study identified several interesting findings that warrant further discussion.

First, a particularly troubling finding was that approximately 85% of the sample had some level of language impairment with almost 70% presenting with severe language deficits. However, we found that only 33% of the entire sample had previously received some form of speech and language intervention. This lack of service provision may be the result of individuals involved with the child not recognizing the significance of their communication impairment as the focus is on the child's other areas of difficulties (ie. poor attention span, sleep difficulties, behavioural issues, etc.). The results from this study clearly suggest that language services need to be viewed as a necessity given the needs of the population. For example, a child who has access to language services prior to the assessment may not receive a different diagnosis but could have improvements in his or her language capabilities overall.

Second, a factor linked to lower scores on the CELF-4 was age. Our sample indicated that younger children scored better than older children. The literature, however, is not clear on whether language performance changes over time, the direction of the change, or if language remains stable. Davies et al. (2011) did note a consistent performance decrease in language testing over time. Wyper & Rasmussen (2011) cites literature differentiating language deficits in both older and younger children; older children with FAS showed deficits most specifically in syntax whereas younger children have more global language deficits. The concern is that language testing does not happen frequently enough to ascertain changes in language development. In addition, it is unclear what factors, if any, may be impacting language development. If there is a common trajectory, is it a product of environment, the nature of FASD, or a unique combination as Coggins and his colleagues suggest (2007). For the S-LP, these factors should be considered, giving way to annual testing and documentation on social environmental factors. Future research, including longitudinal studies, could further impact our understanding if comparisons would be made between the developmental trajectories of typically developing children to those with FASD in similar social environments.

Third, a small proportion (13.7%) of the clinical sample was considered "typical" based on this language assessment, a finding that warrants further examination. Other researchers have noted similar findings and have reported no significant differences in controls and FASD cases (Kodituwakku et al., 2006). One study reported one-third of their clinical sample achieved language scores within the expected range of language performance (Coggins et al., 2007). However, it should be noted that the limitations of the CELF-4 may not have captured weaknesses in written language or social language use. Future research should include an examination into the proportion of FASD children who have typical language development. It may be that certain protective factors are common in that particular population. Streissguth (2003) has posited that at least six protective factors are associated with lower rates of secondary disabilities in the FASD population: living in a stable nurturing home of good quality, not having frequent changes of household, not being a victim

of violence, having received disability services, and having been diagnosed before the age of 6 years. Measuring those factors could implicate practice. Knowing what contributes to typical development would both assist in determining deficiencies in social environments and improve models of assessment and diagnosis. It also highlights the importance of large scale data collection for each clinical assessment, to enable research to conduct multi-factorial studies to better understand both strengths and challenges as well as promote evidence informed best practice for S-LPs.

Since none of the children in the present sample had FAS, we became differently focused on the ARND and pFAS scores in order to better understand if differences by diagnosis were apparent. We found that there were few differences between the scores of participants with either ARND or pFAS; language and communication seemed similar regardless of diagnosis. To the best of our understanding, prior research has not explored language by specific diagnosis which makes this result novel and worthy of further exploration. It also has pragmatic implications for assessment and therapy. Dysmorphology in FASD is a contributor to the diagnosis of FAS and pFAS. Having the physical traits of FAS and pFAS can provide outward evidence of the brain disorder; children with FAS and pFAS may be differently supported as their disability is more recognizable. Because children with ARND appear "typical", there may be an assumption that language and communication also follow along a "typical" trajectory. If children with ARND are not being recognized by parents and teachers as having language difficulties, they are at greater risk for being misunderstood in both the classroom and home environment. Given the severity of the language impairment in the non-dysmorphic diagnostic categories, there is no question that the non-dysmorphic population needs the same level of support as those who are dysmorphic.

Limitations. This study contributes to the examination of language abilities and general language profile of school age children with an FASD. The sample size of 124, collected over a five and a half year period, was appropriate to measure significant differences. The CELF-4 is a validated tool and useful in measuring communication capability. For the scope of this study, it was a valuable tool in that it provided detailed data by age group pertaining to language strengths and limitations in those children being assessed for FASD. One limitation, however, was that very few research studies have utilized the CELF-4 instrument in analyses, making comparisons limited in their specificity. This limitation impacts the study's generalizability and applicability to populations outside of Canada. Additionally, none of the children in the present sample had a diagnosis of FAS. While FAS is not a common diagnosis with the Canadian Guidelines—only about 10% of any clinical sample will be diagnosed with FAS (Coggins et al., 2007) —having the diagnosed population limited to children with either ARND or pFAS was limiting. It may be that due to the more prominent dysmorphia present in children with FAS, diagnoses occur before five years of age. Expanding the inclusion criteria to include pre-school children may have captured FAS children differently. Additional limitations were that the study was unable to determine impact of co-morbid diagnoses (such as ADHD), social-economic backgrounds, or home/family environment (e.g., adopted, foster homes, etc). It also would have been useful to complete a multi-factorial analysis that incorporates the impact of socioeconomic status. The information on family type is useful in that regard but not a direct proxy. At the time of the study, however, the Manitoba FASD Centre did not collect data on socioeconomic status. Finally, the study did not have a typical control group of children from similar socio-economic backgrounds.

