CLINICAL CORRELATES OF FETAL ALCOHOL SPECTRUM DISORDER AMONG DIAGNOSED INDIVIDUALS IN A RURAL DIAGNOSTIC CLINIC

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ABSTRACT

Background
Diagnosis of fetal alcohol spectrum disorder (FASD) is relevant for the reduction of long term adverse sequalae. However, the diagnostic guidelines require a multidisciplinary approach which may hinder access to diagnostic and management services. Most diagnostic clinics are located in urban areas. There is less emphasis on the operations, capacities, and outcomes from rural diagnostic clinics.

Methods
Over a ten and half years of clinic operations to diagnose children and subsequently adults, all consenting adults provided answers to interviews, participated in measurements and other diagnostic procedures. Information was collected on their contact with mental health services. Comparison of the findings with those from other established clinics included variables relevant to outcome measures.

Results
375 individuals were referred, assessed and diagnosed according to the existing guidelines for FASD diagnosis. Alcohol-related neurodevelopmental disorder (ARND), which was closely associated with age, was the most prevalent FASD diagnosis. One third of those diagnosed had IQ above the average range and ADHD was the most relevant clinical correlate. The diagnostic clinic was able to complete diagnosis on potentially 37.5% of likely affected individuals.

Conclusion
FASD can be diagnosed in children and adults in a rural setting. ADHD and other mental disorders should be a focus for treatment in affected individuals especially adults. It is important to consider the impact of age on the outcome of FASD. To increase diagnostic capacity, clinic operations could be modelled similarly.

Key Words: *Fetal alcohol spectrum disorder*, *diagnostic clinic*, *mental disorder*

A wide range of neurobehavioral abnormalities[1,2] comorbid conditions and diagnoses[3,4] and functional outcome[5,6] are common among individuals with fetal alcohol spectrum disorder (FASD). As a result FASD has been described as a heterogeneous, mysterious and complex disorder.[7] These in turn, along with the high prevalence of the disorder have inspired and directed the call for increased diagnostic capacity and diagnostic guideline development.[8,9] In response to this call, there have been valuable diagnostic collaborative initiatives around the world.[10]

Guidelines for FASD diagnosis[11,12] set out optimum conditions to ensure the diagnostic identification, reliability and validity of FASD. The utility and clinical relevance of these guidelines have been compared in samples of diagnosed individuals. Diagnostic agreement are modest when comparing procedures and outcomes.[13] In

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other studies the outcomes are slightly and inconsistently different.[13,14] Adult diagnostic services especially, lag behind and are riddled with lack of funding and discontented validity.[15,16]

In a Western and Northern Canadian multijurisdictional evaluation and estimation of clinical capacity for FASD diagnosis, the need to increase diagnostic capacity based on what the authors described as "woefully inadequate especially for adults"[17] was recommended. Projections were not encouraging and imbalance in diagnostic capacity especially for rural and remote regions with their long distances from services were noted.[17] To remedy these, early referrals and a minimum number of team members of the requisite multidisciplinary diagnostic team have been recommended.[11] Data is beginning to accumulate on those, usually children, referred and diagnosed in various clinics.[18-21] These clinics are characteristically funded by governments[20,22], paradigmatically linked to genetics and dysmorphology, and focused on early referral and prevention. Large numbers of children diagnosed through those clinics have now become adults allowing the study of various clinical and functional correlates of FASD.[23] Rates of comorbid Attention Deficit Hyperactivity Disorder (ADHD), Anxiety and Depression, Learning disability and personality disorders are high in those with FASD.[3,4]

However, there is limited investigation about the effect of geographic location of the diagnostic team (whether rural or urban setting) and age at diagnosis in determining the referral process, clinical capacity, diagnostic categories, or the specific clinical correlates of FASD in a rural population.

Rural Urban disparity can be expected in terms of population behaviour, level of knowledge, stigma related to diagnosis and level of support for individuals affected with FASD. Rural settings by nature are resource limited and relatively limited in modern amenities. These could exert some effect on clinical variables. Support for this possibility is evident in comparative studies involving rates of disorders, access to care, health seeking behaviour and differential manifestation of various disorders.[24,25] With regards to FASD, diagnostic criteria may be the same but dissimilar prevalence rates have been reported in studies among Aboriginal people[26], and in intercontinental comparative studies.[8,27] The reasons for these differences, procedural or locale, are yet to be determined.[28] Diagnostic capacities of the different models of clinics certainly have not been evaluated as required for the quality improvement needed to advance the field of FASD diagnosis and intervention.[7,16] The characteristics of the population from which cross sectional studies are conducted are occasionally mentioned but hardly discussed. If the setting of a diagnostic clinic, rural or urban, uncovers differences in rates of diagnosis and comorbid clinical features, potential interventions could find differential applicability and potentially, cross transferability of strategies.