Directions for Future Research. Future research on the language abilities of children with FASD would require more in-depth data pertaining to the language services children received. This data would allow for greater clarity on the role of S-LP in providing intervention. In addition, future studies should target children with FAS. Future research has many potential avenues. A longitudinal methodology would be useful to understand changes over time, the possible role or impact of environment, as well as the implications of socioeconomic status within a changing demographic. Exploring language abilities as opposed to deficiencies based on results of the subtest scores on the CELF-4 would also be an interest direction with clinical application. Employing a qualitative analysis of children with typical communication behaviours would be an excellent way to explore less tangible variables that may impact language in a child with FASD. In depth diagnostic assessment of multiple language areas is central to understanding the behavioural phenotype of school aged children with FASD. Given that prenatal alcohol ingestion is often paired with other teratogens, future research should explore if language and communication outcomes vary by types of prenatal exposures.

Conclusion

This study contributes to the emerging literature pertaining to language and communication abilities in children with FASD. This study revealed that children with FASD had globally poor performances across expressive and receptive language abilities, suggesting that language development is significantly affected by prenatal alcohol exposure. The Core Language Index Scores of the CELF-4 showed almost 70% of the participants received a language rating of "severe" (indicating significant communication impairments), about

20% were rated as "mild", and fewer than 15% had a rating of "average". In addition, we found that language abilities changed with age: The five to eight year old age group had the highest average scores in all index categories, whereas the nine year olds consistently had the lowest average scores. If we understand this finding to describe a change over time, the clinical ramifications are the need for frequent language testing over time coupled with programming consistent with a child's changing needs. The small proportion of our sample that exhibited average language development was a significant finding and one that requires further investigation. It is imperative that we better understand drivers of success, whether they relate to a child's context, resilience, or to other factors. This research contributes to the development of evidence-informed practice for providing specific S-LP services as well as comprehensive rehabilitation services. Strategies to support children with FASD must target language and communication as part of a multidisciplinary collaborative community and educational supports for affected children and their families. With the proper services in place, individuals with FASD can communicate to their fullest potential.

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Table 1: Demographic Overview by Age Group

	5-8 Years		9 Years		10-12 Years		13-18 Years		TOTAL	
	n=54	%	n=19	%	n=28	%	n=23	%	N=124	%
Diagnosis										
pFAS	15	27.8	3	15.8	3	10.7	2	8.7	**23**	**18.5**
ARND	39	72.2	16	84.2	25	89.3	21	91.3	**101**	**81.5**
Sex										
Male	38	70.4	11	57.9	18	64.3	11	47.8	**78**	**62.9**
Female	16	29.6	7	36.8	10	35.7	12	52.2	**45**	**36.3**
Location										
Urban	36	66.7	12	63.2	18	64.3	15	65.2	**81**	**65.3**
Rural	18	33.3	6	31.6	9	32.1	8	34.8	**41**	**33.1**
Previous Involvement with S-LP										
Yes	15	27.8	9	47.4	13	46.4	5	21.7	**42**	**33.9**
No	39	72.2	9	47.4	14	50.0	18	78.3	**80**	**64.5**
Alcohol Use										
Alcohol only	21	38.9	5	26.3	11	39.3	9	39.1	**46**	**37.1**
Alcohol and tobacco	28	51.9	3	15.8	6	21.4	1	4.3	**38**	**30.6**
Alcohol and other substances	4	7.4	8	42.1	10	35.7	13	56.5	**35**	**28.2**
Family Type										
Biological Parent	15	27.8	2	10.5	5	17.9	2	8.7	**24**	**19.4**
Extended Family	15	27.8	4	21.1	5	17.9	3	13.0	**27**	**21.8**
Adopted	2	3.7	3	15.8	2	7.1	1	4.3	**8**	**6.5**
Foster Care	22	40.7	8	42.1	14	50.0	17	73.9	**61**	**49.2**
Language										
English Only	49	90.7	16	84.2	26	92.9	22	95.7	**113**	**91.1**
Preferred Language English (other languages spoken)	5	9.3	2	10.5	1	3.6	1	4.3	**9**	**7.3**

Table 2: CELF-4 Breakdown of Subtests for Each Age Group

	5-8 Years	9 Years	10-12 Years	13-18 Years
Core Language Scores				
Concepts and Following Directions	X	X	X	
Word Structure	X			
Recalling Sentences	X	X	X	X
Formulated Sentences	X	X	X	X
Word Classes- Total		X	X	X
Word Definitions				X
Receptive Language Index				
Concepts and Following Directions	X	X	X	
Word Classes- Receptive	X	X	X	X
Sentence Structure	X			
Semantic Relationships				X
Understanding Spoken Paragraphs				X
Expressive Language Index				
Word Structure	X			
Recalling Sentences	X	X	X	X
Formulated Sentences	X	X	X	X
Word Classes- Expressive		X	X	X
Language Content Index				
Concepts and Following Directions	X			
Word Classes-Total	X	X	X	
Expressive Vocabulary	X	X		
Word Definitions			X	X
Sentence Assembly				X
Understanding spoken paragraphs		X	X	X