This study investigates the clinical profile of individuals referred and diagnosed in a rural FASD diagnostic clinic[15,29] according to the Canadian guidelines for the diagnosis of FASD.[11] We also compare the different FASD diagnoses, diagnostic capacities and other clinical conditions found in this rural sample with those of other clinics, albeit urban in location. As a secondary objective, we compared FASD diagnoses and clinical conditions among those diagnosed as adults with those diagnosed as children and adolescents.

METHODS

2.1 Lakeland FASD Diagnostic Clinic

Lakeland Centre for Fetal Alcohol Spectrum Disorder (LCFASD) is a multidisciplinary diagnostic clinic linked to preventative services and located in Cold Lake. Cold Lake, Alberta, Canada was chosen as the location of the clinic to cater for the surrounding rural population of about 100,000 residents spread over a hundred (100) kilometre radius. The area, in the northeast part of the Province of Alberta, Canada, is made up of a small city, 25 small towns, seven First Nations communities, Four Métis settlements and one Military base.[15] From its inception 12 years ago, the clinics run about three times a month diagnosing an average of four and one referred child/youth and adult respectively.

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The adult diagnostic services started in 2002 and it is the first clinic in Canada to be dedicated to adult FASD diagnosis. The process of development, composition of the team members, training and mode of operation have been described previously.[15] All patients referred to the LCFASD for FASD diagnosis were confirmed to have prenatal alcohol exposure. The patients were all assessed by a multidisciplinary team, trained in the process of diagnosis. The diagnostic determination of FASD incorporates the four digit diagnostic code of the Diagnostic and Prevention Network (DPN) based at the University of Washington Seattle harmonised with the Canadian guidelines for FASD diagnosis.[11,12] Prior to a patient coming to clinic, intake forms were completed by the caregiver, with appropriate help if required. Consent was obtained to collect information from other agencies including birth records from hospitals, medical information from physicians, and other psychosocial information where applicable. Informed consent was also obtained to record and use data in an aggregate format. Each patient and /or their caregiver were interviewed, growth and facial measurements done, and assessed by a neuropsychologist and a speech language pathologist, and in the younger patient by the occupational therapist. The neuropsychological test battery conforms to the requirements of the diagnostic guidelines and code. The 4-Digit Diagnostic Code derived was translated to provide a diagnosis, initially by the Institute of Medicine criteria, and subsequently, from 2006, based on the Canadian Guidelines criteria.[11]

The clinic coordinator extracts all relevant information from the extensive medical, child mental health, social work and educational reports usually provided. A clinical interview is conducted with the individual referred and supplemented by collateral information from accompanying family members as well as other support persons. This includes support persons from various agencies with whom referred individuals are in contact. Comorbid diagnosis were agreed upon by the consensus peer review process embedded in the procedures of the clinic.[15] In the case of comorbid mental disorder, the synthesis and cumulative review of the information are used to determine the most appropriate clinical diagnosis according to the *Diagnostic and statistical manual for Mental disorders (DSM IV)*. Memory disorders were deduced from the neurocognitive assessment completed in all cases going through the clinics (Table 1).

All neuropsychological, archival, physical and social data on referred persons who were assessed and diagnosed by the different multidisciplinary clinic teams between November 2000 and July 2011 was entered into a spread sheet using Access program of Microsoft word.

TABLE 1
Age Distribution of Diagnosed Individuals

Age Category	Frequency	Percentage
Less than 11 years	56	15.0
Between 11 and 19 years	211	56.2
Between 20 and 30 years	83	22.1
Above 30 years	25	6.7

2.2 Statistical Analyses

Descriptive analysis of FASD diagnoses and other comorbid outcomes such as anxiety, depression, attention deficit hyperactivity disorder (ADHD) of the patients was conducted. As well, the distribution of patients' demographic characteristics such as age, gender, and IQ were summarized using frequency counts, mean, and standard deviation. Statistical test of association between FASD diagnoses and other demographic characteristics was conducted using correlation analysis (for the continuous outcomes) or chi square analyses (for the categorical outcomes). All analyses were conducted using SAS 9.2 (SAS Inc, 2008).

RESULTS

During the study period, and using an FASD prevalence rate of 1%, the rate of diagnosis was 37.5%. Of the 375 individuals assessed and diagnosed over the 10.5 years of the clinic's existence, 15% of the patients are less than 11 years, and 78.3% of this population between 11 and 30 years. This suggests that a larger proportion of this population are

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relatively young (Table 1). The average IQ for the participants was 79.47, with about 66% having an IQ less than 80. There was a weak association between IQ score and age of the participants (i.e. $r = 0.13$).

Alcohol Related Neurodevelopmental Disorder (ARND) was the most prevalent FASD diagnosis (59.9% of those diagnosed). In the total population studied, the rates of fetal alcohol syndrome (FAS), partial FAS (PFAS), ARND and alcohol related birth defects (ARBD) were 0.8%, 12.3%, 59.9% and 4.3% respectively. Among referred adults and diagnosed as such for the first time, the rates were respectively 0%, 13.2%, 76.5% and 4.4% (Table 2). The rates of ARND diagnoses showed a significant association with age ($p< 0.003$), being overrepresented among those 20 years and older (Figure 1). However, the prevalence of FAS, PFAS, and ARBD were not significantly associated with age (Table 2.).

A number of other comorbid outcomes showed a statistically significant association with age, more specifically, receptive and expressive language, social language, Learning Disability, ADHD, and memory disorder showed statistically significant association with age (and age at diagnosis) in the adult subpopulation (23%) studied. Table 3 shows the percentage of those assessed and FASD diagnosed, with different comorbid conditions.

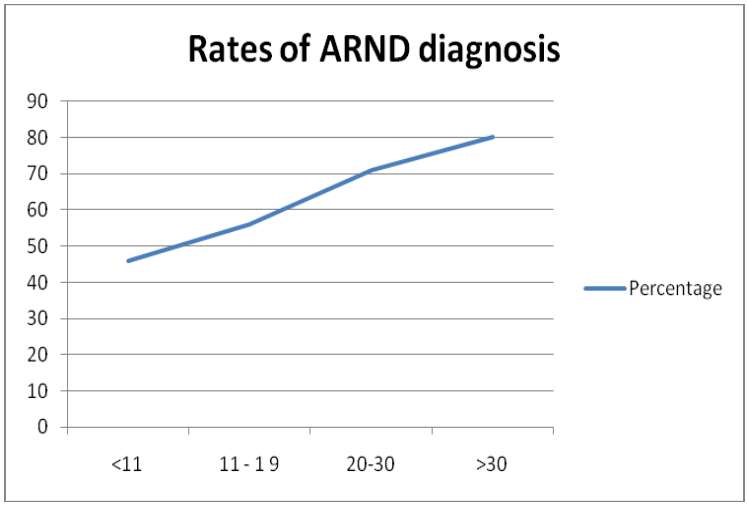
TABLE 2
Distribution of FASD Diagnoses by Age Category

FASD Diagnosis	Age < 11	11< Age < 20	20< Age < 31	Age > 31
ARND	26	115	76	20
ARBD	0	19	4	0
FAS	1	1	1	0
FPAS	1	25	15	5

TABLE 3
Distribution of Comorbid Conditions

Diagnosis	Number of Diagnosed Individuals (%)	Number of Diagnosed Adults (%)
ADHD	185(49.5)	25(23.5)
Memory Disorders	103(27.5)	38(36.9)
Learning Disability	85(22.7)	6(8.8)
Depression	46(12.3)	13(19.1)
Anxiety	27(7.2)	11(13.2)