Language Structure Index				
Word Structure	X			
Recalling Sentences	X			
Formulated Sentences	X			
Sentence Structure	X			
Language Content Index				
Recalling Sentences		X	X	X
Concepts and Following Directions		X	X	
Formulated Sentences		X	X	X
Semantic Relationships				X

Table 3: CELF-4 Clinical Tool Overview (Semel, Wiig & Secord, 2003)

	Test Form A	**Test Form B**		
	5-8 Years	**9 Years**	**10-12 Years**	**13-18 Years**
Core Language Index (total test score)	measures general language ability and quantifies a student's overall language performance. Each Composite Index Score consists of a different compilation of subtests to yield the standardized scores			
Receptive Language Index	measures overall ability to listen to and comprehend information			
Expressive Language Index	measures overall production of language and the ability to express thoughts, ideas and feelings			
Language Content Index	measures various aspects of semantic development, including vocabulary, concept and category development, comprehension of associations and relationships among words, interpretation of factual and inferential information orally presented and the ability to create meaningful semantically and syntactically correct sentences			
Language Structure (LS) & Language Memory (LM)	LS: measures the receptive and expressive components of interpreting and producing sentence structures		LM: measures the ability to recall spoken directions, formulate sentences with given words, and identify semantic relationships. It also provides a measure of the ability to apply working memory to linguistic content and structure	

Table 4: Mean Standard Scores by Index Category and Age Group

Index Category	Age Group	Mean Standard Score	Standard Deviation	Confidence Interval	*p*-value
Core Language Index Score	5-8	69.4	14.1	65.5 to 73.3	0.19
	9	60.3	11.4	54.8 to 65.8	
	10-12	64.3	17.4	57.6 to 71.1	
	13-18	65.8	20.9	56.8 to 74.8	
	total	66.0	16.1	63.2 to 68.9	
Receptive Index Score	5-8	76.6	12.5	73.2 to 80.0	**<0.01**
	9	65.0	10.6	59.8 to 70.0	
	10-12	67.8	13.0	62.7 to 72.8	
	13-18	65.5	18.4	57.5 to 73.4	
	total	70.5	14.5	67.9 to 73.1	
Expressive Index Score	5-8	71.6	14.2	67.7 to 75.5	0.15
	9	62.4	12.4	56.5 to 68.4	
	10-12	67.3	17.1	60.7 to 73.9	
	13-18	65.1	18.4	57.2 to 73.1	
	total	67.9	15.7	65.1 to 70.7	
Language Structure Index Score	5-8	74.0	14.1	70.1 to 77.9	**0.02**
	9	60.2	10.2	55.3 to 65.2	
	10-12	65.5	16.9	59.0 to 72.1	
	13-18	67.6	24.4	57.0 to 78.2	
	total	68.7	17.2	65.6 to 71.2	
Language Content Index Score	5-8	74.1	11.6	71.0 to 77.3	0.20
	9	68.0	12.4	62.0 to 74.0	
	10-12	71.1	13.6	65.9 to 76.4	
	13-18	69.0	21.9	59.5 to 78.5	
	total	71.3	14.7	68.7 to 74.0	

Table 5: T-test scores by Diagnosis and Index Category

Index Category	Diagnosis	Mean Standard Score	Standard Deviation	Confidence Interval	p-value (2-tailed)
Core Language Index Score	pFAS	65.2	13.1	59.6 to 70.8	0.80
	ARND	66.2	16.9	62.9 to 69.5	
Receptive Index Score	pFAS	67.9	11.2	63.0 to 72.7	0.33
	ARND	71.1	15.2	68.1 to 74.1	
Expressive Index Score	pFAS	67.1	13.7	61.2 to 73.0	0.79
	ARND	68.1	16.2	64.9 to 71.2	
Language Content Index Score	pFAS	69.7	12.6	64.3 to 75.2	0.56
	ARND	71.7	15.2	68.7 to 74.7	
Language Structure Index Score	pFAS	68.7	11.8	63.6 to 73.8	0.99
	ARND	68.6	18.3	65.0 to 72.2	

End Notes

[1]The Manitoba FASD Centre (formerly the Clinic for Alcohol and Drug Exposed Children-CADEC) in Winnipeg Manitoba was founded in 1999 and has been assessing and diagnosing children with FASD for over 12 years. To date, the clinic has assessed approximately 2300 children and diagnosed over 1200 individuals with FASD. Although the Centre has many functions, its primary purpose is to provide comprehensive multidisciplinary assessments, diagnosis and follow-up services to individuals who have had prenatal alcohol exposure (PAE).

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