FIG. 1 Distribution of Rates (%) of ARND Diagnosis by Age Group



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DISCUSSION

The capacity of the rural diagnostic clinic is reflected in the rate of diagnosis. With a population prevalence rate of FASD at one per hundred (8), the LCFASD has been successful in identifying 375 cases out of an estimated population of 100,000 (37.5% of the potential FASD individuals). By implication, this capacity affects access to diagnostic and management services. LCFASD has a larger diagnostic capacity compared to other well-funded and child focused FASD diagnostic clinics in Seattle[22], North Dakota[20,30] and Urban clinics in Canada.[19] Such amplified capacity and by extension the services provided, make LCFASD a strong source of support to affected individuals. This is premised on the fact that diagnosis is the logical step in directing intervention and prevention. Taking the potential 340,000 FASD affected persons in Canada, and at a capacity of 1500 assessments a year[7], the rate of diagnosis over the same period of ten years, only 4.4% of the individuals would have been identified. Extrapolating the capacity of diagnosis in Canada, the model of LCFASD is one that can increase access to services, encourage prompt access to diagnosis and should be emulated and adopted.[29] Although the high rate of FASD among the indigenous population served by LCFASD may have contributed to the high pick up rate, other factors may be responsible for the successes of LCFASD. Among these are the in kind contribution of team members, mobile nature of clinic, community awareness on FASD which has reduced stigma and the available links to intervention which encourages referrals. As well, a substantial proportion of non-indigenous people is served by LCFASD.[15,29]

Meagre and insufficient diagnostic capacity which limits access to services is a recognised problem in both rural and urban setting and in the region studied.[9,17] Large numbers of FASD related problems are found in rural areas.[26,31] In one South African study for instance rural off springs had an odds ratio of 7.36 for an FAS diagnosis over urban residents.[32] Fortunately, rural professionals are more likely to access the correct resources for women with addictions and to care for an individual with FASD.[33] The increased capacity in our study is helpful in meeting the demands for access to services[9] and correcting the imbalance in Canadian diagnostic capacity.[17] Studying distinctions like place of residents (rural/urban, on/off reserve), along with IQ and chronological age have been suggested as arbitrary and potentially counterproductive to the lifelong nature of FASD.[7] Our findings of increased accessibility to diagnostic services, a much needed goal, suggest the role of studying various components of a diagnostic clinic that are of a critical success nature. The LCFASD's mobile nature makes the clinic team more accessible to patients for diagnosis. The clinic is held in a centre close to the community of residence for the client. As indicated for a specific client, arrangements are made with one of the agencies or a support worker to provide transportation for the family to ensure attendance occurs. Local support workers and agency representatives play an important role in supporting a client and the family through a process that can be anxiety provoking at times. Familiarity with such support workers makes the process less stressful, as well as allowing for successful support and intervention after. Adherence to diagnostic guidelines by the different teams with team members having undergone the same training allows for consistency in patient diagnosis and recommendations. The team members consist of allied health professionals from local agencies. This in-kind contribution of dedicated professionals allows the clinic to operate at a lower cost than would be necessary if all the team members were specifically hired for the purpose. The presence of local individuals implies an existing knowledge of local and surrounding community resources allowing for appropriate and feasible recommendations and interventions. Knowledge of scarcity of resources in the community also allows for creative development of resources and local community capacity building. A wide range of child as well as adult services, patient focus, community participation and critical success factors may be responsible for the wide coverage and sets it apart as a unique model worth studying. Additionally doing preliminary psychological assessments ahead of the clinic date, and having all the information on the client to determine the amount of testing that may be required ahead of time or on the clinic date ensures that at least two clients are seen on a

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given clinic day. Diagnostic capacity is enhanced as the team members all have trained back up members to replace individual team members who may not be available for a specific clinic date. Each team member has input in the diagnostic process and thus feels valued as a team member. If similar efforts are replicated in urban as well as other rural settings, the capacity in the field of FASD diagnosis and intervention would be advanced.

We found a wide range of IQ, comorbid neuropsychiatric disorders and a predominantly high rate of ARND diagnosis in the subjects diagnosed, especially the adults. Similar to other studies, such heterogeneous psychiatric and neurocognitive outcomes of FASD are the norm[2,34] rather than pathognomonic or specific neurobehavioral outcome.[35] The participants' mean IQ of 79.47 is lower, though not statistically, than mean IQ (86.3 (SD 15.7) (22) and 86 (28)) scores reported in other previous studies. The lower IQ in our study may result from the multiple comorbid diagnoses and older age of the participants. The other clinics are set up for childhood diagnosis and the measurement of IQ employs a different technique. Younger age seems to confer better IQ as well as reduced comorbidity.[2,28,36] These exert relative protective effects on the clinical correlates of FASD, as there is less neurocognitive and behavioural demands on younger individuals, compared to adults.[22] However, mean IQs ranging from the mildly retarded to borderline range, as well as the proportion (31%) of those below the 'proverbial' 70 cut off in our study is consistent with other findings.[37,38] One quarter of a sample of FASD diagnosed and followed up were reported as having an IQ below 70.[6] Our finding of over two thirds of FASD affected individuals with non retarded IQ (>70) scores is also consistent with other findings including one in a major review of neurobehavioral deficits (1, 5). It is not clear what role the rural setting has on the IQ scores. However, it is known that a cut off of IQ = 70 is widely used as criterion to access services. Given the wide range of abilities, using an arbitrary cut off to allocate and designate resources is a disservice to those so entitled and deserving.[7]

Our study showed that ARND is the most prevalent form of FASD in the population and it is strongly associated with age of participants. This finding is consistent with previous research in this area with similar prevalence rates. In the sample of 1400 diagnosed children and followed up as young adults, the rate of FAS, PFAS, Static encephalopathy and neurobehavioral disorder were 4%, 7%, 28% and 52 % respectively.[22] The current study inclusive of adults had a similar rate of FAS and PFAS and ARND diagnosis (with 76.5% rate in our adult only sample) with the Seattle study.[22] The statistically significant change of FASD diagnoses with age in our study resembles the variation of age in other studies. Those with static encephalopathy were statistically older than those with FAS/PFAS.[22] The similarity in age variation across rural/urban divide points to the one organ, the brain, the abnormality of which is the most significant and unifying for the spectrum of FASD. This age variation puts the older subjects as more likely to have non dysmorphic type of FASD compared to the younger participants. Maturational processes involving the face diminishes the nature of the facial dysmorphological[39], even though facial dysmorphology is known to relate to the expression of executive dysfunction related to frontal lobe abnormality in the FAS/PFAS group.[11,12,40] This relationship has been supported by neuroimaging studies and studies of the default mode network among those with FASD.[21,41,42] However the exact explanation for the variations are not yet completely clear[2,37] and further research is required to decipher the determinants of the age variations of diagnosis. This along with variations in exposure and timing of alcohol exposure and outcome of FASD are still being explored[43] in line with explanatory models of FASD.[18]

The rates of comorbid neuropsychiatric conditions found in this study were not substantially different from those reported in the literature. These findings also do not seem to have a rural-urban divide when our results are compared with that of others. ADHD occurred similarly in our sample (49.5%) as in some (53.9%)[22] but differently in others (36-73% depending on the FASD diagnostic sub group).[30] While the over representation of neuropsychiatric disorders, mood, anxiety, substance use, psychotic and personality disorders among FASD diagnosed have been reported in several studies[2,4,22,30] none compared to ADHD has received the greater exploration.

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With several mechanisms suspected to be shared between the FASD and ADHD[44], the synergistic complications of their coexistence and shared benefit from interventions[45], differentiating the two is difficult and require more longitudinal studies.[5,46] Our sample along with others supports the common existence of the two disorders. This is of relevance in understanding the mechanism and therapeutic approaches needed to deal with a heterogeneous disorder whose etiology combines gene and environment factors.

ADHD as well as other mental disorders seem to be age-dependent as younger diagnosed individuals and diagnosed adults differ with respect to expression of memory, language, anxiety and mood disorders. The adults manifested higher rates of anxiety and mood disorders while children and youth had more learning disability and ADHD. This finding is consistent with previously reported findings in both urban and rural FASD diagnosis.[47] Clinical correlates including executive functional problems[22], specificity of screening[48], rates of ADHD[46], dysmorphic types of FASD[40], functional disability and response to intervention have all been shown to be age dependent.[7,9,49]

The findings of our study are limited by the non-representative sampling method of gathering the data on clinic participation. Severity of the disorder and the clinical correlates themselves could have prompted and triggered the diagnostic process. Ascertainment of the diagnosis is only as valid as the expertise of the diagnostic team as there are no concurrent validity measures for FASD. No attempt was made to exclude other prenatal influences and genetic causes of similar clinical correlates.

An important finding worth generalizing is the model for increasing diagnostic capacities of clinics, rural or urban.[29] Further research will investigate the role of increasing the local capacity and team members on the increased diagnostic capacity. As well, we hope to examine the trajectories of FASD along emergence of disorders for which targeted intervention is highly needed and sought out. Adherence to treatment recommendation of the team may shed light on the secondary prevention strategy of the disorder and possibly ways of reducing clinical correlates.

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